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

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

August 19, 2020

SUBJECT: Revised Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the revised validation reports for the fractions listed below. Please replace the previously submitted reports with the enclosed revised reports.

LDC Project #48680RV1:

SDG #	Fraction
20F0039, 20F0075 20F0094, 20F0157	Semivolatiles, Hexachlorobenzene, Polychlorinated Biphenyls, Metals

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

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

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

August 13, 2020

SUBJECT: Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on July 17, 2020. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #48680:

SDG #	Fraction
20F0039, 20F0075, 20F0094 20F0105, 20F0109, 20F0157 20F0186, 20F0191, 20F0194	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

14,171 pages-ADV R1 (Added Stage 4 to PCB for C & I) Attachment 1

Stage 2B/4 (client Select) EDD

LDC #48680 (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)		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	20F0039	07/17/20	08/07/20	0	1	0	1	0	1	0	2	0	1	0	1	0	1	0	2	0	2														
B	20F0075	07/17/20	08/07/20	0	7	0	10	0	7	0	13	0	10	0	7	0	1	0	11	0	11														
C	20F0094	07/17/20	08/07/20	0	8	0	12	0	8	0	15	0	12	0	8	0	1	0	15	0	15														
D	20F0105	07/17/20	08/07/20	-	-	-	-	-	-	0	4	0	1	-	-	0	1	0	4	0	4														
E	20F0109	07/17/20	08/07/20	0	3	0	3	0	3	0	10	0	5	0	3	-	-	0	9	0	9														
F	20F0157	07/17/20	08/07/20	0	5	0	4	0	4	0	4	0	4	0	4	0	1	0	4	0	4														
G	20F0186	07/17/20	08/07/20	0	3	0	2	0	2	0	6	0	6	0	2	0	4	0	6	0	6														
H	20F0191	07/17/20	08/07/20	0	4	0	6	0	4	0	11	0	10	0	4	0	4	0	10	0	10														
I	20F0194	07/17/20	08/07/20	0	13	0	13	0	13	0	13	0	13	0	13	0	4	0	13	0	13														
Total	J/PG			0	44	0	51	0	42	0	78	0	62	0	42	0	17	0	74	0	74	0	0	0	0	0	0	0	0	0	0	0	0	0	484

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

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 18, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20

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

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0310-SRM1	Phenol	36.2 (42-150)	All samples in SDG	J (all detects)	P
	Naphthalene	22.2 (33-167)	20F0039	J (all detects)	
	Acenaphthylene	41.7 (52-148)		J (all detects)	
	Anthracene	56.7 (57-143)		J (all detects)	

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 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 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	Phenol Naphthalene Acenaphthylene Anthracene	J (all detects) J (all detects) J (all detects) J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A2a
SDG #: 20F0039
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/05/20
Page: 1 of 1
Reviewer: CW
2nd Reviewer: CL

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 / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20 % ICV ≤ 30 %
IV.	Continuing calibration	A	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	SN	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2				
3				
4				
5				
6				
7				
8				
9				

Notes:

	BIF0310-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680A2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

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

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

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

Y N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0310-SRM1	A	36.2 (42-158)	( )	( )	All (Det)	J/UJ/P
		S	22.2 (33-167)	( )	( )		
		DD	41.7 (52-148	( )	( )		
		VV	56.7 (57-143	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20

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

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	All samples in SDG 20F0039	UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/16/20	Benzoic acid	29.2	All samples in SDG 20F0039	J (all detects)	A
	Pentachlorophenol	40.6		UJ (all non-detects) J (all detects) UJ (all non-detects)	

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0310-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	11.7 (34-166) 11.6 (36-164) 26.5 (40-160) 28.6 (38-162)	All samples in SDG 20F0039	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 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 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	N-Nitrosodiphenylamine	UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SC109	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-SC109	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 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A2b
SDG #: 20F0039
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/05/20
Page: 1 of 1
Reviewer: JW
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 / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2				
3				
4				
5				
6				
7				
8				
9				

Notes:

—	BIF0310-BLK2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: GC/MS ~~PAH~~ SVOA (EPA SW 846 Method 8270~~D~~E-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Were all %D within the validation criteria of ≤~~20~~/30% %D ?

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

LDC #: 48680A26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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

(Y) N N/A Was 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
	06/16/20	NT102006160335	PPP	29.2		All (ND + Det)	J/UJ/A
			TT	40.6		↓ ↓	↓

LDC #: 48680A26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples (LCS) /SRM

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

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

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

[✓ Y] N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0310-SRM2	E	11.7 (34-166)	( )	( )	All (ND + Det)	J/UJ/P
		F	11.6 (36-164)	( )	( )	↓	↓
		O	26.5 (40-160)	( )	( )	↓	↓
		R	28.6 (38-162)	( )	( )	↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC Report# 48680A3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20

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

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

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% with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0039	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	UJ (all non-detects)	A

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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC109)	Hexachlorobenzene	165 (26-120)	165 (26-120)	NA	-

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.

Due to no ICV performed, 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
Hexachlorobenzene - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	Hexachlorobenzene	UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A3a

SDG #: 20F0039

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/04/20

Page: 1 of 1

Reviewer: SK

2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20 ? ICVE 20 ?
IV.	Continuing calibration	A	CCVE 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes / IS	A / A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
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-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
3	LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20
4				
5				
6				
7				
8				
9				
10				

Notes:

1	BI F0122-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: 4

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

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A

LDC #: 48680A3a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

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

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

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

[✓ Y] N N/A Was a 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 the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	2/3	FF	165 (26-120)	( )	( )	1 (ND)	J dets/A
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC113	20F0039-05	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20

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

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

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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0039	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC109)	Aroclor-1260	-	198 (58-120)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC109)	Aroclor-1260	40.5 (≤30)	J (all detects)	A

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D and MS/MSD %R and RPD, data were qualified as estimated in two samples.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109 LDW20-SC113	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SC109	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)(RPD)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A3b
SDG #: 20F0039
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: JW
2nd Reviewer: CT

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / SW	ICAL ≤ 20%, ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC113	20F0039-05	Sediment	06/01/20
3	LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
4	LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20
5				
6				
7				
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9				
10				
11				
12				

Notes:

-	BIF0284-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680A3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

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

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? /%D or ___%R

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

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

LDC #: 48680A3b

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates

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

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

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

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
[✓ Y] N N/A Was a 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 the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	3/4	BB	( )	198 (58-120)	( )	1 (Det)	J dets/A
		BB	( )	( )	40.5 (30)	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20
LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20

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.

Although the low level check standard exceeded QC limits for arsenic, no data was qualified since all associated results were greater than 2X the reporting limit.

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-SC109MS/MSD (All samples in SDG 20F0039)	Silver	41.5 (75-125)	49.8 (75-125)	J (all detects)	A

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (All samples in SDG 20F0039)	Copper	130 (75-125)	-	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the 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 methods. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in one sample.

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

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0039

Sample	Analyte	Flag	A or P	Reason
LDW20-SC109	Silver Copper	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0039

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: ATL

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	(2,3)
VIII.	Duplicate sample analysis	A	4
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
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-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
3	LDW20-SC109MSD	20F0039-04MSD	Sediment	06/01/20
4	LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20
5				
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12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
QC	
2,3,4	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg

Analysis Method	
ICP	
ICP-MS	
CVAA	

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
2 & 3	S	Ag	41.5	49.8	75-125			all	J/UJ/A	Det
		Cu	130		75-125			all	Jdet/A	Det

Comments:

LDC Report# 48680A6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC113	20F0039-05	Sediment	06/01/20
LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20

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 20F0039

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/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 method. 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 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0039 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
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	3
VII.	Duplicate sample analysis	A	4
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC113	20F0039-05	Sediment	06/01/20
3	LDW20-SC109MS	20F0039-04MS	Sediment	06/01/20
4	LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20
5				
6				
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8				
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11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1,2	TS, TOC
QC	
4	TS, TOC
3	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**									
TOC		0.02										

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC109	20F0039-04	Sediment	06/01/20
LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20

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 with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0039	1,2,3,4,7,8,9-HpCDF	J (all detects)	P

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0039

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

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

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SC109DUP (LDW20-SC109)	OCDF	46.2 (≤25)	J (all detects)	A

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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 20F0039	All compounds reported as estimated maximum possible concentration (EMPC).	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 continuing calibration concentration, DUP RPD, and compounds reported as EMPC, 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 20F0039

Sample	Compound	Flag	A or P	Reason
LDW20-SC109	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-SC109	OCDF	J (all detects)	A	Duplicate sample analysis (RPD)
LDW20-SC109	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0039

No Sample Data Qualified in this SDG

LDC #: 48680A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0039 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤20/35% ICV ≤ QC Limits
IV.	Continuing calibration	SW	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates/LD	N/SW	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jdets/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC109	20F0039-04	Sediment	06/01/20
2	LDW20-SC109DUP	20F0039-04DUP	Sediment	06/01/20
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BIF0465-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

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

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

Y Was a routine calibration performed at the beginning of each 12 hour period?

N Were all concentrations within method QC limits for unlabeled and labeled compounds?

Y Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)

LDC #: 48680A21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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

Blank extraction date: 06/22/20 **Blank analysis date:** 06/25/20 **Associated samples:** All **(>5x)**
Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)									
B	0.175	0.88									
M	0.0946*	0.47									
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

LDC #: 48680A21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

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

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

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

Y Was a duplicate sample analyzed for each matrix in this SDG?
N Were all duplicate sample relative percent differences (RPD) ≤ 25?

#	Duplicate ID	Compound	RPD (Limits)		Associated Samples	Qualifications
	2	Q	46.2	(≤25%)	1 (Det)	Jdets/A
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-SC102MS	20F0075-02MS	Sediment	06/02/20
LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 11.6°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. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0380-SRM1	Phenol	40.0 (42-158)	All samples in SDG 20F0075	J (all detects)	P
	Naphthalene	16.2 (33-167)		J (all detects)	
	Acenaphthylene	32.4 (52-148)		J (all detects)	
	Acenaphthene	46.9 (51-149)		J (all detects)	
	Anthracene	44.6 (57-143)		J (all detects)	
	Benzo(a)pyrene	53.8 (54-146)		J (all detects)	

X. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC123	LDW20-SC123FD	
Phenol	14.1	18.6	28
Naphthalene	11.0	12.3	11
2-Methylnaphthalene	13.1	11.9	10
Acenaphthylene	7.6	6.8	11
Dimethylphthalate	7.4	19.3U	Not calculable
Acenaphthene	6.6	5.4	20

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC123	LDW20-SC123FD	
Dibenzofuran	9.3	7.8	18
Fluorene	7.8	7.2	8
Phenanthrene	57.5	48.6	17
Anthracene	18.5	15.6	17
Fluoranthene	115	105	9
Pyrene	142	136	4
Butylbenzylphthalate	74.7	22.6	107
Benzo(a)anthracene	56.5	48.1	16
Chrysene	80.5	67.1	18
Bis(2-ethylhexyl)phthalate	141	124	13
Benzofluoranthenes, total	183	159	14
Benzo(a)pyrene	71.0	61.6	14
Indeno(1,2,3-cd)pyrene	46.6	42.2	10
Dibenzo(a,h)anthracene	12.7	11.8	7
Benzo(g,h,i)perylene	56.2	49.2	13

XI. Internal Standards

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

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

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 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC102	Phenol	J (all detects)	P	Standard reference materials (%R)
LDW20-SC101	Naphthalene	J (all detects)		
LDW20-SC117	Acenaphthylene	J (all detects)		
LDW20-SC123	Acenaphthene	J (all detects)		
LDW20-SC123FD	Anthracene	J (all detects)		
LDW20-SC125	Benzo(a)pyrene	J (all detects)		
LDW20-SC130				

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B2a

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/05/20

SDG #: 20F0075

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps. = 9.6°C, 12.8°C, 11.6°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20 % ICV ≤ 30 %
IV.	Continuing calibration	A	CV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 4/5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	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-SC102	20F0075-02	Sediment	06/02/20
2	LDW20-SC101	20F0075-03	Sediment	06/02/20
3	LDW20-SC117	20F0075-04	Sediment	06/02/20
4	LDW20-SC123 D	20F0075-06	Sediment	06/02/20
5	LDW20-SC123FD D	20F0075-07	Sediment	06/02/20
6	LDW20-SC125	20F0075-08	Sediment	06/02/20
7	LDW20-SC130	20F0075-10	Sediment	06/02/20
8	LDW20-SC102MS	20F0075-02MS	Sediment	06/02/20
9	LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20
10				
11				
12				
13	BIF0350-BLK1			
14				

LDC #: 48680 B2a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?		✓		
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			✓	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 30%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	-	✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10%, was a reanalysis performed to confirm %R ?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	✓			

Validation Area	Yes	No	NA	Findings/Comments
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. 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?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), 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?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

A2. Benzofluoranthenes, total

LDC #: 48680 B2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

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

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

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

[✓ Y] N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0380-SRM1	A	40.0 (42-158)	( )	( )	All (Det)	J/UJ/P
		S	16.2 (33-167)	( )	( )		
		DD	32.4 (52-148)	( )	( )		
		GG	46.9 (51-149)	( )	( )		
		VV	44.6 (57-143)	( )	( )		
		III	53.8 (54-146)	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680B2a

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
	4	5	
A	14.1	18.6	28
S	11.0	12.3	11
W	13.1	11.9	10
DD	7.6	6.8	11
CC	7.4	19.3U	NC
GG	6.6	5.4	20
JJ	9.3	7.8	18
NN	7.8	7.2	8
UU	57.5	48.6	17
VV	18.5	15.6	17
YY	115	105	9
ZZ	142	136	4
AAA	74.7	22.6	107
CCC	56.5	48.1	16
DDD	80.5	67.1	18
EEE	141	124	13
A2	183	159	14
III	71.0	61.6	14
JJJ	46.6	42.2	10
KKK	12.7	11.8	7
LLL	56.2	49.2	13

LDC #: 48680B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs, — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	02/28/20	Phenol (DCB)	1.59347	1.59347	1.65585	1.65585	7.959	7.959
			Naphthalene (NPT)	0.92453	0.92453	0.92758	0.92758	1.339	1.339
	NT10		Diethylphthalate (ANT)	1.37384	1.37384	1.35321	1.35321	7.313	7.313
			Phenanthrene (PHN)	1.03992	1.03992	1.02052	1.02052	1.897	1.897
			Chrysene (CRY)	1.20105	1.20105	1.21232	1.21232	3.091	3.091
			BEHP (DNOP)	0.49495	0.49495	0.48711	0.48710	3.070	3.070
			Benzo(g,h,i)perylene (PRY)	1.23732	1.23732	1.24193	1.24193	6.014	6.014

LDC # 48680B2a

VALIDATION FINDINGS WORSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT1020062302.	6/23/2020	Phenol (DCB)	1.65585	1.62455	1.62455	1.9	1.9
			Naphthalene (NPT)	0.92758	0.94636	0.94636	2.0	2.0
	NT10		Fluorene (ANT)	1.55760	1.32268	1.32268	15.1	15.1
			Phenanthrene (PHN)	1.02052	1.01094	1.01094	0.9	0.9
			Chrysene (CRY)	1.21232	1.15605	1.15605	4.6	4.6
			BEHP (DNOP)	0.48711	0.47106	0.47106	3.3	3.3
			Benzo(g,h,i)perylene (PRY)	1.24193	1.17446	1.17446	5.4	5.4

LDC #: 48680 B2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer:

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

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	5.00	3.040 ~~1.098~~	60.8	60.8	0
2-Fluorobiphenyl	↓	3.626	72.5	72.5	↓
Terphenyl-d14	↓	~~4.536~~ 3.372	67.4	67.4	↓
Phenol-d5	7.50	~~3.953~~ 4.536	60.5	60.5	↓
2-Fluorophenol	↓	3.957	52.7	52.7	↓
2,4,6-Tribromophenol	↓	5.666	75.6	75.6	↓
2-Chlorophenol-d4	↓	5.019	66.9	66.9	↓
1,2-Dichlorobenzene-d4	5.00	3.229	64.6	64.6	✓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 48680B2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: d

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD samples: 8/9

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	504	504	92.5	426	448	66.1	66.2	70.4	70.5	4.94	5.03
~~N-Nitroso-di-n-propylamine~~											
~~4-Chloro-3-methylphenol~~											
Acenaphthene			7.1	412	414	80.3	80.3	80.6	80.7	0.459	0.48
~~Pentachlorophenol~~											
Pyrene			216	659	667	87.8	87.9	89.4	89.5	1.26	1.21

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

LDC #: 48680B2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

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

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

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BIF0380-BS1

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	500	NA	397	NA	79.3	79.3				
~~N-Nitroso-di-n-propylamine~~										
~~4-Chloro-3-methylphenol~~										
Acenaphthene			350		69.9	69.9				
~~Pentachlorophenol~~										
Pyrene	↓	↓	400	↓	80.0	80.0				

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

LDC #: 48680 B2a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

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

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 = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

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).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 1, Chrysene

Conc. = $\frac{(107564)(4.0)(1mL)(1000)(\quad)}{(308779)(1.21232)(16.65g)(0.5880)(\quad)}$

= 115.4 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	1	Chrysene	115	115	-

LDC Report# 48680B2b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20
LDW20-IT127MS	20F0075-11MS	Sediment	06/02/20
LDW20-IT127MSD	20F0075-11MSD	Sediment	06/02/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 12.8°C, and 11.6°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
02/28/20	N-Nitrosodiphenylamine	34.4	LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	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
06/23/20	Benzoic acid	29.2	LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	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
BIF0656-BLK2	06/23/20	1,4-Dichlorobenzene 1,2-Dichlorobenzene	0.7 ug/Kg 0.8 ug/Kg	All samples in SDG 20F0075

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-SC102	1,4-Dichlorobenzene 1,2-Dichlorobenzene	3.0 ug/Kg 1.3 ug/Kg	3.0U ug/Kg 1.3U ug/Kg
LDW20-SC101	1,4-Dichlorobenzene	3.6 ug/Kg	3.6U ug/Kg
LDW20-SC117	1,4-Dichlorobenzene	1.8 ug/Kg	1.8U ug/Kg
LDW20-SC123	1,4-Dichlorobenzene	2.1 ug/Kg	2.1U ug/Kg
LDW20-SC123FD	1,2-Dichlorobenzene	1.2 ug/Kg	1.2U ug/Kg
LDW20-SC125	1,4-Dichlorobenzene	1.5 ug/Kg	1.5U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT127MS/MSD (LDW20-IT127)	Chrysene	126 (48-120)	--	J (all detects)	A

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

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC123	LDW20-SC123FD	
1,4-Dichlorobenzene	2.1	27.3	171
1,2-Dichlorobenzene	4.9U	1.2	Not calculable
Benzyl alcohol	13.2	17.5	28
Benzoic acid	38.5	54.3	34
N-Nitrosodiphenylamine	3.1	2.9	7

XI. Internal Standards

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

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

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 MS/MSD %R, data were qualified as estimated in eight samples.

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

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	Benzoic acid	J (all detects)	A	Continuing calibration (%D)
LDW20-IT127	Chrysene	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0075

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC102	1,4-Dichlorobenzene 1,2-Dichlorobenzene	3.0U ug/Kg 1.3U ug/Kg	A
LDW20-SC101	1,4-Dichlorobenzene	3.6U ug/Kg	A
LDW20-SC117	1,4-Dichlorobenzene	1.8U ug/Kg	A
LDW20-SC123	1,4-Dichlorobenzene	2.1U ug/Kg	A
LDW20-SC123FD	1,2-Dichlorobenzene	1.2U ug/Kg	A
LDW20-SC125	1,4-Dichlorobenzene	1.5U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B2b

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/05/20

SDG #: 20F0075

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: SM

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 9.6°C, 12.8°C, 11.6°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% RF ICV ≤
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	A	LCS SRM
X.	Field duplicates	SW	D = 5/6
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
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 2	LDW20-IT106	20F0075-01	Sediment	06/02/20
2 1	LDW20-SC102	20F0075-02	Sediment	06/02/20
3 1	LDW20-SC101	20F0075-03	Sediment	06/02/20
4 1	LDW20-SC117	20F0075-04	Sediment	06/02/20
5 1	LDW20-SC123	20F0075-06	Sediment	06/02/20
6 1	LDW20-SC123FD	20F0075-07	Sediment	06/02/20
7 1	LDW20-SC125	20F0075-08	Sediment	06/02/20
8 2	LDW20-IT105	20F0075-09	Sediment	06/02/20
9 1	LDW20-SC130	20F0075-10	Sediment	06/02/20
10 2	LDW20-IT127	20F0075-11	Sediment	06/02/20
11	LDW20-IT127MS	20F0075-11MS	Sediment	06/02/20
12	LDW20-IT127MSD	20F0075-11MSD	Sediment	06/02/20
13				
14 1	BIF0330-Blk2			

2 BIF0329-Blk1

cPAH = 1, 8, 10

LDC #: 48680 B26

VALIDATION FINDINGS CHECKLIST

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

SVOA E

Method: ~~PAH~~ (EPA SW 846 Method 8270D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤30%?		✓		
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?				
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VIII. 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
IX. 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?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), 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?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680 B26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: [signature]

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

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

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤20.0%~~ 30%)	Associated Samples	Qualifications
	02/28/20	SIC0029-SCV1	QQ	34.4	2-7, 9, MB1 (Det)	J/UJ/A

LDC #: 48680B26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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

(Y) N N/A Was 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
	06/23/20	NT10200623035	PPP	29.2		2-7, 9, MB 1 (Det)	J/UJ/A

CONCAL.wpd

LDC #: 48680 B26

VALIDATION FINDINGS WORKSHEET
Blanks

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

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

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: 06/16/20 **Blank analysis date:** 06/23/20
Conc. units: ug/kg Associated Samples: 2-7, 9

Compound	Blank ID								
	BIF0350-	Blk2	2	3	4	5	6	7	
E	0.7		3.0 / U	3.6 / U	1.8 / U	2.1 / U		1.5 / U	
F	0.8		1.3 / J				1.2 / U		

CRL J

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 48680B26

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)
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?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		11/12	DDD	126 (48-120)	( )	( )	10 (Det)	J dets/A
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		

LDC#: 48680B2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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

Compound	Concentration (ug/Kg)		RPD
	5	6	
E	2.1	27.3	171
F	4.9U	1.2	NC
QQQ	13.2	17.5	28
PPP	38.5	54.3	34
QQ	3.1	2.9	7

V:\Josephine\FIELD DUPLICATES\48680B2a windward duwamish.wpd

LDC #: 48680B2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs, — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 5 std)	Recalculated RRF (RRF 5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SIM NT10	02/28/20	1,4-DCB (DCB)	1.31443	1.31443	1.41049	1.41049	10.3	10.3
			1,2,4-TCB (NPT)	0.36297	0.36297	0.40284	0.40284	12.2	12.2
			Pentachlorophenol (PHN)	0.19257	0.19257	0.16863	0.16863	11.6	11.6

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 2.5 std)	Recalculated RRF (RRF 2.5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
2	ICAL SIM NT8	05/11/20	Chrysene (CRY)	1.22429	1.22429	1.17941	1.17941	5.1	5.1
			Benzo(a)pyrene (PRY)	1.17321	1.17321	1.08195	1.08195	9.9	9.9

LDC # 48680B2a

VALIDATION FINDINGS WORSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT1020062303S	6/23/2020	1,4-DCB (DCB)	1.41049	1.35447	1.35447	4.0	4.0
			1,2,4-TCB (NPT)	0.40284	0.41332	0.41332	2.6	2.6
	NT10		Pentachlorophenol (PHN)	0.16863	0.17243	0.17243	2.3	2.3
2	N820061502	6/15/2020	Chrysene (CRY)	1.17941	1.11921	1.11921	5.1	5.1
	NT8		Benzo(a)pyrene (PRY)	1.08195	1.02197	1.02197	5.6	5.5

LDC #: 48680 B26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nit~~robenzene-d~~5 W-d10	3.00	1.997	66.6	66.6	0
2-Fl~~uorobiphen~~yl KKK-d14	↓	2.767	92.2	92.2	↓
Ter~~phenyl-~~d14 YY-d10	↓	2.485	82.8	82.8	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

LDC #: 48680B25

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = | MSC - MSC | * 2/(MSC + MSDC) MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD samples: 11 17

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Acenaphthene											
Pyrene											
Benzo(a)pyrene	300	300	31.1	380	606	116	116	192	192	45.8	45.8

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

LDC #: 48680B26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

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

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

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BIF0380-BS2

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene										
Pyrene										
PCP	1500	NA	823	NA	54.9	54.9				

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

LDC #: 48680 B26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

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

(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 = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

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).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 10, Chrysene

Conc. = $\frac{(35460)(2.0)(0.5mL)(1000)(\quad)}{(72885)(1.17941)(15.57g)(0.6424)}$

= 41.2 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	10	Chrysene	41.2	41.2	-

LDC Report# 48680B3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-SC102MS	20F0075-02MS	Sediment	06/02/20
LDW20-SC102MSD	20F0075-02MSD	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 12.8°C, and 11.6°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% with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0075	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	J (all detects) UJ (all non-detects)	A

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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0278-BLK1	06/10/20	Hexachlorobenzene	0.42 ug/Kg	All samples in SDG 20F0075

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. 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

Samples LDW20-SC123 and LDW20-SC123FD 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.

Due to no ICV performed, 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
Hexachlorobenzene - Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	Hexachlorobenzene	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B3a
SDG #: 20F0075
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: JJR
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temp = 9.6°C, 12.8°C, 11.6°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A / SW	ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 4/5
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data	A	

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

	Client ID		Lab ID	Matrix	Date
1	LDW20-SC102		20F0075-02	Sediment	06/02/20
2	LDW20-SC101		20F0075-03	Sediment	06/02/20
3	LDW20-SC117		20F0075-04	Sediment	06/02/20
4	LDW20-SC123	D	20F0075-06	Sediment	06/02/20
5	LDW20-SC123FD	D	20F0075-07	Sediment	06/02/20
6	LDW20-SC125		20F0075-08	Sediment	06/02/20
7	LDW20-SC130		20F0075-10	Sediment	06/02/20
8	LDW20-SC102MS		20F0075-02MS	Sediment	06/02/20
9	LDW20-SC102MSD		20F0075-02MSD	Sediment	06/02/20
10					

Notes:

	BIF0278-Blk1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680B3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

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

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A

LDC #: 48680 B3a

VALIDATION FINDINGS WORKSHEET
Blanks

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

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

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

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A If extract clean-up was performed, were extract clean-up blanks analyzed at the proper frequencies?
Y N N/A Was there contamination in the method blanks? If yes, please see the qualifications below.

Blank extraction date: 06/10/20 **Blank analysis date:** 06/15/20 **Associated samples:** All (either ND or > RL)
Conc. units: ug/Kg

Compound	Blank ID	Sample Identification								
RL	BIF0278-Blk1									
FF	0.42									

Blank extraction date: **Blank analysis date:** **Associated samples:**
Conc. units:

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 18, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC102DL	20F0075-02DL	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC121	20F0075-05	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-SC130DL	20F0075-10DL	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20
LDW20-IT106MS	20F0075-01MS	Sediment	06/02/20
LDW20-IT106MSD	20F0075-01MSD	Sediment	06/02/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.6°C, 12.8°C, and 11.6°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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0075	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) 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-IT106MS/MSD (LDW20-IT106)	Aroclor-1260	-	204 (58-120)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT106MS/MSD (LDW20-IT106)	Aroclor-1260	60.3 (≤30)	J (all detects)	A

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-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC123	LDW20-SC123FD	
Aroclor-1248	51.4	59.1	14
Aroclor-1254	70.9	88.2	22
Aroclor-1260	98.7	104	5

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-SC102	Aroclor-1260	74	J (all detects)	A
LDW20-SC101	Aroclor-1254 Aroclor-1260	41.4 48.8	J (all detects) J (all detects)	A
LDW20-SC125	Aroclor-1248	40.2	J (all detects)	A
LDW20-IT105	Aroclor-1248	42.6	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

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-SC102 LDW20-SC130	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-SC102DL LDW20-SC130DL	All compounds except Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, MS/MSD %R and RPD, 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 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-IT106 LDW20-SC101 LDW20-SC117 LDW20-SC121 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-IT105 LDW20-IT127	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC102 LDW20-SC130	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC102DL LDW20-SC130DL	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT106	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)(RPD)
LDW20-SC101	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC125 LDW20-IT105	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC102 LDW20-SC130	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-SC102DL LDW20-SC130DL	All compounds except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B3b
SDG #: 20F0075
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: DC
2nd Reviewer: [signature]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	cooler temps = 9.6°C, 12.8°C, 11.6°C (Insufficient time to cool)
II.	Initial calibration/ICV	A / SW	1 CAL ≤ 20%, 1CV ≤ 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	SW	
VIII.	Laboratory control samples	A	LCS/D, SRM
IX.	Field duplicates	SW	D = 7/8
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	SW	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT106	20F0075-01	Sediment	06/02/20
2	LDW20-SC102	20F0075-02	Sediment	06/02/20
3	LDW20-SC102~~RE~~ DL	20F0075-02~~RE~~ DL	Sediment	06/02/20
4	LDW20-SC101	20F0075-03	Sediment	06/02/20
5	LDW20-SC117	20F0075-04	Sediment	06/02/20
6	LDW20-SC121	20F0075-05	Sediment	06/02/20
7	LDW20-SC123 D	20F0075-06	Sediment	06/02/20
8	LDW20-SC123FD D	20F0075-07	Sediment	06/02/20
9	LDW20-SC125	20F0075-08	Sediment	06/02/20
10	LDW20-IT105	20F0075-09	Sediment	06/02/20
11	LDW20-SC130	20F0075-10	Sediment	06/02/20
12	LDW20-SC130~~RE~~ DL	20F0075-10~~RE~~ DL	Sediment	06/02/20
13	LDW20-IT127	20F0075-11	Sediment	06/02/20
14	LDW20-IT106MS	20F0075-01MS	Sediment	06/02/20
15	LDW20-IT106MSD	20F0075-01MSD	Sediment	06/02/20
16				
17	BIF0228-BLK1			

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

_____

_____

LDC #: 48680B36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

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

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

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

LDC #: 48680B3b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

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

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

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
[✓ Y] N N/A Was a 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 the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	14/15	BB	( )	204 (58-120)	( )	1 (Det)	J dets/A
		↓	( )	( )	60.3 (30)	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680B3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: ✕

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

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

Compound	Concentration (ug/Kg)		RPD
	7	8	
Aroclor 1248	51.4	59.1	14
Aroclor 1254	70.9	88.2	22
Aroclor 1260	98.7	104	5

V:\Josephine\FIELD DUPLICATES\48680B3b windward duwamish.wpd

LDC #: 48680 B3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / GC __ HPLC

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

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	2	74	J dets /A
	AA	4	41.4	
	BB	↓	98.8	
	Z	9	40.2	
	Z	10	42.6	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680 B36

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

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

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

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

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

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

#	Compound Name	Finding	Associated sample	Qualifications
	BB	> cal range	2, 11	NR/A
				↓
	All except above	dil	3, 12	↓

Comments: _____

OVR cpd.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20

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	Arsenic	0.025 ug/L	LDW20-SC130 LDW20-IT127

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130)	Silver	41.5 (75-125)	49.8 (75-125)	J (all detects)	A
LDW20-SC109MS/MSD (LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130)	Copper	130 (75-125)	-	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

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

XI. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC123	LDW20-SC123FD	
Arsenic	6.35	6.70	5
Cadmium	0.19	0.21	10
Chromium	21.9	23.4	7
Copper	35.3	38.0	7

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC123	LDW20-SC123FD	
Lead	16.3	19.8	19
Mercury	0.110	0.126	14
Silver	0.17	0.18	6
Zinc	79.6	83.8	5

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 seven samples.

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

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0075

Sample	Analyte	Flag	A or P	Reason
LDW20-SC102 LDW20-SC101 LDW20-SC117 LDW20-SC123 LDW20-SC123FD LDW20-SC125 LDW20-SC130	Silver Copper	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0075

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: ATh

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	From SDG # 20F0039 (LDW20-SC109MS/MSD)
VIII.	Duplicate sample analysis	A	From SDG # 20F0039 (LDW20-SC109DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	SW	(5,6)
XII.	Internal Standard (ICP-MS)	N	
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-IT106	20F0075-01	Sediment	06/02/20
2	LDW20-SC102	20F0075-02	Sediment	06/02/20
3	LDW20-SC101	20F0075-03	Sediment	06/02/20
4	LDW20-SC117	20F0075-04	Sediment	06/02/20
5	LDW20-SC123	20F0075-06	Sediment	06/02/20
6	LDW20-SC123FD	20F0075-07	Sediment	06/02/20
7	LDW20-SC125	20F0075-08	Sediment	06/02/20
8	LDW20-IT105	20F0075-09	Sediment	06/02/20
9	LDW20-SC130	20F0075-10	Sediment	06/02/20
10	LDW20-IT127	20F0075-11	Sediment	06/02/20
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2 to 7, 9	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,8,10	As

Analysis Method	
ICP	
ICP-MS	
CVAA	

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: 9,10

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (ug/L)**	**Action Level**									
As		0.025										

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-SC109	S	Ag	41.5	49.8	75-125			2 to 7, 9	J/UJ/A	Det
		Cu	130		75-125			2 to 7, 9	Jdet/A	Det

Comments:

Method: Metals

Analyte	Concentration (mg/kg)		RPD	Qualifiers (Parents Only)
	5	6		
Arsenic	6.35	6.70	5	
Cadmium	0.19	0.21	10	
Chromium	21.9	23.4	7	
Copper	35.3	38.0	7	
Lead	16.3	19.8	19	
Mercury	0.110	0.126	14	
Silver	0.17	0.18	6	
Zinc	79.6	83.8	5	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT106	20F0075-01	Sediment	06/02/20
LDW20-SC102	20F0075-02	Sediment	06/02/20
LDW20-SC101	20F0075-03	Sediment	06/02/20
LDW20-SC117	20F0075-04	Sediment	06/02/20
LDW20-SC121	20F0075-05	Sediment	06/02/20
LDW20-SC123	20F0075-06	Sediment	06/02/20
LDW20-SC123FD	20F0075-07	Sediment	06/02/20
LDW20-SC125	20F0075-08	Sediment	06/02/20
LDW20-IT105	20F0075-09	Sediment	06/02/20
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20
LDW20-IT106DUP	20F0075-01DUP	Sediment	06/02/20

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 20F0075

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/Standard Reference Materials

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

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

IX. Field Duplicates

Samples LDW20-SC123 and LDW20-SC123FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SC123	LDW20-SC123FD	
Total solids	58.50	58.13	1
Total organic carbon	1.63	1.67	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 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0075 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
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	From SDG # 20F0039 (LDW20-SC109MS)
VII.	Duplicate sample analysis	A	12, From SDG # 20F0039 (LDW20-SC109DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	SW	(6,7)
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-IT106	20F0075-01	Sediment	06/02/20
2	LDW20-SC102	20F0075-02	Sediment	06/02/20
3	LDW20-SC101	20F0075-03	Sediment	06/02/20
4	LDW20-SC117	20F0075-04	Sediment	06/02/20
5	LDW20-SC121	20F0075-05	Sediment	06/02/20
6	LDW20-SC123	20F0075-06	Sediment	06/02/20
7	LDW20-SC123FD	20F0075-07	Sediment	06/02/20
8	LDW20-SC125	20F0075-08	Sediment	06/02/20
9	LDW20-IT105	20F0075-09	Sediment	06/02/20
10	LDW20-SC130	20F0075-10	Sediment	06/02/20
11	LDW20-IT127	20F0075-11	Sediment	06/02/20
12	LDW20-IT106DUP	20F0075-01DUP	Sediment	06/02/20
13				
14				
15				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 11	TS, TOC
QC	
12	TS

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

Reviewer: ATL

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**									
TOC		0.02										

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

METHOD: Inorganics

Analyte	Concentration (%)		RPD	Qualifiers (Parents Only)
	6	7		
Total Solids	58.50	58.13	1	
Total Organic Carbon	1.63	1.67	2	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0075

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC130	20F0075-10	Sediment	06/02/20
LDW20-IT127	20F0075-11	Sediment	06/02/20

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 at 11.6°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 percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0075	1,2,3,4,7,8,9-HpCDF	J (all detects)	P

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0075

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-SC130	1,2,3,7,8-PeCDD	0.582 ng/Kg	0.582U ng/Kg
LDW20-IT127	1,2,3,7,8-PeCDD	0.871 ng/Kg	0.871U 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. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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 20F0075	All compounds reported as estimated maximum possible concentration (EMPC).	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 continuing calibration concentration and compounds reported as EMPC, data were qualified as estimated in two 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
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0075

Sample	Compound	Flag	A or P	Reason
LDW20-SC130 LDW20-IT127	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-SC130 LDW20-IT127	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0075

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC130	1,2,3,7,8-PeCDD	0.582U ng/Kg	A
LDW20-IT127	1,2,3,7,8-PeCDD	0.871U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0075

No Sample Data Qualified in this SDG

LDC #: 48680B21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0075 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer: 4

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 11.6 deg C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35% ICV ≤ QC Limits
IV.	Continuing calibration	SW	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jdets/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC130	20F0075-10	Sediment	06/02/20
2	LDW20-IT127	20F0075-11	Sediment	06/02/20
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BIF0465-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680B21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

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

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

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

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)

LDC #: 48680B21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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

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

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)	1	2							
B	0.175	0.88	0.582*/U	0.871/U							
M	0.0946*	0.47									
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC140MS	20F0094-02MS	Sediment	06/03/20
LDW20-SC140MSD	20F0094-02MSD	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 9.5°C, 10.0°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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
BIF0403-SRM	Anthracene	56.3 (57-143)	All samples in SDG 20F0094	J (all detects)	P

X. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC211	LDW20-SC211FD	
Naphthalene	8.7	7.7	12
2-Methylnaphthalene	9.4	8.8	7
Acenaphthylene	7.1	7.6	7
Dimethylphthalate	16.6	12.9	25
Acenaphthene	5.7	6.3	10
Dibenzofuran	6.5	6.9	6
Fluorene	19.9	20.0U	Not calculable

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC211	LDW20-SC211FD	
Phenanthrene	78.1	73.6	6
Anthracene	19.8	18.3	8
Fluoranthene	181	178	2
Pyrene	239	225	6
Butylbenzylphthalate	21.8	30.0	32
Benzo(a)anthracene	86.8	85.4	2
Chrysene	126	127	1
Bis(2-ethylhexyl)phthalate	185	180	3
Benzofluoranthenes, total	280	271	3
Benzo(a)pyrene	120	120	0
Indeno(1,2,3-cd)pyrene	78.8	71.7	9
Dibenzo(a,h)anthracene	24.8	27.5	10
Benzo(g,h,i)perylene	84.3	79.3	6

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 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	Anthracene	J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C2a
SDG #: 20F0094
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/05/20
Page: 1 of 1
Reviewer:
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 10.0°C, 9.5°C, 12.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 7/8
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-SC140		20F0094-02	Sediment	06/03/20
2	LDW20-SC142		20F0094-03	Sediment	06/03/20
3	LDW20-SC150		20F0094-04	Sediment	06/03/20
4	LDW20-SC135		20F0094-07	Sediment	06/03/20
5	LDW20-SC202		20F0094-08	Sediment	06/03/20
6	LDW20-SC203		20F0094-09	Sediment	06/03/20
7	LDW20-SC211	D	20F0094-10	Sediment	06/03/20
8	LDW20-SC211FD	D	20F0094-11	Sediment	06/03/20
9	LDW20-SC140MS		20F0094-02MS	Sediment	06/03/20
10	LDW20-SC140MSD		20F0094-02MSD	Sediment	06/03/20
11					
12					
13	BIF0403-BLK1				
14					

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680C2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples (LCS) /SRM

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

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

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

[✓ Y] N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0463-SRM	VV	56.3 (57-143)	( )	( )	All (Det)	J/UJ/P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680C2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

Y N NA Were field duplicate pairs identified in this SDG?

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

Compound	Concentration (ug/Kg)		RPD
	7	8	
S	8.7	7.7	12
W	9.4	8.8	7
DD	7.1	7.6	7
CC	16.6	12.9	25
GG	5.7	6.3	10
JJ	6.5	6.9	6
NN	19.9	20.0U	NC
UU	78.1	73.6	6
VV	19.8	18.3	8
YY	181	178	2
ZZ	239	225	6
AAA	21.8	30.0	32
CCC	86.8	85.4	2
DDD	126	127	1
EEE	185	180	3
A2	280	271	3
III	120	120	0
JJJ	78.8	71.7	9
KKK	24.8	27.5	10
LLL	84.3	79.3	6

LDC Report# 48680C2b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20
LDW20-ITT133MS	20F0094-01MS	Sediment	06/03/20
LDW20-ITT133MSD	20F0094-01MSD	Sediment	06/03/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 10.0°C, 9.5°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/20/20	Benzoic acid	37.8	LDW20-SC140 LDW20-SC142	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	58.9	LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	J (all detects) UJ (all non-detects)	

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

X. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC211	LDW20-SC211FD	
1,4-Dichlorobenzene	1.7	1.6	6
Benzyl alcohol	9.8	7.7	24
Benzoic acid	34.8	30.9	12

XI. Internal Standards

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

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

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 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 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C2b

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/06/20

SDG #: 20F0094

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: JVC

2nd Reviewer: CF

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 10.0°C, 9.5°C, 12.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	SW	D = 8/9
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
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-ITT133	20F0094-01	Sediment	06/03/20
2	LDW20-SC140	20F0094-02	Sediment	06/03/20
3	LDW20-SC142	20F0094-03	Sediment	06/03/20
4	LDW20-SC150	20F0094-04	Sediment	06/03/20
5	LDW20-SC135	20F0094-07	Sediment	06/03/20
6	LDW20-SC202	20F0094-08	Sediment	06/03/20
7	LDW20-SC203	20F0094-09	Sediment	06/03/20
8	LDW20-SC211 D	20F0094-10	Sediment	06/03/20
9	LDW20-SC211FD D	20F0094-11	Sediment	06/03/20
10	LDW20-IT139	20F0094-13	Sediment	06/03/20
11	LDW20-IT151	20F0094-14	Sediment	06/03/20
12	LDW20-IT146	20F0094-15	Sediment	06/03/20
13	LDW20-ITT133MS	20F0094-01MS	Sediment	06/03/20
14	LDW20-ITT133MSD	20F0094-01MSD	Sediment	06/03/20

-1. BFI0371-Blk1 -2. BI F0403-Blk2 cPAH = 1, 10-12

LDC #: 48680 C26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: ~~PAH~~ SVOA (EPA SW 846 Method 8270D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤30%?		✓		
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?	✓	✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VIII. 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
IX. 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?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), 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?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 48680C26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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

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

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: ~~<20.0%~~ 30%)	Associated Samples	Qualifications
		SIC0029-SCV1	QQ	34.4	2-9, MB2 (ND+Det)	J/UJ/A

LDC #: 48680 C26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

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

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

(Y) N N/A Was 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
	06/20/20	NT1006 20035	PPP	37.8		2-9, MB 2 (ND + Det)	J/UJ/A
			TT	58.9			

LDC#: 48680C2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

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

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

Compound	Concentration (ug/Kg)		RPD
	8	9	
E	1.7	1.6	6
QQQ	9.8	7.7	24
PPP	34.8	30.9	12

V:\Josephine\FIELD DUPLICATES\48680C2b windward duwamish.wpd

LDC #: 48680C2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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 (IS)	Reported RRF (RRF 5 std)	Recalculated RRF (RRF 5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SIM NT10	02/28/20	1,4-DCB (DCB)	1.31443	1.31443	1.41049	1.41049	10.3	10.3
			1,2,4-TCB (NPT)	0.36297	0.36297	0.40284	0.40284	12.2	12.2
			Pentachlorophenol (PHN)	0.19257	0.19257	0.16863	0.16863	11.6	11.6

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 2.5 std)	Recalculated RRF (RRF 2.5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
2	ICAL SIM NT8	05/11/20	Chrysene (CRY)	1.22429	1.22429	1.17941	1.17941	5.1	5.1
			Benzo(a)pyrene (PRY)	1.17321	1.17321	1.08195	1.08195	9.9	9.9

LDC # 48680C2a

VALIDATION FINDINGS WORSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT10062003S	6/20/2020	1,4-DCB (DCB)	1.41049	1.37278	1.37278	2.7	2.7
			1,2,4-TCB (NPT)	0.40284	0.41085	0.41085	2.0	2.0
	NT10		Pentachlorophenol (PHN)	0.16863	0.06929	0.06929	58.9	58.9
2	N820061702	6/17/2020	Chrysene (CRY)	1.17941	1.15108	1.15108	2.4	2.4
	NT8		Benzo(a)pyrene (PRY)	1.08195	1.02197	1.01383	6.3	6.3

LDC #: 48680 C2b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Ni~~trobenzene-d5~~ W-d10	3.00	1.978	65.9	65.9	0
2-Fl~~uorobiphe~~nyl KKK-d14	↓	2.749	91.6	91.3	↓
Ter~~phenyl-~~d14 YY-d10	↓	2.224	74.1	74.1	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

LDC #: 48680 C26

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = | MSC - MSC | * 2/(MSC + MSDC) MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD samples: 13/14

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Acenaphthene											
Pyrene											
Benzo(a)pyrene	300	300	21.3	324	310	101	101	96.4	96.4	4.19	4.52

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

LDC #: 43686C26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

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

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

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = | LCSC - LCSDC | * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BI F0403-BS2

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene										
Pyrene										
PCP	1500	NA	916	NA	61.0	61.0				

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

LDC #: 48680C26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

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

(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?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$$

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).
V_i = Volume of extract injected in microliters (ul)
V_t = Volume of the concentrated extract in microliters (ul)
Df = Dilution Factor.
%S = Percent solids, applicable to soil and solid matrices only.
2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 1, Chrysene

$$\text{Conc.} = \frac{(27114)(2.0)(0.5\text{mL})(1000)(\quad)}{(64278)(1.17941)(13.7\text{g})(0.7307)(\quad)}$$

$$= 35.73 \text{ ug/kg}$$

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	1	Chrysene	35.7	35.7	—

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC142MS	20F0094-03MS	Sediment	06/03/20
LDW20-SC142MSD	20F0094-03MSD	Sediment	06/03/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 10.0°C, 9.5°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0094	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	UJ (all non-detects)	A

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

Samples LDW20-SC211 and LDW20-SC211FD 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.

Due to no ICV performed, 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
Hexachlorobenzene - Data Qualification Summary - SDG 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	Hexachlorobenzene	UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C3a
SDG #: 20F0094
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: DO
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temps. = 10.0°C, 9.5°C, 12.0°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /15	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 7/8
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-SC140		20F0094-02	Sediment	06/03/20
2	LDW20-SC142		20F0094-03	Sediment	06/03/20
3	LDW20-SC150		20F0094-04	Sediment	06/03/20
4	LDW20-SC135		20F0094-07	Sediment	06/03/20
5	LDW20-SC202		20F0094-08	Sediment	06/03/20
6	LDW20-SC203		20F0094-09	Sediment	06/03/20
7	LDW20-SC211	D	20F0094-10	Sediment	06/03/20
8	LDW20-SC211FD	D	20F0094-11	Sediment	06/03/20
9	LDW20-SC142MS		20F0094-03MS	Sediment	06/03/20
10	LDW20-SC142MSD		20F0094-03MSD	Sediment	06/03/20
11					

Notes:

	BIF0353-Blk1						

LDC #: 48680C3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

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

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC156	20F0094-05	Sediment	06/03/20
LDW20-SC162	20F0094-06	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC144	20F0094-12	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20
LDW20-ITT133MS	20F0094-01MS	Sediment	06/03/20
LDW20-ITT133MSD	20F0094-01MSD	Sediment	06/03/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 10.0°C, 9.5°C, and 12.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0094	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) 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-ITT133MS/MSD (LDW20-ITT133)	Aroclor-1260	-	126 (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) 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-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-SC211	LDW20-SC211FD	
Aroclor-1248	47.9	55.5	15
Aroclor-1254	67.2	78.0	15
Aroclor-1260	82.2	54.3	41

X. Compound Quantitation

All compound quantitations met validation criteria.

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-SC135	Aroclor-1248	44.9	J (all detects)	A
LDW20-SC211FD	Aroclor-1248 Aroclor-1260	48.9 44.9	J (all detects) J (all detects)	A
LDW20-IT139	Aroclor-1248	54.2	J (all detects)	A
LDW20-IT151	Aroclor-1248	48.5	J (all detects)	A
LDW20-IT146	Aroclor-1248	46.8	J (all detects)	A

XI. Target Compound Identification

All target compound identifications met validation criteria.

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 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 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-ITT133 LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC156 LDW20-SC162 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD LDW20-SC144 LDW20-IT139 LDW20-IT151 LDW20-IT146	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-ITT133	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC135	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC211FD	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT139	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT151	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT146	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C3b

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/04/20

SDG #: 20F0094

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: SW

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 10.0°C, 9.5°C, 12.0°C (Insufficient time to cool)
II.	Initial calibration/ICV	A / SW	ICAL ≤ 20%, ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS/D, SRM
IX.	Field duplicates	SW	D = 10/11
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	A	
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-ITT133		20F0094-01	Sediment	06/03/20
2	LDW20-SC140		20F0094-02	Sediment	06/03/20
3	LDW20-SC142		20F0094-03	Sediment	06/03/20
4	LDW20-SC150		20F0094-04	Sediment	06/03/20
5	LDW20-SC156		20F0094-05	Sediment	06/03/20
6	LDW20-SC162		20F0094-06	Sediment	06/03/20
7	LDW20-SC135		20F0094-07	Sediment	06/03/20
8	LDW20-SC202		20F0094-08	Sediment	06/03/20
9	LDW20-SC203		20F0094-09	Sediment	06/03/20
10	LDW20-SC211	D	20F0094-10	Sediment	06/03/20
11	LDW20-SC211FD	D	20F0094-11	Sediment	06/03/20
12	LDW20-SC144		20F0094-12	Sediment	06/03/20
13	LDW20-IT139		20F0094-13	Sediment	06/03/20
14	LDW20-IT151		20F0094-14	Sediment	06/03/20
15	LDW20-IT146		20F0094-15	Sediment	06/03/20
16	LDW20-ITT133MS		20F0094-01MS	Sediment	06/03/20
17	LDW20-ITT133MSD		20F0094-01MSD	Sediment	06/03/20

- BIF0320-BLK1

Note: Some surr NR due to chromatographic interference. (NRS)

LDC #: 48680C3b

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?		✓		
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?			✓	
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?			✓	
Were endrin and 4,4'-DDT breakdowns ≤ 15% for individual breakdown in the Evaluation mix standards?			✓	
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			✓	
Were the RT windows properly established?	✓			
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20%?		✓		
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
Were all the retention times within the acceptance windows?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?	✓			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	

LDC #: 48680 C3b

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Were internal standard area counts within ± 50% of the average area calculated during calibration?	✓			
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?		✓		
IX. 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?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	✓			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?		✓		
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

_____

_____

LDC #: 48680C36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SCV	1 2C	BB	21.0	All (bet)	J/UJ/A (qual Z, AA, BB)

LDC #: 48680C3b

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates

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

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

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

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
[✓ Y] N N/A Was a 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 the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	16/17	BB	( )	126 (58-120)	( )	1 (Det)	J dets/A
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680C3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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

Compound	Concentration (ug/Kg)		RPD
	10	11	
Aroclor 1248	47.9	55.5	15
Aroclor 1254	67.2	78.0	15
Aroclor 1260	82.2	54.3	41

LDC #: 48680 C35

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

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

METHOD: / GC __ HPLC

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

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	7	44.9	J dets /A
	Z	11	48.9	
	BB	↓	44.9	
	Z	13	54.2	
	Z	14	48.5	
	Z	15	46.8	/

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680C3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs, — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (250 std)	Recalculated RRF (250 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL ECD7	6/10/2020	1260-1 ZB5 (HBP)	0.03748	0.03748	0.03633	0.03633	1.944	1.946
			1260-1 ZB35 (HBP)	0.04683	0.04683	0.04865	0.04865	13.540	13.537

LDC # 48680C3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

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

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Conc	Reported Conc (CCV)	Recalculated Conc (CCV)	Reported % D	Recalculated %D
1	20061804ECD7	6/17/2020	1260-1 ZB5 (HBP)	250.0	254.5	254.5	1.8	1.8
			1260-1 ZB35 (HBP)	250.0	261.9	261.9	4.7	4.7
2	20061821ECD7	6/17/2020	1260-1 ZB5 (HBP)	250.0	266.7	266.7	6.7	6.7
			1260-1 ZB35 (HBP)	250.0	284.9	284.9	13.9	13.9
3	20061833ECD7.	6/18/2020	1260-1 ZB5 (HBP)	250.0	277.1	277.1	10.9	10.9
			1260-1 ZB35 (HBP)	250.0	293.4	293.4	17.4	17.4
4	20061903ECD7	6/19/2020	1260-1 ZB5 (HBP)	250.0	250.5	250.5	0.2	0.2
			1260-1 ZB35 (HBP)	250.0	258.3	258.3	3.3	3.3

LDC #: 48680C3b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene	Col 1	40.0	6.8 (5)	84.6	85	
Tetrachloro-m-xylene						
Decachlorobiphenyl	Col 1	↓	8.0 (5)	100	100	
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:

LDC #: 48680 C2b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: (V)

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

The percent recoveries (%R) and Relative Percent difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration
SA = Spike added
SC = Concentration

RPD = I MS - MSD I * 2/(MS + MSD)

MS = Matrix spike percent recovery
MSD = Matrix spike duplicate percent recovery

MS/MSD samples: 16/17

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	-	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC											
4,4'-DDT											
Aroclor 1260	101	101	69.5	179	197	108	108	126	126	9.82	9.57

Comments: Refer ot Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48680 C36

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Reviewer: JVG
2nd Reviewer:

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

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

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration
SA = Spike added
SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: BIF0320-BS1

Compound	Spike Added (ug/kg)		Spiked Sample Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC										
4,4'-DDT										
Aroclor 1260	101	101	86.2	95.6	85.5	85.5	94.8	94.8	10.4	10.3

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

LDC #: 48680C36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

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

(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 = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

A = Area of compound
Fv = Final Volume of extract
Df = Dilution Factor
RF = Average Response Factor of compound in ICal
Vs = Initial Volume of sample
Ws = Initial Weight of sample
%S = Percent Solid

Example:

Sample I.D. 1 1260 : Col. 1
1260-1

Conc. = $\frac{(6245)(80)}{(189079)(0.07633)}$

= 72.7

1260 Ave = $\frac{72.7 + 67.7 + 69.4 + 68.7 + 70.5}{5}$

= 69.81

final conc. = $\frac{(69.81)(2.5\,mL)(5)}{(17.19g)(0.7367)}$

= 69.47

≈ 69.5 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	1	1260	69.5	69.5	—

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 18, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20

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	Arsenic	0.025 ug/L	All samples in SDG 20F0094

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC109MS/MSD (LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD)	Silver	41.5 (75-125)	49.8 (75-125)	J (all detects)	A
LDW20-SC109MS/MSD (LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD)	Copper	130 (75-125)	-	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

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

XI. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC211	LDW20-SC211FD	
Arsenic	9	8.06	11

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SC211	LDW20-SC211FD	
Cadmium	0.33	0.29	13
Chromium	25.9	23.8	8
Copper	46.2	40.7	13
Lead	25.9	25.6	1
Mercury	0.130	0.146	12
Silver	0.32	0.29	10
Zinc	104	93.0	11

XII. Internal Standards (ICP-MS)

Internal standard 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 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 20F0094

Sample	Analyte	Flag	A or P	Reason
LDW20-SC140 LDW20-SC142 LDW20-SC150 LDW20-SC135 LDW20-SC202 LDW20-SC203 LDW20-SC211 LDW20-SC211FD	Silver Copper	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C4a

SDG #: 20F0094

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

Page: 1 of 1

Reviewer: ATL

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	From SDG # 20F0039 (LDW20-SC109MS/MSD), SDG # 20F0109 (LDW20-SC214MS/MSD)
VIII.	Duplicate sample analysis	A	From SDG # 20F0039 (LDW20-SC109DUP), SDG # 20F0109 (LDW20-SC214DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	SW	(8,9)
XII.	Internal Standard (ICP-MS)	N	
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-IT133	20F0094-01	Sediment	06/03/20
2	LDW20-SC140	20F0094-02	Sediment	06/03/20
3	LDW20-SC142	20F0094-03	Sediment	06/03/20
4	LDW20-SC150	20F0094-04	Sediment	06/03/20
5	LDW20-SC135	20F0094-07	Sediment	06/03/20
6	LDW20-SC202	20F0094-08	Sediment	06/03/20
7	LDW20-SC203	20F0094-09	Sediment	06/03/20
8	LDW20-SC211	20F0094-10	Sediment	06/03/20
9	LDW20-SC211FD	20F0094-11	Sediment	06/03/20
10	LDW20-IT139	20F0094-13	Sediment	06/03/20
11	LDW20-IT151	20F0094-14	Sediment	06/03/20
12	LDW20-IT146	20F0094-15	Sediment	06/03/20
13				
14				

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2 to 9	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,10,11,12	As

Analysis Method

ICP	
ICP-MS	
CVAA	

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 (units)**	**Maximum ICB/CCB (ug/L)**	**Action Level**									
As		0.025										

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-SC109	S	Ag	41.5	49.8	75-125			2 to 9	J/UJ/A	Det
		Cu	130		75-125			2 to 9	Jdet/A	Det

Comments:

Method: Metals

Analyte	Concentration (mg/kg)		RPD	Qualifiers (Parents Only)
	8	9		
Arsenic	9	8.06	11	
Cadmium	0.33	0.29	13	
Chromium	25.9	23.8	8	
Copper	46.2	40.7	13	
Lead	25.9	25.6	1	
Mercury	0.130	0.146	12	
Silver	0.32	0.29	10	
Zinc	104	93.0	11	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-ITT133	20F0094-01	Sediment	06/03/20
LDW20-SC140	20F0094-02	Sediment	06/03/20
LDW20-SC142	20F0094-03	Sediment	06/03/20
LDW20-SC150	20F0094-04	Sediment	06/03/20
LDW20-SC156	20F0094-05	Sediment	06/03/20
LDW20-SC162	20F0094-06	Sediment	06/03/20
LDW20-SC135	20F0094-07	Sediment	06/03/20
LDW20-SC202	20F0094-08	Sediment	06/03/20
LDW20-SC203	20F0094-09	Sediment	06/03/20
LDW20-SC211	20F0094-10	Sediment	06/03/20
LDW20-SC211FD	20F0094-11	Sediment	06/03/20
LDW20-SC144	20F0094-12	Sediment	06/03/20
LDW20-IT139	20F0094-13	Sediment	06/03/20
LDW20-IT151	20F0094-14	Sediment	06/03/20
LDW20-IT146	20F0094-15	Sediment	06/03/20
LDW20-ITT133DUP	20F0094-01DUP	Sediment	06/03/20
LDW20-SC202MS	20F0094-08MS	Sediment	06/03/20
LDW20-SC202DUP	20F0094-08DUP	Sediment	06/03/20

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 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. 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 method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC211 and LDW20-SC211FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SC211	LDW20-SC211FD	
Total solids	53.66	54.83	2
Total organic carbon	1.79	1.84	3

X. Sample Result Verification

All sample result verifications were acceptable.

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 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0094 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
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	17, From SDG # 20F0039 (LDW20-SC109MS)
VII.	Duplicate sample analysis	A	16,18, From SDG # 20F0039 (LDW20-SC109DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	SW	(10,11)
X.	Sample result verification	A	
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-ITT133	20F0094-01	Sediment	06/03/20
2	LDW20-SC140	20F0094-02	Sediment	06/03/20
3	LDW20-SC142	20F0094-03	Sediment	06/03/20
4	LDW20-SC150	20F0094-04	Sediment	06/03/20
5	LDW20-SC156	20F0094-05	Sediment	06/03/20
6	LDW20-SC162	20F0094-06	Sediment	06/03/20
7	LDW20-SC135	20F0094-07	Sediment	06/03/20
8	LDW20-SC202	20F0094-08	Sediment	06/03/20
9	LDW20-SC203	20F0094-09	Sediment	06/03/20
10	LDW20-SC211	20F0094-10	Sediment	06/03/20
11	LDW20-SC211FD	20F0094-11	Sediment	06/03/20
12	LDW20-SC144	20F0094-12	Sediment	06/03/20
13	LDW20-IT139	20F0094-13	Sediment	06/03/20
14	LDW20-IT151	20F0094-14	Sediment	06/03/20
15	LDW20-IT146	20F0094-15	Sediment	06/03/20
16	LDW20-ITT133DUP	20F0094-01DUP	Sediment	06/03/20
17	LDW20-SC202MS	20F0094-08MS	Sediment	06/03/20
18	LDW20-SC202DUP	20F0094-08DUP	Sediment	06/03/20

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
II. Calibration				
Were all instruments calibrated at the required frequency?	X			
Were the proper number of standards used?	X			
Were all initial and continuing calibration verifications within the QC limits?	X			
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
Were balance checks performed as required?	X			
III. 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		
IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries within 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			
V. 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			
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			

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
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	

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 15	TS, TOC
QC	
16	TS
17,18	TOC

METHOD: Inorganics

Analyte	Concentration (%)		RPD	Qualifiers (Parents Only)
	10	11		
Total Solids	53.66	54.83	2	
Total Organic Carbons	1.79	1.84	3	

LDC #: 48680C6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

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

METHOD: Inorganics, Method TOC (EPA 9060A)

The correlation coefficient (r) for the calibration of N/A was recalculated. Calibration date: N/A

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found x 100 / True

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Found (units)	True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	N/A	Blank			N/A	N/A	N/A
		Standard 1					
		Standard 2					
		Standard 3					
		Standard 4					
		Standard 5					
		Standard 6					
		Standard 7					
Calibration verification ICV	TOC		44.637	44.446	100	100	Y
Calibration verification CCV1	TOC		45.265	44.446	102	102	Y
Calibration verification CCV2	TOC		46.913	44.446	106	106	Y

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

METHOD: Inorganics

Percent recoveries (%R) for the laboratory control sample (LCS) and matrix spike (MS) were recalcuated 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

Sample ID	Type of Analysis	Element	Found/S	True/D	Recalculated %R/RPD	Reported %R/RPD	Acceptable (Y/N)
LCS	LCS	TOC	43.031	44.4	96.91666667	96.8	Y
17	MS	TOC	1.8802	1.97	95.44162437	95.5	Y
16	Duplicate	TS	72.028	72.3644	0.465952502	0.466	Y

METHOD: Inorganics

Analytes were recalculated and verified using the following equation:

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

Sample ID	Analyte	Raw Data (%)	Dilution	Initial Weight/ Volume (g)	Final Volume (g)	Percent solids (%)	Reported Result (%)	Recalculated Result (%)	Acceptable (Y/N)
1	TS		1	6.8636	4.9668		72.36	72.3643569	Y
2	TOC	0.543	1	0.23	0.23	66.02	0.82	0.822478037	Y
3	TS		1	6.4035	4.6174		72.11	72.10744124	Y
4	TOC	1.417	1	0.2248	0.2248	62.84	2.25	2.254933164	Y
5	TS		1	6.6351	4.4181		66.59	66.58678844	Y
6	TOC	1.161	1	0.3222	0.3222	57.19	2.03	2.030075188	Y
7	TS		1	6.2706	3.8344		61.15	61.14885338	Y
8	TOC	1.104	1	0.2183	0.2183	61.55	1.79	1.793663688	Y
9	TS		1	5.6582	3.3779		59.7	59.69919762	Y
10	TOC	0.963	1	0.2737	0.2737	53.66	1.79	1.794632874	Y
11	TS		1	6.8484	3.7547		54.83	54.82594475	Y
12	TOC	0.768	1	0.4534	0.4534	64.53	1.19	1.190144119	Y
13	TS		1	6.5502	4.7143		71.97	71.97184819	Y
14	TOC	0.445	1	0.2858	0.2858	67.22	0.66	0.662005356	Y
15	TS		1	7.1653	5.2522		73.3	73.30048986	Y

LDC Report# 48680C21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT146	20F0094-15	Sediment	06/03/20

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 at 10°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

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

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

III. Initial Calibration and Initial Calibration Verification

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0094	1,2,3,4,7,8,9-HpCDF	J (all detects)	P

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0094

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. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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 20F0094	All compounds reported as estimated maximum possible concentration (EMPC).	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 continuing calibration concentration and compounds reported as EMPC, 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 20F0094

Sample	Compound	Flag	A or P	Reason
LDW20-IT146	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-IT146	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0094

No Sample Data Qualified in this SDG

LDC #: 48680C21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0094 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 10 deg C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35% ICV ≤ QC Limits
IV.	Continuing calibration	SW	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jdets/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT146	20F0094-15	Sediment	06/03/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680C21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [signature]

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

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

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)

LDC #: 48680C21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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

Blank extraction date: 06/22/20 **Blank analysis date:** 06/25/20 **Associated samples:** All **(>5X)**

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)									
B	0.175	0.88									
M	0.0946*	0.47									
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC159	20F0105-01	Sediment	06/04/20
LDW20-SC154	20F0105-02	Sediment	06/04/20
LDW20-SC158	20F0105-03	Sediment	06/04/20
LDW20-IT243	20F0105-04	Sediment	06/04/20
LDW20-SC159MS	20F0105-01MS	Sediment	06/04/20
LDW20-SC159MSD	20F0105-01MSD	Sediment	06/04/20

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

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

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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0105	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) 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-SC159MS/MSD (LDW20-SC159)	Aroclor-1260	48.0 (58-120)	51.1 (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-IT243	Aroclor-1248	43.5	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, MS/MSD %R, 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 20F0105

Sample	Compound	Flag	A or P	Reason
LDW20-SC159 LDW20-SC154 LDW20-SC158 LDW20-IT243	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC159	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT243	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

LDC #: 48680D3b

SDG #: 20F0105

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/04/20

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 / A	
II.	Initial calibration/ICV	A / SW	ICAL ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC159	20F0105-01	Sediment	06/04/20
2	LDW20-SC154	20F0105-02	Sediment	06/04/20
3	LDW20-SC158	20F0105-03	Sediment	06/04/20
4	LDW20-IT243	20F0105-04	Sediment	06/04/20
5	LDW20-SC159MS	20F0105-01MS	Sediment	06/04/20
6	LDW20-SC159MSD	20F0105-01MSD	Sediment	06/04/20
7				
8				
9				
10				
11				
12				

Notes:

—	BIF0376-BLK1						

Note: #4 = DCB not reported due to chromatographic interference. (KRS)

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

_____

_____

LDC #: 48680 J3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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

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

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

LDC #: 48680D3b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

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

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

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

[✓ Y] N N/A Was a 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 the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	5/6	BB	48.0 (58-120)	51.1 (58-120)	( )	1 (Det)	J/UJ/A
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 48680 D3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: / GC __ HPLC

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

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	4	43.5	J dets /A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT243	20F0105-04	Sediment	06/04/20

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

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/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.

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 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

LDC #: 48680D4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0105

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: ATL

2nd Reviewer:

METHOD: Arsenic (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	A	From SDG # 20F0109 (LDW20-SC214MS/MSD)
VIII.	Duplicate sample analysis	A	From SDG # 20F0109 (LDW20-SC214DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
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-IT243	20F0105-04	Sediment	06/04/20
2				
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11				
12				
13				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC159	20F0105-01	Sediment	06/04/20
LDW20-SC154	20F0105-02	Sediment	06/04/20
LDW20-SC158	20F0105-03	Sediment	06/04/20
LDW20-IT243	20F0105-04	Sediment	06/04/20

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 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

LDC #: 48680D6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0105 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
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	From SDG # 20F0094 (LDW20-SC202MS)
VII.	Duplicate sample analysis	A	From SDG # 20F0094 (LDW20-ITT133DUP), (LDW20-SC202DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC159	20F0105-01	Sediment	06/04/20
2	LDW20-SC154	20F0105-02	Sediment	06/04/20
3	LDW20-SC158	20F0105-03	Sediment	06/04/20
4	LDW20-IT243	20F0105-04	Sediment	06/04/20
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15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 4	TS, TOC

LDC Report# 48680D21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0105

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT243	20F0105-04	Sediment	06/04/20

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 with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0105	1,2,3,4,7,8,9-HpCDF	J (all detects)	P

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0105

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. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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 20F0105	All compounds reported as estimated maximum possible concentration (EMPC).	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 continuing calibration concentration and compounds reported as EMPC, 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 20F0105

Sample	Compound	Flag	A or P	Reason
LDW20-IT243	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-IT243	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0105

No Sample Data Qualified in this SDG

LDC #: 48680D21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0105 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

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

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

	Validation Area		Comments	
I.	Sample receipt/Technical holding times	A/A		
II.	HRGC/HRMS Instrument performance check	A		
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35%	ICV ≤ QC Limits
IV.	Continuing calibration	SW	CCV ≤ QC Limits	
V.	Laboratory Blanks	SW		
VI.	Field blanks	N		
VII.	Matrix spike/Matrix spike duplicates	N		
VIII.	Laboratory control samples	A	OPR, SRM	
IX.	Field duplicates	N		
X.	Labeled Compounds	A		
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jdets/A	
XII.	Target compound identification	N		
XIII.	System performance	N		
XIV.	Overall assessment of data	A		

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT243	20F0105-04	Sediment	06/04/20
2				
3				
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10				

Notes:

	BIF0465-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680D21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [signature]

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

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

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)

LDC #: 48680D21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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

Blank extraction date: 06/22/20 **Blank analysis date:** 06/25/20 **Associated samples:** All **(>5X)**

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)									
B	0.175	0.88									
M	0.0946*	0.47									
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
LDW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C, 12.4°C, 10.1°C, and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

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 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680E2a
SDG #: 20F0109
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/05/20
Page: 1 of 1
Reviewer: SMG
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp. = 13.8°C, 12.4°C, 10.1°C, 11.2°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC214	20F0109-05	Sediment	06/04/20
2	LDW20-SC251	20F0109-09	Sediment	06/04/20
3	LDW20-SC264	20F0109-10	Sediment	06/04/20
4	LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
5	LDW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20
6				
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Notes:

	BIF0410-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
LDW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C, 12.4°C, 10.1°C, and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0109	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
06/26/20	Benzoic acid	22.9	All samples in SDG 20F0109	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
BIF0410-BLK2	06/17/20	1,4-Dichlorobenzene Benzoic acid	0.7 ug/Kg 17.1 ug/Kg	All samples in SDG 20F0109

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-SC214	1,4-Dichlorobenzene	2.5 ug/Kg	2.5U ug/Kg
LDW20-SC251	1,4-Dichlorobenzene Benzoic acid	2.1 ug/Kg 89.0 ug/Kg	2.1U ug/Kg 89.0U ug/Kg
LDW20-SC264	1,4-Dichlorobenzene	2.9 ug/Kg	2.9U 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.

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 three 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 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-SC214 LDW20-SC251 LDW20-SC264	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC214 LDW20-SC251 LDW20-SC264	Benzoic acid	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0109

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC214	1,4-Dichlorobenzene	2.5U ug/Kg	A
LDW20-SC251	1,4-Dichlorobenzene Benzoic acid	2.1U ug/Kg 89.0U ug/Kg	A
LDW20-SC264	1,4-Dichlorobenzene	2.9U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680E2b

SDG #: 20F0109

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/06/20

Page: 1 of 1

Reviewer: DK

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	~~SW~~ / A	Cooler temps = 13.8°C, 12.4°C, 10.1°C, 11.2°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% and 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	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC214	20F0109-05	Sediment	06/04/20
2	LDW20-SC251	20F0109-09	Sediment	06/04/20
3	LDW20-SC264	20F0109-10	Sediment	06/04/20
4	LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
5	LDW20-SC251MSD	20F0109-09MSD	Sediment	06/04/20
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Notes:

-	BIF 0410-Blk2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680 E26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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

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

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤20.0%~~ (30%))	Associated Samples	Qualifications
		SIF0395-SCV1	QQ	65.7	All (Det)	J/UJ/A

LDC #: 48680 E26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [illegible]

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

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

(Y) N N/A Was 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
	06/26/20	NT14200626155	PPP	22.9		All (Det)	J/UJ/A

CONCAL.wpd

LDC #: 48680 E 26

VALIDATION FINDINGS WORKSHEET
Blanks

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

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

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

Y N N/A Was a 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: 06/17/20 **Blank analysis date:** 06/26/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID								
	BIF0410-BLK2		1	2	3				
E	0.7		2.5/U	2.1/U	2.9/U				
PPP	17.1			89.0/U					

<RL

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C and 11.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Sample	Compound	Finding	Criteria	Flag	A or P
All samples in SDG 20F0109	Hexachlorobenzene	ICV not performed.	ICV required prior to each analytical run.	UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

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

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to no ICV performed, 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
Hexachlorobenzene - Data Qualification Summary - SDG 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-SC214 LDW20-SC251 LDW20-SC264	Hexachlorobenzene	UJ (all non-detects)	A	Initial calibration verification (%D)

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680E3a
SDG #: 20F0109
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/09/20
Page: 1 of 1
Reviewer: JMP
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temps = 13.8°C, 11.2°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20? ICV ≤ 20?
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes TCS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC214	20F0109-05	Sediment	06/04/20
2	LDW20-SC251	20F0109-09	Sediment	06/04/20
3	LDW20-SC264	20F0109-10	Sediment	06/04/20
4				
5				
6				
7				
8				
9				
10				

Notes:

+	BI F0353-Blk1						

LDC #: 48680E3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: 9

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

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
		No ICV performed		Hexachlorobenzene		All (ND)	J/UJ/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC168	20F0109-01	Sediment	06/04/20
LDW20-SC161	20F0109-02	Sediment	06/04/20
LDW20-IT236	20F0109-03	Sediment	06/04/20
LDW20-SC167	20F0109-04	Sediment	06/04/20
LDW20-SC167DL	20F0109-04DL	Sediment	06/04/20
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-IT232	20F0109-07	Sediment	06/04/20
LDW20-SC318	20F0109-08	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC168MS	20F0109-01MS	Sediment	06/04/20
LDW20-SC168MSD	20F0109-01MSD	Sediment	06/04/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.8°C, 12.4°C, 10.1°C, and 11.2°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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0109	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) 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

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-SC168	Aroclor-1260	44.5	J (all detects)	A
LDW20-SC161	Aroclor-1248	44.8	J (all detects)	A
LDW20-SC167	Aroclor-1248	42.1	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-SC167	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-SC167DL	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 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 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-SC168 LDW20-SC161 LDW20-IT236 LDW20-SC214 LDW20-IT232 LDW20-SC318 LDW20-SC251 LDW20-SC264	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC167	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC167DL	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SC168	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC161 LDW20-SC167	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC167	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-SC167DL	All compounds except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680E3b

SDG #: 20F0109

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/04/20

Page: 1 of 1

Reviewer: ~~AC~~

2nd Reviewer: ~~AC~~

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps. = 13.8°C, 12.4°C, 10.1°C, 11.2°C (Insufficient time to cool)
II.	Initial calibration/ICV	A / SW	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS/D, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	SW	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC168	20F0109-01	Sediment	06/04/20
2	LDW20-SC161	20F0109-02	Sediment	06/04/20
3	LDW20-IT236	20F0109-03	Sediment	06/04/20
4	LDW20-SC167	20F0109-04	Sediment	06/04/20
5	LDW20-SC167~~RE~~ DL	20F0109-04~~RE~~ DL	Sediment	06/04/20
6	LDW20-SC214	20F0109-05	Sediment	06/04/20
7	LDW20-IT232	20F0109-07	Sediment	06/04/20
8	LDW20-SC318	20F0109-08	Sediment	06/04/20
9	LDW20-SC251	20F0109-09	Sediment	06/04/20
10	LDW20-SC264	20F0109-10	Sediment	06/04/20
11	LDW20-SC168MS	20F0109-01MS	Sediment	06/04/20
12	LDW20-SC168MSD	20F0109-01MSD	Sediment	06/04/20
13	~~- SC169~~	~~- 06~~		

Notes:

-	BIF0745-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

_____

_____

LDC #: 48680 E3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer:

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

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

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

LDC #: 48680 E36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: + GC __ HPLC

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

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	1	44.5	J dets (+)
	Z	2	44.8	
	Z	4	42.1	
	BB	13	41.7	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680 E3b

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

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

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

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

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

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

#	Compound Name	Finding	Associated sample	Qualifications
	BB	> cal range	4	NR / A
				↓
	All except BB	dil	5	↓

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT236	20F0109-03	Sediment	06/04/20
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-IT232	20F0109-07	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC214MS	20F0109-05MS	Sediment	06/04/20
LDW20-SC214MSD	20F0109-05MSD	Sediment	06/04/20
LDW20-SC214DUP	20F0109-05DUP	Sediment	06/04/20

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	Arsenic	0.025 ug/L	LDW20-SC214

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC214MS/MSD (LDW20-SC214 LDW20-SC251 LDW20-SC264)	Silver	29.7 (75-125)	44 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-SC214MS/MSD (LDW20-SC214 LDW20-SC251 LDW20-SC264)	Silver	37.8 (≤20)	J (all detects)	A

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW20-SC214DUP (LDW20-SC214 LDW20-SC251 LDW20-SC264)	Mercury	-	0.189 mg/Kg (≤0.0974)	J (all detects)	A

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the 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 methods. No results were rejected in this SDG.

Due to MS/MSD %R and RPD and DUP difference, 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
Metals - Data Qualification Summary - SDG 20F0109

Sample	Analyte	Flag	A or P	Reason
LDW20-SC214 LDW20-SC251 LDW20-SC264	Silver	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)(RPD)
LDW20-SC214 LDW20-SC251 LDW20-SC264	Mercury	J (all detects)	A	Duplicate sample analysis (difference)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680E4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0109

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: ATL

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	(6,7)
VIII.	Duplicate sample analysis	SW	8
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
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-IT236	20F0109-03	Sediment	06/04/20
2	LDW20-SC214	20F0109-05	Sediment	06/04/20
3	LDW20-IT232	20F0109-07	Sediment	06/04/20
4	LDW20-SC251	20F0109-09	Sediment	06/04/20
5	LDW20-SC264	20F0109-10	Sediment	06/04/20
6	LDW20-SC214MS	20F0109-05MS	Sediment	06/04/20
7	LDW20-SC214MSD	20F0109-05MSD	Sediment	06/04/20
8	LDW20-SC214DUP	20F0109-05DUP	Sediment	06/04/20
9				
10				
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2,4,5	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,3	As
QC	
6,7,8	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg

Analysis Method

ICP	
ICP-MS	
CVAA	

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: 2

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (ug/L)**	**Action Level**									
As		0.025										

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
6 & 7	S	Ag	29.7	44	75-125			2,4,5	J/UJ/A	Det PS=96.6%
		Ag				37.8	20	2,4,5	J/UJ/A	Det

Comments:

VALIDATION FINDINGS WORKSHEETS

Laboratory Duplicates

Reviewer: ATL

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 (mg/kg)	Difference Limit	Associated Samples	Qualification	Det/ND
8	S	Hg			0.189	0.0974	2,4,5	J/UJ/A	Det

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC168	20F0109-01	Sediment	06/04/20
LDW20-SC161	20F0109-02	Sediment	06/04/20
LDW20-IT236	20F0109-03	Sediment	06/04/20
LDW20-SC167	20F0109-04	Sediment	06/04/20
LDW20-SC214	20F0109-05	Sediment	06/04/20
LDW20-SC169	20F0109-06	Sediment	06/04/20
LDW20-IT232	20F0109-07	Sediment	06/04/20
LDW20-SC318	20F0109-08	Sediment	06/04/20
LDW20-SC251	20F0109-09	Sediment	06/04/20
LDW20-SC264	20F0109-10	Sediment	06/04/20
LDW20-SC168DUP	20F0109-01DUP	Sediment	06/04/20
LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
LDW20-SC251DUP	20F0109-09DUP	Sediment	06/04/20

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 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680E6
SDG #: 20F0109
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 7/30/20
Page: 1 of 1
Reviewer: ATL
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	11, From SDG # 20F0094 (LDW20-SC202MS)
VII.	Duplicate sample analysis	A	10,12, From SDG # 20F0094 (LDW20-SC202DUP)
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-SC168	20F0109-01	Sediment	06/04/20
2	LDW20-SC161	20F0109-02	Sediment	06/04/20
3	LDW20-IT236	20F0109-03	Sediment	06/04/20
4	LDW20-SC167	20F0109-04	Sediment	06/04/20
5	LDW20-SC214	20F0109-05	Sediment	06/04/20
6	LDW20-IT232	20F0109-07	Sediment	06/04/20
7	LDW20-SC318	20F0109-08	Sediment	06/04/20
8	LDW20-SC251	20F0109-09	Sediment	06/04/20
9	LDW20-SC264	20F0109-10	Sediment	06/04/20
10	LDW20-SC168DUP	20F0109-01DUP	Sediment	06/04/20
11	LDW20-SC251MS	20F0109-09MS	Sediment	06/04/20
12	LDW20-SC251DUP	20F0109-09DUP	Sediment	06/04/20

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 9	TS, TOC
QC	
10	TS
11,12	TOC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC148CDL	20F0157-01DL	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20
LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20

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

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC148CMS/MSD (LDW20-SC148C)	Phenanthrene	415 (49-120)	-80.1 (49-120)	J (all detects)	A
LDW20-SC148CMS/MSD (LDW20-SC148C)	Benzo(a)anthracene Chrysene	- -	-0.974 (49-120) -159 (47-120)	J (all detects) J (all detects)	A
LDW20-SC148CMS/MSD (LDW20-SC148C)	Benzofluoranthenes, total	-	23.5 (30-160)	J (all detects)	A

For LDW20-SC148CMS/MSD, no data were qualified for fluoranthene and pyrene percent recoveries (%R) and relative percent differences (RPD) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SC148CMS/MSD (LDW20-SC148C)	Phenanthrene Benzo(a)anthracene Chrysene	133 (≤30) 48.8 (≤30) 71.1 (≤30)	J (all detects) J (all detects) J (all detects)	A

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
BIF0512-SRM1	Anthracene	53.0 (57-143)	All samples in SDG 20F0157	J (all 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.

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-SC148C	Fluoranthene Pyrene	Results exceeded calibration range.	Not reportable	A
LDW20-SC148CDL	All compounds except Fluoranthene Pyrene	Results from undiluted analyses were more usable.	Not reportable	A

Due to MS/MSD %R and RPD and SRM %R, 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
Semivolatiles - Data Qualification Summary - SDG 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC148C	Phenanthrene	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC148C	Benzo(a)anthracene Chrysene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC148C	Benzofluoranthenes, total	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC148C	Phenanthrene Benzo(a)anthracene Chrysene	J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	Anthracene	J (all detects)	P	Standard reference materials (%R)
LDW20-SC148C	Fluoranthene Pyrene	Not reportable	A	Overall assessment of data
LDW20-SC148CDL	All compounds except Fluoranthene Pyrene	Not reportable	A	Overall assessment of data

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F2a

SDG #: 20F0157

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/05/20

Page: 1 of 1

Reviewer: DM

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, A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	ICAL ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	SW	

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-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC148C~~RE~~ DL	20F0157-01~~RE~~ DL	Sediment	06/08/20
3	LDW20-SC155B	20F0157-02	Sediment	06/08/20
4	LDW20-SC166C	20F0157-03	Sediment	06/08/20
5	LDW20-SC208B	20F0157-04	Sediment	06/08/20
6	LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
7	LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20
8	LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20
9				

Notes:

-	BIF0512- Bulk						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

A2. Benzofluoranthenes, Total

LDC #: 45680 F2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

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

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

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?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		6/7	UU	415 (49-120)	-80.1 (49-120)	( )	(Det)	J dets/A
			YY	367 (53-120)	-854 (53-120)	( )		NQ *
			ZZ	172 (48-121)	-546 (48-121)	( )		
			CCC	( )	-0.974 (49-120)	( )	(Det)	J/R/A
			DDD	( )	-159 (47-120)	( )		
			AZ	( )	23.5 (30-160)	( )		J/UJ/A
			UU	( )	( )	133 (30)		J dets/A
			YY	( )	( )	139 ( )		NQ *
			ZZ	( )	( )	45.4 ( )		
			CCC	( )	( )	48.8 ( )	(Det)	J dets/A
			DDD	( )	( )	71.1 ( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		

* Parent conc > 4x spike

LDC #: 48680 F2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples (LCS) / SRM

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

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

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
[✓ Y] N N/A Was a LCS required?
[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0512-SRM1	VV	53.0 (57-143)	( )	( )	All (Det)	J/UJ/P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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LDC #: 48686F2a

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

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

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

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

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

#	Date	Sample ID	Compound	Finding	Qualifications
		1	YY, ZZ	> cal range	NR/A
					↓
		2	All except above	dil	↓

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20

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

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
02/28/20	N-Nitrosodiphenylamine	34.4	All samples in SDG 20F0157	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/22/20	Benzoic acid	25.1	All samples in SDG 20F0157	J (all detects)	A

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0512-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene	33.9 (34-166) 33.6 (36-164)	All samples in SDG 20F0039	J (all detects) UJ (all non-detects) 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 four samples.

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	Benzoic acid	J (all detects)	A	Continuing calibration (%D)
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	1,4-Dichlorobenzene 1,2-Dichlorobenzene	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 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/05/20

SDG #: 20F0157

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: JG

2nd Reviewer: CJ

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 / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r^2 ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC155B	20F0157-02	Sediment	06/08/20
3	LDW20-SC166C	20F0157-03	Sediment	06/08/20
4	LDW20-SC208B	20F0157-04	Sediment	06/08/20
5	LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
6	LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20
7				
8				
9				

Notes:

—	BIF0512-Blk2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48650F26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

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

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

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

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

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

LDC #: 48680F26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [initials]

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

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

(Y) N N/A Was 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
	06/22/20	NT10200622035	PPP	25.1		All (Det)	J/UJ/A

LDC #: 48680F26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples (LCS) /SRM

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

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

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

[✓ Y] N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0512-SRM2	E	33.9 (34-166	( )	( )	All (ND + Det)	J/UJ/P
		F	33.6 (36-164	( )	( )	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 18, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20

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

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

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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0496-BLK1	06/19/20	Hexachlorobenzene	0.18 ug/Kg	All samples in SDG 20F0157

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. 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 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F3a
SDG #: 20F0157
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: DVG
2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes TCS	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-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC155B	20F0157-02	Sediment	06/08/20
3	LDW20-SC166C	20F0157-03	Sediment	06/08/20
4	LDW20-SC208B	20F0157-04	Sediment	06/08/20
5	LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
6	LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20
7				
8				
9				
10				

Notes:

	BIF0496-BLK1						

LDC #: 48680 F3a

VALIDATION FINDINGS WORKSHEET
Blanks

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

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

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

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A If extract clean-up was performed, were extract clean-up blanks analyzed at the proper frequencies?
Y N N/A Was there contamination in the method blanks? If yes, please see the qualifications below.

Blank extraction date: 06/19/20 **Blank analysis date:** 06/23/20 **Associated samples:** All (ND)
Conc. units: ug/kg

Compound	Blank ID	Sample Identification								
	BIF0496-BLK1									
Hexachlorobenzene	0.18									

Blank extraction date: _____ **Blank analysis date:** _____ **Associated samples:** _____
Conc. units: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20

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

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

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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0157	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

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-SC148C	Aroclor-1260	40.1	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.

Due to ICV %D 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 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC148C LDW20-SC155B LDW20-SC166C LDW20-SC208B	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SC148C	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F3b
SDG #: 20F0157
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: SK
2nd Reviewer: CH

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 / A	
II.	Initial calibration/ICV	A/SW	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	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-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC155B	20F0157-02	Sediment	06/08/20
3	LDW20-SC166C	20F0157-03	Sediment	06/08/20
4	LDW20-SC208B	20F0157-04	Sediment	06/08/20
5	LDW20-SC148CMS	20F0157-01MS	Sediment	06/08/20
6	LDW20-SC148CMSD	20F0157-01MSD	Sediment	06/08/20
7				
8				
9				
10				
11				
12				

Notes:

-	BIF0491-BLK1						

(no SRM)

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

_____

_____

LDC #: 48680 F36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: [illegible]

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

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

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

LDC #: 48680F3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: A

METHOD: / GC __ HPLC

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

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	1	40.1	J detects A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20

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.

Although the low level check standard exceeded QC limits for arsenic, no data was qualified since all associated results were greater than 2X the reporting limit.

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Zinc	2.3 mg/Kg	All samples in SDG 20F0157
ICB/CCB	Arsenic	0.028 ug/L	LDW20-SC166C

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

Standard reference materials (SRM) were analyzed as required by the 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 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 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0157

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: ATL

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	SW	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	non-client sample used
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
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-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC155B	20F0157-02	Sediment	06/08/20
3	LDW20-SC166C	20F0157-03	Sediment	06/08/20
4	LDW20-SC208B	20F0157-04	Sediment	06/08/20
5				
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12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1,2,3,4	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg

Analysis Method

ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEETS
Low Level Calibration Check

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

All low level calibration check standards were performed at the required frequency and were within the acceptance limits with the following exceptions:

Date	Time	Calibration ID	Analyte	%R	%R Limits	Associated Samples	Qualification*	Det/ND
6/22/2020	14:01	SIF0327-CRL1	As	142	70-130	1,2,4	no qual	det > 2x RL

Comments: *Only results that are non-detect or <2X the reporting limit require qualification.

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
All initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were performed at the required frequency and were within the acceptance limits with the following exceptions:

Date	Time	Calibration ID	Analyte	%R	%R Limits	Associated Samples	Qualification	Det/ND
6/22/2020	14:29	SIF0327-HCV2	Zn	87.7	90-110	1,2,4	no qual (samples were analyzed below ICAL range)	Det

Comments:

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**									
Zn	2.3											

Sample Concentration, unless otherwise noted: mg/kg Associated Samples: 3

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**									
As		0.028										

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC148C	20F0157-01	Sediment	06/08/20
LDW20-SC155B	20F0157-02	Sediment	06/08/20
LDW20-SC166C	20F0157-03	Sediment	06/08/20
LDW20-SC208B	20F0157-04	Sediment	06/08/20
LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

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

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

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

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F6

SDG #: 20F0157

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

Page: 1 of 1

Reviewer: ATL

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	5
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-SC148C	20F0157-01	Sediment	06/08/20
2	LDW20-SC155B	20F0157-02	Sediment	06/08/20
3	LDW20-SC166C	20F0157-03	Sediment	06/08/20
4	LDW20-SC208B	20F0157-04	Sediment	06/08/20
5	LDW20-SC148CDUP	20F0157-01DUP	Sediment	06/08/20
6				
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	TS, TOC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0157

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC208B	20F0157-04	Sediment	06/08/20

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 with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0157	1,2,3,4,7,8,9-HpCDF	J (all detects)	P

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0157

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. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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 20F0157	All compounds reported as estimated maximum possible concentration (EMPC).	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 continuing calibration concentration and compounds reported as EMPC, 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 20F0157

Sample	Compound	Flag	A or P	Reason
LDW20-SC208B	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-SC208B	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0157

No Sample Data Qualified in this SDG

LDC #: 48680F21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0157 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35% ICV ≤ QC Limits
IV.	Continuing calibration	SW	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = Jdets/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC208B	20F0157-04	Sediment	06/08/20
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	BIF0465-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680F21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

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

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

Y Was a routine calibration performed at the beginning of each 12 hour period?

N Were all concentrations within method QC limits for unlabeled and labeled compounds?

Y Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)

LDC #: 48680F21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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

Blank extraction date: 06/22/20 **Blank analysis date:** 06/25/20 **Associated samples:** All **(>5X)**

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)									
B	0.175	0.88									
M	0.0946*	0.47									
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379DL	20F0186-05DL	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379FDDL	20F0186-06DL	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 7.0°C and 12.4°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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0656-BLK1	06/23/20	Phenol	8.5 ug/Kg	All samples in SDG 20F0186

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-IT379	Phenol	16.0 ug/Kg	16.0U ug/Kg
LDW20-IT379FD	Phenol	14.0 ug/Kg	14.0U 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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379 LDW20-IT379DL)	Acenaphthene	139 (45-120)	-	J (all detects)	A
	Dibenzofuran	-	162 (43-120)	J (all detects)	
	Fluorene	132 (45-120)	-	J (all detects)	
	Anthracene	224 (45-120)	1430 (45-120)	J (all detects)	
	Benzo(a)anthracene	341 (49-120)	2450 (49-120)	J (all detects)	
	Chrysene	361 (47-120)	2260 (47-120)	J (all detects)	
	Benzofluoranthenes, total	244 (30-160)	1500 (30-160)	J (all detects)	
	Benzo(a)pyrene	317 (42-120)	2160 (42-120)	J (all detects)	
	Indeno(1,2,3-cd)pyrene	179 (42-123)	740 (42-123)	J (all detects)	
	Dibenzo(a,h)anthracene	-	471 (30-133)	J (all detects)	
	Benzo(g,h,i)perylene	198 (38-126)	756 (38-126)	J (all detects)	

For LDW20-IT379MS/MSD, no data were qualified for fluoranthene, phenanthrene, and pyrene percent recoveries (%R) and relative percent differences (RPD) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379 LDW20-IT379DL)	Acenaphthene	38.4 (≤30)	J (all detects)	A
	Dibenzofuran	37.5 (≤30)	J (all detects)	
	Fluorene	41.6 (≤30)	J (all detects)	
	Anthracene	126 (≤30)	J (all detects)	
	Benzo(a)anthracene	122 (≤30)	J (all detects)	
	Chrysene	112 (≤30)	J (all detects)	
	Benzofluoranthenes, total	116 (≤30)	J (all detects)	
	Benzo(a)pyrene	120 (≤30)	J (all detects)	
	Indeno(1,2,3-cd)pyrene	93.6 (≤30)	J (all detects)	
	Dibenzo(a,h)anthracene	100 (≤30)	J (all detects)	
	Benzo(g,h,i)perylene	87.3 (≤30)	J (all detects)	

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
BIF0656-SRM1	Anthracene	55.9 (57-143)	All samples in SDG 20F0186	J (all detects)	P

X. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD and samples LDW20-IT379DL and LDW20-IT379FDDL were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
Phenol	16.0	14.0	13
Naphthalene	29.7	53.0	56
2-Methylnaphthalene	25.6	37.0	36

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
Acenaphthylene	13.4	24.1	57
Acenaphthene	252	246	2
Dibenzofuran	74.2	123	49
Fluorene	184	223	19
Phenanthrene	2230	3030	30
Anthracene	665	878	28
Fluoranthene	3800	4170	9
Pyrene	3720	4010	8
Benzo(a)anthracene	1670	1820	9
Chrysene	1900	2050	8
Benzofluoranthenes, total	2130	2410	12
Benzo(a)pyrene	1520	1690	11
Indeno(1,2,3-cd)pyrene	702	759	8
Dibenzo(a,h)anthracene	237	263	10
Benzo(g,h,i)perylene	813	800	2

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT379DL	LDW20-IT379FDDL	
Acenaphthene	258	257	0
Dibenzofuran	68.1	121	56
Fluorene	211	247	16
Phenanthrene	2230	3010	30
Anthracene	664	864	26

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT379DL	LDW20-IT379FDDL	
Fluoranthene	3930	4400	11
Pyrene	3850	4210	9
Benzo(a)anthracene	1670	1840	10
Chrysene	1870	2070	10
Benzofluoranthenes, total	2140	2380	11
Benzo(a)pyrene	1510	1640	8
Indeno(1,2,3-cd)pyrene	706	769	9
Dibenzo(a,h)anthracene	235	325	32
Benzo(g,h,i)perylene	733	831	13

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

Sample	Compound	Reason	Flag	A or P
LDW20-IT379	Phenanthrene Fluoranthene Pyrene	Results exceeded calibration range.	Not reportable	A
LDW20-IT379DL	All compounds except Phenanthrene Fluoranthene Pyrene	Results from undiluted analyses were more usable.	Not reportable	A
LDW20-IT379FD	Phenanthrene Fluoranthene Pyrene Chrysene	Results exceeded calibration range.	Not reportable	A
LDW20-IT379FDDL	All compounds except Phenanthrene Fluoranthene Pyrene Chrysene	Results from undiluted analyses were more usable.	Not reportable	A

Due to MS/MSD %R and RPD and SRM %R, data were qualified as estimated in three 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
Semivolatiles - Data Qualification Summary - SDG 20F0186

Sample	Compound	Flag	A or P	Reason
LDW20-IT379	Acenaphthene Dibenzofuran Fluorene Anthracene Benzo(a)anthracene Chrysene Benzofluoranthenes, total Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT379	Acenaphthene Dibenzofuran Fluorene Anthracene Benzo(a)anthracene Chrysene Benzofluoranthenes, total Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
LDW20-IT379 LDW20-IT379FD	Anthracene	J (all detects)	P	Standard reference materials (%R)
LDW20-IT379	Phenanthrene Fluoranthene Pyrene	Not reportable	A	Overall assessment of data
LDW20-IT379DL	All compounds except Phenanthrene Fluoranthene Pyrene	Not reportable	A	Overall assessment of data
LDW20-IT379FD	Phenanthrene Fluoranthene Pyrene Chrysene	Not reportable	A	Overall assessment of data
LDW20-IT379FDDL	All compounds except Phenanthrene Fluoranthene Pyrene Chrysene	Not reportable	A	Overall assessment of data

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0186

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT379	Phenol	16.0U ug/Kg	A
LDW20-IT379FD	Phenol	14.0U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G2a

SDG #: 20F0186

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/05/20

Page: 1 of 1

Reviewer: JVG

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW, A	Cooler temps. = 12.4°C, 7.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	ICAL ≤ 20%, r ✓, 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	SW	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 1/3, 2/6
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	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-IT379	20F0186-05	Sediment	06/09/20
2	LDW20-IT379~~RE~~DL	20F0186-05~~RE~~DL	Sediment	06/09/20
3	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
4	LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
5	LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20
6	3DL	-06DL	↓	↓
7				
8				
9				

Notes:

	BIF0656-blk1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

A2. Benzofluoranthenes, total

LDC #: 48686 G2a

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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: 06/23/20 **Blank analysis date:** 06/27/20
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID								
	BIF0656-Blk1		1	3					
4A A	8.5		16.0/U	14.0/U					

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 48680G2a

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates

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

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

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

[✓ Y] N N/A 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?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		4/5	See	attached)	( )	( )	1, 2	see attached
				( )	( )	( )	(All Det)	
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

MS / MS DUPLICATE RECOVERY
EPA 8270E

Laboratory:	Analytical Resources, Inc.	SDG:	20F0186
Client:	Anchor QEA, LLC	Project:	Lower Duwamish AOC4
Matrix:	Solid	Analyzed:	06/27/20 14:34
Batch:	BIF0656	Laboratory ID:	BIF0656-MS1
Preparation:	EPA 3546 (Microwave)	Sequence Name:	Matrix Spike
Initial/Final:	13.21 g / 1 mL	Source Sample:	LDW20-IT379

COMPOUND	SPIKE ADDED (ug/kg dry)	SAMPLE CONCENTRATION (ug/kg dry)	Q	MS CONCENTRATION (ug/kg dry)	Q	MS % REC. #		QC LIMITS REC.	
Phenol	500	16.0	J	367		70.2		34 - 120	
4-Methylphenol	500	ND	U	397		79.4		29 - 120	
Naphthalene	500	29.7		422		78.4		43 - 120	
2-Methylnaphthalene	500	25.6		439		82.7		43 - 120	
Acenaphthylene	500	13.4	J	407		78.6		42 - 120	
Dimethylphthalate	500	ND	U	408		81.6		43 - 120	
Acenaphthene GG	500	252		947	*	139	*	45 - 120	Jdets/A
Dibenzofuran	500	74.2		606		106		43 - 120	
Fluorene NN	500	184		843	*	132	*	45 - 120	Jdets/A
Phenanthrene UU	500	2230	E	5300	*, E	614	*	49 - 120	NQ *
Anthracene VV	500	665		1780	*	224	*	45 - 120	Jdets/A
Fluoranthene YY	500	3800	E	6780	*, E	597	*	53 - 120	NQ *
Pyrene ZZ	500	3720	E	6680	*, E	591	*	48 - 121	
Butylbenzylphthalate	500	ND	U	403		80.5		45 - 132	
Benzo(a)anthracene CCC	500	1670		3380	*, E	341	*	49 - 120	Jdets/A
Chrysene DDD	500	1900		3700	*, E	361	*	47 - 120	
bis(2-Ethylhexyl)phthalate	500	ND	U	390		77.9		34 - 130	
Benzofluoranthenes, Total A2	1000	2130		4570	*, E	244	*	30 - 160	Jdets/A
Benzo(a)pyrene III	500	1520		3100	*, E	317	*	42 - 120	
Indeno(1,2,3-cd)pyrene JJJ	500	702		1600	*	179	*	42 - 123	
Dibenzo(a,h)anthracene	500	237		864		125		30 - 133	
Benzo(g,h,i)perylene LLL	500	813		1800	*	198	*	38 - 126	Jdets/A

* Values outside of QC limits

* Parent conc > 4x spike

MS / MS DUPLICATE RECOVERY
EPA 8270E

Laboratory:	Analytical Resources, Inc.	SDG:	20F0186
Client:	Anchor QEA, LLC	Project:	Lower Duwamish AOC4
Matrix:	Solid	Analyzed:	06/27/20 15:10
Batch:	BIF0656	Laboratory ID:	BIF0656-MSD1
Preparation:	EPA 3546 (Microwave)	Sequence Name:	Matrix Spike Dup
Initial/Final:	13.21 g / 1 mL	Source Sample:	LDW20-IT379

COMPOUND	SPIKE ADDED (ug/kg dry)	MSD CONCENTRATION (ug/kg dry)	Q	MSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Phenol	500	386		74.0	4.96	30	34 - 120
4-Methylphenol	500	413		82.6	4.04	30	29 - 120
Naphthalene	500	443		82.6	4.88	30	43 - 120
2-Methylnaphthalene	500	457		86.2	3.93	30	43 - 120
Acenaphthylene	500	433		83.9	6.26	30	42 - 120
Dimethylphthalate	500	417		83.3	2.09	30	43 - 120
Acenaphthene GG	500	642	*	78.0	38.4 *	30	45 - 120
Dibenzofuran JJ	500	887	*	162 *	37.5 *	30	43 - 120
Fluorene NN	500	553	*	73.7	41.6 *	30	45 - 120
Phenanthrene UU	500	24200	*, E	4400 *	128 *	30	49 - 120
Anthracene VV	500	7840	*, E	1430 *	126 *	30	45 - 120
Fluoranthene YY	500	23300	*, E	3890 *	110 *	30	53 - 120
Pyrene ZZ	500	21100	*, E	3480 *	104 *	30	48 - 121
Butylbenzylphthalate	500	414		82.8	2.83	30	45 - 132
Benzo(a)anthracene CCC	500	13900	*, E	2450 *	122 *	30	49 - 120
Chrysene DDD	500	13200	*, E	2260 *	112 *	30	47 - 120
bis(2-Ethylhexyl)phthalate	500	450		90.0	14.4	30	34 - 130
Benzofluoranthenes, Total A2	1000	17100	*, E	1500 *	116 *	30	30 - 160
Benzo(a)pyrene III	500	12300	*, E	2160 *	120 *	30	42 - 120
Indeno(1,2,3-cd)pyrene JJJ	500	4400	*, E	740 *	93.6 *	30	42 - 123
Dibenzo(a,h)anthracene KKK	500	2590	*, E	471 *	100 *	30	30 - 133
Benzo(g,h,i)perylene LLL	500	4590	*, E	756 *	87.3 *	30	38 - 126

* Values outside of QC limits

LDC #: 48680G2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) /SRM

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

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

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
[✓ Y] N N/A Was a LCS required?
[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0656-SRM1	VV	55.9 (57-143	( )	( )	All (Det)	J/UJ/P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680G2a

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
	1	3	
A	16.0	14.0	13
S	29.7	53.0	56
W	25.6	37.0	36
DD	13.4	24.1	57
GG	252	246	2
JJ	74.2	123	49
NN	184	223	19
UU	2230	3030	30
VV	665	878	28
YY	3800	4170	9
ZZ	3720	4010	8
CCC	1670	1820	9
DDD	1900	2050	8
A2	2130	2410	12
III	1520	1690	11
JJJ	702	759	8
KKK	237	263	10
LLL	813	800	2

Compound	Concentration (ug/Kg)		RPD
	2	6	
GG	258	257	0
JJ	68.1	121	56
NN	211	247	16
UU	2230	3010	30
VV	664	864	26
YY	3930	4400	11
ZZ	3850	4210	9
CCC	1670	1840	10
DDD	1870	2070	10
A2	2140	2380	11
III	1510	1640	8
JJJ	706	769	9
KKK	235	325	32
LLL	733	831	13

LDC #: 48680G2a

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: JVG
2nd Reviewer: [signature]

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

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

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

#	Date	Sample ID	Compound	Finding	Qualifications
		1	UU, YY, ZZ	> cal range	NR / A
		2	All except above	dil	
		3	UU, YY, ZZ, DDD	> cal range	
		4	All except above	dil	✓

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0109

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 12.4°C and 7.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0109	UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/27/20	Benzoic acid	22.9	All samples in SDG 20F0109	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
BIF0656-BLK2	06/23/20	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.1 ug/Kg 1.0 ug/Kg	All samples in SDG 20F0109

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-IT379	1,4-Dichlorobenzene 1,2-Dichlorobenzene	2.5 ug/Kg 1.6 ug/Kg	2.5U ug/Kg 1.6U ug/Kg
LDW20-IT379FD	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.9 ug/Kg 0.9 ug/Kg	1.9U 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.

X. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
1,4-Dichlorobenzene	2.5	1.9	27
1,2-Dichlorobenzene	1.6	0.9	56
Benzyl alcohol	6.2	6.7	8
Benzoic acid	65.9	73.8	11
2,4-Dimethylphenol	2.8	2.4	15
1,2,4-Trichlorobenzene	4.1	5.0U	Not calculable
Pentachlorophenol	8.4	3.1	92

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 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 20F0109

Sample	Compound	Flag	A or P	Reason
LDW20-IT379 LDW20-IT379FD	N-Nitrosodiphenylamine	UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-IT379 LDW20-IT379FD	Benzoic acid	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0109

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT379	1,4-Dichlorobenzene 1,2-Dichlorobenzene	2.5U ug/Kg 1.6U ug/Kg	A
LDW20-IT379FD	1,4-Dichlorobenzene 1,2-Dichlorobenzene	1.9U ug/Kg 0.9U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0109

No Sample Data Qualified in this SDG

LDC #: 48680G2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/06/20

SDG #: 20F0186

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: AVC

2nd Reviewer: CF

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 12.4°C, 7.0°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	SW	D = 1/2
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-IT379	20F0186-05	Sediment	06/09/20
2	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
3	LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
4	LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20
5				
6				
7				
8				
9				

Notes:

+	BIF0656-BLK2						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680G2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: Q

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

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

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤20.0%~~/(30%))	Associated Samples	Qualifications
	06/26/20	SIF0395-SCV1	QQ	65.7	All (ND)	J/UJ/A

LDC #: 48680G2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [illegible]

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

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

(Y) N N/A Was 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
	06/27/20	NT14200627035	PPP	22.9		All (Det)	J/UJ/A

CONCAL.wpd

LDC #: 48680G26

VALIDATION FINDINGS WORKSHEET
Blanks

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

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

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: 06/23/20 **Blank analysis date:** 06/27/20
Conc. units: ug/Kg Associated Samples: All

Compound	Blank ID								
	BIF0656-BLK2		1	2					
< RL E	1.1		2.5/U	1.9/U					
↓ F	1.0		1.6/↓	0.9/↓					

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC#: 48680G2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

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

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

Compound	Concentration (ug/Kg)		RPD
	1	2	
E	2.5	1.9	27
F	1.6	0.9	56
QQQ	6.2	6.7	8
PPP	65.9	73.8	11
O	2.8	2.4	15
R	4.1	5.0U	NC
TT	8.4	3.1	92

V:\Josephine\FIELD DUPLICATES\48680G2b windward duwamish.wpd

LDC Report# 48680G3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20

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 12.4°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

Samples LDW20-IT379 and LDW20-IT379FD 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 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G3a
SDG #: 20F0186
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 12.4°C (Insufficient time to cool
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /15	A/X	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	
X.	Field duplicates	ND	D = 1/2
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-IT379	20F0186-05	Sediment	06/09/20
2	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
3	LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
4	LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20
5				
6				
7				
8				
9				
10				

Notes:

1	BIF0589-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT372	20F0186-03	Sediment	06/09/20
LDW20-IT377	20F0186-04	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT356MS	20F0186-01MS	Sediment	06/09/20
LDW20-IT356MSD	20F0186-01MSD	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 12.4°C and 7.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0186	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
Aroclor-1248	8.1	8.4	4
Aroclor-1254	9.2	9.2	0
Aroclor-1260	21.1	25.5	19

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-IT377	Aroclor-1248	40.8	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

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

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0186

Sample	Compound	Flag	A or P	Reason
LDW20-IT356 LDW20-IT369 LDW20-IT372 LDW20-IT377 LDW20-IT379 LDW20-IT379FD	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-IT377	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G3b
SDG #: 20F0186
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 06/04/20
Page: 1 of 1
Reviewer: SVe
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW, A	Cooler temp = 12.4°C, 7.0°C (Insufficient time to cool)
II.	Initial calibration/ICV	A/SW	ICAL ≤ 20%. ICV ≤ 20%.
III.	Continuing calibration	A	CCV ≤ 20%.
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS/D, SRM
IX.	Field duplicates	SW	D = 5/6
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-IT356		20F0186-01	Sediment	06/09/20
2	LDW20-IT369		20F0186-02	Sediment	06/09/20
3	LDW20-IT372		20F0186-03	Sediment	06/09/20
4	LDW20-IT377		20F0186-04	Sediment	06/09/20
5	LDW20-IT379	D	20F0186-05	Sediment	06/09/20
6	LDW20-IT379FD	D	20F0186-06	Sediment	06/09/20
7	LDW20-IT356MS		20F0186-01MS	Sediment	06/09/20
8	LDW20-IT356MSD		20F0186-01MSD	Sediment	06/09/20
9					
10					
11					
12					

Notes:

-	BJF0587-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

_____

_____

LDC #: 48680G3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: 4

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

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SCN1	2C	BB	21.0	All (Det)	J/UJ/A (qual 2, AA, BB)

LDC#: 48680G3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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

Compound	Concentration (ug/Kg)		RPD
	5	6	
Aroclor 1248	8.1	8.4	4
Aroclor 1254	9.2	9.2	0
Aroclor 1260	21.1	25.5	19

LDC #: 48680G3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer:

METHOD: ✓ GC __ HPLC

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

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	2	4	40.8	J dets /A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT372	20F0186-03	Sediment	06/09/20
LDW20-IT377	20F0186-04	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20
LDW20-IT379MS	20F0186-05MS	Sediment	06/09/20
LDW20-IT379MSD	20F0186-05MSD	Sediment	06/09/20
LDW20-IT379DUP	20F0186-05DUP	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Zinc	2.3 mg/Kg	LDW20-IT379
ICB/CCB	Silver	0.027 ug/L	LDW20-IT379 LDW20-IT379FD

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-IT379	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-IT379FD	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-IT379MS/MSD (LDW20-IT379FD)	Silver	34.1 (75-125)	43.2 (75-125)	J (all detects)	A
LDW20-IT334MS/MSD (LDW20-IT379FD)	Mercury	-	127 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT379MS/MSD (LDW20-IT379FD)	Silver	23 (≤20)	J (all detects)	A

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

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

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

XI. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
Arsenic	4.65	5.12	10
Cadmium	0.16	0.15	6
Chromium	24.8	15	49
Copper	24.4	23.9	2
Lead	11.4	13.2	15
Mercury	0.0853	0.0467	58
Silver	0.16	0.14	13
Zinc	51.3	53.1	3

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 and RPD, data were qualified as estimated in one sample.

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 20F0186

Sample	Analyte	Flag	A or P	Reason
LDW20-IT379FD	Silver Mercury	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT379FD	Silver	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0186

Sample	Analyte	Modified Final Concentration	A or P
LDW20-IT379	Silver	0.16U mg/Kg	A
LDW20-IT379FD	Silver	0.14U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G4a
SDG #: 20F0186
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 7/30/20
Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	(7,8), From SDG # 20F0191 (LDW20-IT334MS/MSD)
VIII.	Duplicate sample analysis	A	9, From SDG # 20F0191 (LDW20-IT334DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	SW	(5,6)
XII.	Internal Standard (ICP-MS)	N	
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-IT356	20F0186-01	Sediment	06/09/20
2	LDW20-IT369	20F0186-02	Sediment	06/09/20
3	LDW20-IT372	20F0186-03	Sediment	06/09/20
4	LDW20-IT377	20F0186-04	Sediment	06/09/20
5	LDW20-IT379	20F0186-05	Sediment	06/09/20
6	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
7	LDW20-IT379FDMS	20F0186-06MS	Sediment	06/09/20
8	LDW20-IT379FDMSD	20F0186-06MSD	Sediment	06/09/20
9	LDW20-IT379FDDUP	20F0186-06DUP	Sediment	06/09/20
10				
11				
12				
13				

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
5,6	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1 to 4	As
QC	
7,8,9	Cr,Pb,Ag,As,Cd,Cu,Zn

Analysis Method

ICP	
ICP-MS	
CVAA	

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

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

Sample Concentration, unless otherwise noted: mg/kg Associated Samples: 5

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**									
Zn	2.3											

Sample Concentration, unless otherwise noted: mg/kg Associated Samples: 5,6

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	5	6							
Ag		0.027		0.16	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
7 & 8	S	Ag	34.1	43.2	75-125			6	J/UJ/A	Det
		Ag				23	20	6	J/UJ/A	Det
LDW20-IT334		Hg		127	75-125			6	Jdet/A	Det

Comments:

Method: Metals

Analyte	Concentration (mg/kg)		RPD	Qualifiers (Parents Only)
	5	6		
Arsenic	4.65	5.12	10	
Cadmium	0.16	0.15	6	
Chromium	24.8	15	49	
Copper	24.4	23.9	2	
Lead	11.4	13.2	15	
Mercury	0.0853	0.0467	58	
Silver	0.16	0.14	13	
Zinc	51.3	53.1	3	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT372	20F0186-03	Sediment	06/09/20
LDW20-IT377	20F0186-04	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

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

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

Samples LDW20-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-IT379	LDW20-IT379FD	
Total solids	75.63	74.61	1
Total organic carbon	0.56	0.83	39

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 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0186 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	From SDG # 20F0157 (LDW20-SC148C DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	SW	(5,6)
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-IT356	20F0186-01	Sediment	06/09/20
2	LDW20-IT369	20F0186-02	Sediment	06/09/20
3	LDW20-IT372	20F0186-03	Sediment	06/09/20
4	LDW20-IT377	20F0186-04	Sediment	06/09/20
5	LDW20-IT379	20F0186-05	Sediment	06/09/20
6	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
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 6	TS, TOC

METHOD: Inorganics

Analyte	Concentration (%)		RPD	Qualifiers (Parents Only)
	5	6		
Total Solids	75.63	74.61	1	
Total Organic Carbon	0.56	0.83	39	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT356	20F0186-01	Sediment	06/09/20
LDW20-IT369	20F0186-02	Sediment	06/09/20
LDW20-IT379	20F0186-05	Sediment	06/09/20
LDW20-IT379FD	20F0186-06	Sediment	06/09/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

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

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

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

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 7.0°C and 12.4°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 percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/20	13C12-1,2,3,4,7,8,9-HpCDF	73.9 ng/mL (77-129)	All samples in SDG 20F0186	1,2,3,4,7,8,9-HpCDF	J (all detects)	P

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0465-BLK1	06/22/20	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF OCDF OCDD Total PeCDD Total HpCDF	0.175 ng/Kg 0.0946 ng/Kg 0.166 ng/Kg 0.521 ng/Kg 1.32 ng/Kg 0.175 ng/Kg 0.166 ng/Kg	All samples in SDG 20F0186

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-IT356	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.449 ng/Kg 0.355 ng/Kg	0.449U ng/Kg 0.355U ng/Kg
LDW20-IT369	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.507 ng/Kg 0.353 ng/Kg	0.507U ng/Kg 0.353U ng/Kg
LDW20-IT379	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.756 ng/Kg 0.448 ng/Kg	0.756U ng/Kg 0.448U ng/Kg
LDW20-IT379FD	1,2,3,7,8-PeCDD	0.439 ng/Kg	0.439U 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. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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-IT379 and LDW20-IT379FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
2,3,7,8-TCDD	0.284	0.986U	Not calculable
1,2,3,7,8-PeCDF	0.328	0.363	10
2,3,4,7,8-PeCDF	0.624	0.737	17
1,2,3,7,8-PeCDD	0.756	0.439	53
1,2,3,4,7,8-HxCDF	0.861	0.817	5
1,2,3,6,7,8-HxCDF	0.6055	0.533	13
2,3,4,6,7,8-HxCDF	0.448	0.479	7
1,2,3,7,8,9-HxCDF	0.164	0.202	21
1,2,3,4,7,8-HxCDD	0.788	0.749	5
1,2,3,6,7,8-HxCDD	2.97	3.40	14
1,2,3,7,8,9-HxCDD	1.14	1.06	7
1,2,3,4,6,7,8-HpCDF	6.90	7.61	10
1,2,3,4,7,8,9-HpCDF	0.539	0.530	2
1,2,3,4,6,7,8-HpCDD	75.1	158	71
OCDF	12.1	22.4	60
OCDD	379	793	71
Total TCDF	1.39	4.80	110
Total TCDD	0.834	1.08	26

Compound	Concentration (ng/Kg)		RPD
	LDW20-IT379	LDW20-IT379FD	
Total PeCDF	6.23	8.98	36
Total PeCDD	1.72	3.04	55
Total HxCDF	11.5	14.4	22
Total HxCDD	26.3	25.3	4
Total HpCDF	20.3	25.6	23
Total HpCDD	144	262	58

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Compound	Flag	A or P
LDW20-IT379	13C12-1,2,3,4,7,8-HxCDF 13C12-1,2,3,6,7,8-HxCDF 13C12-2,3,4,6,7,8-HxCDF 13C12-1,2,3,4,7,8-HxCDD 13C12-1,2,3,6,7,8-HxCDD	160 (26-152) 130 (26-123) 162 (28-136) 155 (32-141) 148 (28-130)	1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P

XI. Compound Quantitation

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

Sample	Compound	Flag	A or P
All samples in SDG 20F0186	All compounds reported as estimated maximum possible concentration (EMPC).	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 continuing calibration concentration, labeled compound %R, and compounds reported as EMPC, data were qualified as estimated in four 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
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0186

Sample	Compound	Flag	A or P	Reason
LDW20-IT356 LDW20-IT369 LDW20-IT379 LDW20-IT379FD	1,2,3,4,7,8,9-HpCDF	J (all detects)	P	Continuing calibration (concentration)
LDW20-IT379	1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P	Labeled compounds (%R)
LDW20-IT356 LDW20-IT369 LDW20-IT379 LDW20-IT379FD	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0186

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT356	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.449U ng/Kg 0.355U ng/Kg	A
LDW20-IT369	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.507U ng/Kg 0.353U ng/Kg	A
LDW20-IT379	1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	0.756U ng/Kg 0.448U ng/Kg	A
LDW20-IT379FD	1,2,3,7,8-PeCDD	0.439U ng/Kg	A

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0186

No Sample Data Qualified in this SDG

LDC #: 48680G21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0186 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer: CL

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 12.4 deg C, 7.0 deg C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35% ICV ≤ QC Limits
IV.	Continuing calibration	SW	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	SW	D = 3/4
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	N	EMPC = J dets
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT356	20F0186-01	Sediment	06/09/20
2	LDW20-IT369	20F0186-02	Sediment	06/09/20
3	LDW20-IT379	20F0186-05	Sediment	06/09/20
4	LDW20-IT379FD	20F0186-06	Sediment	06/09/20
5				
6				
7				
8				
9				
10				

Notes:

	BIF0465-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 48680G21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

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

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

Y Was a routine calibration performed at the beginning of each 12 hour period?

N Were all concentrations within method QC limits for unlabeled and labeled compounds?

Y Did all routine calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	Conc:ng/mL (Limits)	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	06/25/20	SIF0380-ICV1	13C12-P	73.9 (77-129)		All (Det)	J/UJ/P (qual P)

LDC #: 48680G21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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

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

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

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0465-BLK1	(5x)	1	2	3	4					
B	0.175	0.88	0.449/U	0.507/U	0.756/U	0.439/U					
M	0.0946*	0.47	0.355/U	0.353/U	0.448/U						
O	0.166	0.83									
Q	0.521*	2.61									
G	1.32	6.60									
S	0.175	0.88									
Y	0.166	0.83									

*EMPC

LDC#: 48680G21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

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

Compound	Concentration (ng/Kg)		RPD
	3	4	
A	0.284	0.986U	NC
I	0.328	0.363	10
J	0.624	0.737	17
B	0.756	0.439	53
K	0.861	0.817	5
L	0.6055	0.533	13
M	0.448	0.479	7
N	0.164	0.202	21
C	0.788	0.749	5
D	2.97	3.40	14
E	1.14	1.06	7
O	6.90	7.61	10
P	0.539	0.530	2
F	75.1	158	71
Q	12.1	22.4	60
G	379	793	71
V	1.39	4.80	110
R	0.834	1.08	26
W	6.23	8.98	36
S	1.72	3.04	55
X	11.5	14.4	22
T	26.3	25.3	4
Y	20.3	25.6	23
U	144	262	58

LDC #: 48680G21

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: JVG
2nd Reviewer:

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

Y N N/A Are all labeled compound recoveries within limits?
Y N N/A Was the S/N ratio all internal standard peaks ≥ 10?

#	Date	Lab ID/Reference	Labeled Compound	Associated Compound	% Recovery (Limits)	Qualifications
		3 (All dets)	13C12-K	K	160 (26-152)	J/UJ/P
			13C12-L	L	130 (26-123)	J/UJ/P
			13C12-M	M	162 (28-136)	J/UJ/P
			13C12-C	C	155 (32-141)	J/UJ/P
			13C12-D	D	148 (28-130)	J/UJ/P

LDC Report# 48680H2a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.8°C, 11.1°C, and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

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 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H2a

SDG #: 20F0191

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/05/20

Page: 1 of 1

Reviewer: JDG

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temps = 15.8°C, 11.1°C, 18.8°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT334	20F0191-03	Sediment	06/10/20
2	LDW20-SC238B	20F0191-06	Sediment	06/10/20
3	LDW20-SC235B	20F0191-08	Sediment	06/10/20
4	LDW20-SC250B	20F0191-09	Sediment	06/10/20
5	LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
6	LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
7				
8				
9				

Notes:

-	BIF0612-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
LDW20-IT359MS	20F0191-04MS	Sediment	06/10/20
LDW20-IT359MSD	20F0191-04MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 12.4°C and 7.0°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	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
06/30/20	Benzoic acid	24.2	LDW20-IT334 LDW20-SC238B	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	24.8	LDW20-SC235B LDW20-SC250B	J (all detects) UJ (all non-detects)	

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT359MS/MSD (LDW20-IT359)	N-Nitrosodiphenylamine	-	122 (27-120)	NA	-

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
BIF0605-SRM1	Benzo(a)anthracene Chrysene Benzo(a)pyrene	46.3 (50-150) 51.3 (53-147) 36.0 (45-155)	LDW20-IT359 LDW20-IT374	J (all detects) J (all detects) J (all 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 six samples.

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

Duwamish AOC4
Semivolatiles – Data Qualification Summary - SDG 20F0191

Sample	Compound	Flag	A or P	Reason
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	N-Nitrosodiphenylamine	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
LDW20-IT359 LDW20-IT374	Benzo(a)anthracene Chrysene Benzo(a)pyrene	J (all detects) J (all detects) J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 08/06/20

SDG #: 20F0191

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 15.8°C, 11.1°C, 18.8°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% ICVE 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	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1 2	LDW20-IT334	20F0191-03	Sediment	06/10/20
2 1	LDW20-IT359	20F0191-04	Sediment	06/10/20
3 1	LDW20-IT374	20F0191-05	Sediment	06/10/20
4 2	LDW20-SC238B	20F0191-06	Sediment	06/10/20
5 2	LDW20-SC235B	20F0191-08	Sediment	06/10/20
6 2	LDW20-SC250B	20F0191-09	Sediment	06/10/20
7	LDW20-IT359MS	20F0191-04MS	Sediment	06/10/20
8	LDW20-IT359MSD	20F0191-04MSD	Sediment	06/10/20
9	1 MS	-03MS		
~~Notes~~10	1 MSD	-03MSD		

1	BIF0605-BLK1						
2	BIF0612-BLK2						

cPAH = 2, 3

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 48680#26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Were all %D within the validation criteria of ~~<20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ~~<20.0%~~ 30%)	Associated Samples	Qualifications
	06/26/20	SIF0395-SCV1	QQ	65.7	1, 4-6, 9, 10, MB2 (ND + Det)	J/UJ/A

LDC #: 48680H26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

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

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours 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
	06/30/20	NT14200630035	PPP	24.2		1, 4-6, 9, 10, MB2	(ND+Det) J/UJ/A
			TT	24.8		↓	↓

LDC #: 48680 #26

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates

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

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

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

[✓ Y] N N/A 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?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		9/10	QQ	( )	122 (27-120)	( )	1 (ND)	J dets/A
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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LDC #: 48680 H2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) / SRM

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

METHOD: GC/MS ~~PAH~~ SVOA (EPA SW 846 Method 8270~~D~~E-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
[✓ Y] N N/A Was a LCS required?
[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0605_SRM1	CCC	46.3 (50-150)	( )	( )	2, 3, MB1 (Det)	J/UJ/P
		DDD	51.3 (53-147)	( )	( )	↓ ↓	↓
		III	36.0 (45-155)	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.8°C, 11.1°C, and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

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

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

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 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H3a
SDG #: 20F0191
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/09/20
Page: 1 of 1
Reviewer: DRG
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 15.8°C, 11.1°C, 18.8°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20 %. ICV ≤ 20 %
IV.	Continuing calibration	A	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	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-IT334	20F0191-03	Sediment	06/10/20
2	LDW20-SC238B	20F0191-06	Sediment	06/10/20
3	LDW20-SC235B	20F0191-08	Sediment	06/10/20
4	LDW20-SC250B	20F0191-09	Sediment	06/10/20
5	LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
6	LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
7				
8				
9				
10				

Notes:

	BI F0609-BLK1						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT364	20F0191-01	Sediment	06/10/20
LDW20-IT224	20F0191-02	Sediment	06/10/20
LDW20-IT224DL	20F0191-02DL	Sediment	06/10/20
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 15.8°C, 11.1°C, 18.8°C, and 11.2°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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0191	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	Column	%R (Limits)	Associated Samples	Flag	A or P
BIF0615-SRM1	Aroclor-1260	1C	29.6 (38-167)	All samples in SDG 20F0039	J (all detects)	P
BIF0615-SRM1	Aroclor-1260	2C	26.6 (38-167)	All samples in SDG 20F0039	J (all detects)	P

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-IT374	Aroclor-1254	45.2	J (all detects)	A
LDW20-SC238B	Aroclor-1260	40.3	J (all detects)	A
LDW20-IT228	Aroclor-1248	40.7	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.

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-IT224	Aroclor-1248 Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT224DL	All compounds except Aroclor-1248 Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, SRM %R, 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 20F0191

Sample	Compound	Flag	A or P	Reason
LDW20-IT364 LDW20-IT334 LDW20-IT359 LDW20-IT374 LDW20-SC238B LDW20-IT228 LDW20-SC235B LDW20-SC250B LDW20-IT244	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-IT224	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-IT224DL	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-IT364 LDW20-IT224 LDW20-IT334 LDW20-IT359 LDW20-IT374 LDW20-SC238B LDW20-IT228 LDW20-SC235B LDW20-SC250B LDW20-IT244	Aroclor-1260	J (all detects)	P	Standard reference materials (%R)
LDW20-IT374	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-SC238B	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT228	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT224	Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT224DL	All compounds except Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H3b
SDG #: 20F0191
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B ~~2A~~ 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: JG
2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	cooler temps = 15.8°C, 11.1°C, 18.8°C (Insufficient time to cool)
II.	Initial calibration/ICV	A / SW	ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	SW	LCS, SRM
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	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-IT364	20F0191-01	Sediment	06/10/20
2	LDW20-IT224	20F0191-02	Sediment	06/10/20
3	LDW20-IT224~~RE~~ DL	20F0191-02~~RE~~ DL	Sediment	06/10/20
4	LDW20-IT334	20F0191-03	Sediment	06/10/20
5	LDW20-IT359	20F0191-04	Sediment	06/10/20
6	LDW20-IT374	20F0191-05	Sediment	06/10/20
7	LDW20-SC238B	20F0191-06	Sediment	06/10/20
8	LDW20-IT228	20F0191-07	Sediment	06/10/20
9	LDW20-SC235B	20F0191-08	Sediment	06/10/20
10	LDW20-SC250B	20F0191-09	Sediment	06/10/20
11	LDW20-IT244	20F0191-10	Sediment	06/10/20
12	LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
13	LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
14				
15				
16	BJF0615-BLK1			
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

_____

_____

LDC #: 48680 H96

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: JVG
2nd Reviewer: 4

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? ✓ %D or ___ %R
Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SCV1	2C	BB	21.0	All (Det 7 ND)	J / UJ / A (qual 2, AA, BB)

LDC #: 48680 H3b

VALIDATION FINDINGS WORKSHEET

Laboratory Control Samples / SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Were laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y [✓ N] N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound (Col)	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0615-SRM1	BB	(1C) 29.6 (38-167)	( )	( )	All (Det)	J/UJ/P
		↓	(2C) 26.6 (↓)	( )	( )	↓ ↓	↓
			( )	( )	( )		(qual BB only)
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 48680H36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

X N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	AA	6	45.2	J det A
	BB	7	40.3	
	Z	8	40.7	J

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680 #36

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated sample	Qualifications
	Z, AA	> cal range	2	NR / A
	All except above	dil	3	↓

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT364	20F0191-01	Sediment	06/10/20
LDW20-IT224	20F0191-02	Sediment	06/10/20
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
LDW20-IT334DUP	20F0191-03DUP	Sediment	06/10/20

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	0.033 ug/L	LDW20-IT334
ICB/CCB	Silver	0.018 ug/L	LDW20-SC238B LDW20-SC235B LDW20-SC250B

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-IT334	Silver	0.21 mg/Kg	0.21U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SC238B	Silver	0.2 mg/Kg	0.2U mg/Kg
LDW20-SC235B	Silver	0.17 mg/Kg	0.17U mg/Kg
LDW20-SC250B	Silver	0.2 mg/Kg	0.2U 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-IT379FDMS/MSD (LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B)	Silver	34.1 (75-125)	43.2 (75-125)	J (all detects)	A
LDW20-IT334MS/MSD (LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B)	Mercury	-	127 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT379FDMS/MSD (LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B)	Silver	23 (≤20)	J (all detects)	A

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the 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 methods. No results were rejected in this SDG.

Due to MS/MSD %R and RPD, data were qualified as estimated in four 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 20F0191

Sample	Analyte	Flag	A or P	Reason
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	Silver Mercury	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-IT334 LDW20-SC238B LDW20-SC235B LDW20-SC250B	Silver	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0191

Sample	Analyte	Modified Final Concentration	A or P
LDW20-IT334	Silver	0.21U mg/Kg	A
LDW20-SC238B	Silver	0.2U mg/Kg	A
LDW20-SC235B	Silver	0.17U mg/Kg	A
LDW20-SC250B	Silver	0.2U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0191

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: ATL

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	(11,12), From SDG # 20F0186 (LDW20-IT379FD MS/MSD)
VIII.	Duplicate sample analysis	A	13, From SDG # 20F0186 (LDW20-IT379FD MS/MSD)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	
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-IT364	20F0191-01	Sediment	06/10/20
2	LDW20-IT224	20F0191-02	Sediment	06/10/20
3	LDW20-IT334	20F0191-03	Sediment	06/10/20
4	LDW20-IT359	20F0191-04	Sediment	06/10/20
5	LDW20-IT374	20F0191-05	Sediment	06/10/20
6	LDW20-SC238B	20F0191-06	Sediment	06/10/20
7	LDW20-IT228	20F0191-07	Sediment	06/10/20
8	LDW20-SC235B	20F0191-08	Sediment	06/10/20
9	LDW20-SC250B	20F0191-09	Sediment	06/10/20
10	LDW20-IT244	20F0191-10	Sediment	06/10/20
11	LDW20-IT334MS	20F0191-03MS	Sediment	06/10/20
12	LDW20-IT334MSD	20F0191-03MSD	Sediment	06/10/20
13	LDW20-IT334DUP	20F0191-03DUP	Sediment	06/10/20
14				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
3,6,8,9	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
1,2,4,5,7,10	As
QC	
11,12,13	Hg

Analysis Method

ICP	
ICP-MS	
CVAA	

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

Reviewer: ATL

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: 3

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	3								
Ag		0.033		0.21								

Sample Concentration, unless otherwise noted: mg/kg Associated Samples: 6,8,9

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	6	8	9						
Ag		0.018		0.2	0.17	0.2						

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-IT379FD	S	Ag	34.1	43.2	75-125			3,6,8,9	J/UJ/A	Det
		Ag				23	20	3,6,8,9	J/UJ/A	Det
11 &12	S	Hg		127	75-125			3,6,8,9	Jdet/A	Det

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 11, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT364	20F0191-01	Sediment	06/10/20
LDW20-IT224	20F0191-02	Sediment	06/10/20
LDW20-IT334	20F0191-03	Sediment	06/10/20
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-SC238B	20F0191-06	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-SC235B	20F0191-08	Sediment	06/10/20
LDW20-SC250B	20F0191-09	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT228MS	20F0191-07MS	Sediment	06/10/20
LDW20-IT228DUP	20F0191-07DUP	Sediment	06/10/20

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 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0191 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
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	11
VII.	Duplicate sample analysis	A	12, From SDG # 20F0157 (LDW20-SC148C DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT364	20F0191-01	Sediment	06/10/20
2	LDW20-IT224	20F0191-02	Sediment	06/10/20
3	LDW20-IT334	20F0191-03	Sediment	06/10/20
4	LDW20-IT359	20F0191-04	Sediment	06/10/20
5	LDW20-IT374	20F0191-05	Sediment	06/10/20
6	LDW20-SC238B	20F0191-06	Sediment	06/10/20
7	LDW20-IT228	20F0191-07	Sediment	06/10/20
8	LDW20-SC235B	20F0191-08	Sediment	06/10/20
9	LDW20-SC250B	20F0191-09	Sediment	06/10/20
10	LDW20-IT244	20F0191-10	Sediment	06/10/20
11	LDW20-IT228MS	20F0191-07MS	Sediment	06/10/20
12	LDW20-IT228DUP	20F0191-07DUP	Sediment	06/10/20
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	TS, TOC
QC	
11,12	TOC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT359	20F0191-04	Sediment	06/10/20
LDW20-IT374	20F0191-05	Sediment	06/10/20
LDW20-IT228	20F0191-07	Sediment	06/10/20
LDW20-IT244	20F0191-10	Sediment	06/10/20
LDW20-IT359DUP	20F0191-04DUP	Sediment	06/10/20

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 at 11.1°C, 15.8°C, and 18.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The 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 20F0191

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-IT359DUP (LDW20-IT359)	OCDF	39.0 (≤25)	J (all detects)	A

VIII. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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 20F0191	All compounds reported as estimated maximum possible concentration (EMPC).	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 DUP RPD and compounds reported as EMPC, 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 20F0191

Sample	Compound	Flag	A or P	Reason
LDW20-IT359	OCDF	J (all detects)	A	Duplicate sample analysis (RPD)
LDW20-IT359 LDW20-IT374 LDW20-IT228 LDW20-IT244	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0191

No Sample Data Qualified in this SDG

LDC #: 48680H21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0191 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 15.8, 11.1, 18.8 deg C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35% ICV ≤ QC Limits
IV.	Continuing calibration	A	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates/LD	N/SW	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	A	EMPC = Jdets/A
XII.	Target compound identification	A	
XIII.	System performance	A	
XIV.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT359	20F0191-04	Sediment	06/10/20
2	LDW20-IT374	20F0191-05	Sediment	06/10/20
3	LDW20-IT228	20F0191-07	Sediment	06/10/20
4	LDW20-IT244	20F0191-10	Sediment	06/10/20
5	LDW20-IT359DUP	20F0191-04DUP	Sediment	06/10/20
6				
7				
8				
9				
10				

Notes:

	BFI0780-BLK1						

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA 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 #: 48680H21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Were all samples associated with a method blank?
Y Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y Was the method blank contaminated?

Blank extraction date: 06/29/20 **Blank analysis date:** 07/02/20 **Associated samples:** All (>5X)

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0780-BLK1	(5x)									
O	0.0726*	0.36									
F	0.220*	1.10									
Q	0.477*	2.39									
G	1.66	8.30									

*EMPC

LDC #: 48680H21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Y Was a duplicate sample analyzed for each matrix in this SDG?
N Were all duplicate sample relative percent differences (RPD) < 25?

#	Duplicate ID	Compound	RPD (Limits)		Associated Samples	Qualifications
	5	Q	39.0	(≤25%)	1 (Det)	Jdets/A
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
				(≤)		
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				(≤)		
				(≤)		
				(≤)		
				(≤)		

Comments:

LDC #: 48680H21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
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:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ A_x = Area of Compound A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards C_x = Concentration of compound, C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) S= Standard deviation of the RRFs, X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF	Recalculated RRF	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL Autospec01	7/1/2020	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.8118	0.8117	0.8223	0.8223	6.7	6.7
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	1.2126	1.2125	1.2310	1.2310	11.4	11.4
			1,2,3,6,7,8-HxCDF (13C-1,2,3,6,7,8-HxCDF)	0.9856	0.9856	0.9154	0.9154	11.0	11.0
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.1931	1.1930	1.1246	1.1246	12.3	12.3
			OCDD (13C-OCDD)	1.0731	1.0732	1.2095	1.2095	12.4	12.4

LDC # 48680H21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Ref IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	20070202 Autospec01	7/2/2020	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.8223	0.8060	0.8060	2.0	2.0
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	1.2310	1.2380	1.2380	0.6	0.6
			1,2,3,6,7,8-HxCDF (13C-1,2,3,6,7,8-HxCDF)	0.9154	0.9359	0.9359	2.2	2.2
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.1246	1.1394	1.1394	1.3	1.3
			OCDD (13C-OCDD)	1.2095	1.1641	1.1641	3.8	3.8

LDC #: 48680H21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS 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 = Laboratory 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	Recalc.
2,3,7,8-TCDD	20		19.97		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				

LDC #: 48680H21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS Dioxins/Dibenzofurans (Method 1613B)

Y Were all reported results recalculated and verified for all level IV samples?
Y 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 , OCDD :

Conc. = $\frac{(1.037e6+1.171e6)(200)(20uL)}{(3.537e5+3.825e5)(1.2095)(17.24g)(0.583)}$

= 986.85

= 987 ng/Kg

#	Sample ID	Compound	Reported Concentration (ng/Kg)	Calculated Concentration (ng/Kg)	Acceptable (Y/N)
	1	OCDD	987	987	-

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS135MS	20F0194-13MS	Sediment	06/10/20
LDW20-SS135MSD	20F0194-13MSD	Sediment	06/10/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. 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
BIF0662-SRM1	Acenaphthylene	51.7 (52-148)	All samples in SDG 20F0194	J (all detects) UJ (all non-detects)	P
	Anthracene	54.7 (57-143)		J (all detects) UJ (all non-detects)	

X. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-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-SS338	LDW20-SS338-FD	
2-Methylnaphthalene	10.2	10.2	0
Fluorene	20.0U	10.6	Not calculable
Phenanthrene	69.3	77.2	11
Anthracene	19.8	21.1	6
Fluoranthene	156	153	2
Pyrene	146	137	6

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS338	LDW20-SS338-FD	
Butylbenzylphthalate	18.3	21.8	17
Benzo(a)anthracene	58.0	63.6	9
Chrysene	117	115	2
Bis(2-ethylhexyl)phthalate	230	202	13
Benzofluoranthenes, total	180	170	6
Benzo(a)pyrene	67.4	63.7	6
Indeno(1,2,3-cd)pyrene	49.9	47.8	4
Dibenzo(a,h)anthracene	18.1	14.1	25
Benzo(g,h,i)perylene	62.6	58.9	6

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS123	LDW20-SS123-FD	
Phenanthrene	38.5	38.0	1
Anthracene	12.7	13.9	9
Fluoranthene	91.4	92.3	1
Pyrene	89.7	91.2	2
Butylbenzylphthalate	11.1	20.0U	Not calculable
Benzo(a)anthracene	39.7	38.8	2
Chrysene	66.0	61.4	7
Bis(2-ethylhexyl)phthalate	86.8	118	30
Benzofluoranthenes, total	109	112	3
Benzo(a)pyrene	42.1	42.9	2
Indeno(1,2,3-cd)pyrene	29.8	3.5	158

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS123	LDW20-SS123-FD	
Dibenzo(a,h)anthracene	11.1	20.0U	Not calculable
Benzo(g,h,i)perylene	37.0	36.5	1

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS130	LDW20-SS130-FD	
Phenanthrene	30.6	30.1	2
Anthracene	10.4	10.5	1
Fluoranthene	60.3	501	157
Pyrene	81.4	65.7	21
Butylbenzylphthalate	19.9U	10.4	Not calculable
Benzo(a)anthracene	28.3	25.0	12
Chrysene	45.9	65.8	36
Bis(2-ethylhexyl)phthalate	66.8	61.0	9
Benzofluoranthenes, total	85.8	71.1	19
Benzo(a)pyrene	34.8	27.6	23
Indeno(1,2,3-cd)pyrene	24.0	19.9	19
Benzo(g,h,i)perylene	25.6	25.8	1

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

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 thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364	Acenaphthylene	J (all detects) UJ (all non-detects)	P	Standard reference materials (%R)
LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	Anthracene	J (all detects) UJ (all non-detects)		

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680I2a

SDG #: 20F0194

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/05/20

Page: 1 of 2

Reviewer: JAG

2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW, A	Cooler temps. = 13.6°C, 15.6°C, 20.1°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A SW A	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 3/4, 8/9, 11/12
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
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-SS356		20F0194-01	Sediment	06/10/20
2	LDW20-SS364		20F0194-02	Sediment	06/10/20
3	LDW20-SS338	D1	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	D1	20F0194-04	Sediment	06/10/20
5	LDW20-SS336		20F0194-05	Sediment	06/10/20
6	LDW20-SS106		20F0194-06	Sediment	06/10/20
7	LDW20-SS121		20F0194-07	Sediment	06/10/20
8	LDW20-SS123	D2	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	D2	20F0194-09	Sediment	06/10/20
10	LDW20-SS125		20F0194-10	Sediment	06/10/20
11	LDW20-SS130	D3	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	D3	20F0194-12	Sediment	06/10/20
13	LDW20-SS135		20F0194-13	Sediment	06/10/20
14	LDW20-SS135MS		20F0194-13MS	Sediment	06/10/20

LDC #: 48680I2a

SDG #: 20F0194

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/05/20

Reviewer: SVG

2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

15	LDW20-SS135MSD	20F0194-13MSD	Sediment	06/10/20
16				
17				
18				

Notes:

	BIF0662-BLK1						

LDC #: 48680 I2a

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: JVG
2nd Reviewer:

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?		✓		
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 30%?		✓		
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10%, was a reanalysis performed to confirm %R ?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	✓			

LDC #: 48680 I2a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. 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?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), 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?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

A2. Benzofluoranthenes, Total

LDC #: 48680 I2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) / SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Was a LCS required?
[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0662-SRM1	DD	51.7 (52-148)	( )	( )	All (ND + Det)	J/UJ/P
		VV	54.7 (57-143)	( )	( )	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680l2a

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	4	
W	10.2	10.2	0
NN	20.0U	10.6	NC
UU	69.3	77.2	11
VV	19.8	21.1	6
YY	156	153	2
ZZ	146	137	6
AAA	18.3	21.8	17
CCC	58.0	63.6	9
DDD	117	115	2
EEE	230	202	13
A2	180	170	6
III	67.4	63.7	6
JJJ	49.9	47.8	4
KKK	18.1	14.1	25
LLL	62.6	58.9	6

Compound	Concentration (ug/Kg)		RPD
	8	9	
UU	38.5	38.0	1
VV	12.7	13.9	9
YY	91.4	92.3	1
ZZ	89.7	91.2	2
AAA	11.1	20.0U	NC
CCC	39.7	38.8	2
DDD	66.0	61.4	7
EEE	86.8	118	30
A2	109	112	3
III	42.1	42.9	2
JJJ	29.8	3.5	158
KKK	11.1	20.0U	NC
LLL	37.0	36.5	1

Compound	Concentration (ug/Kg)		RPD
	11	12	
UU	30.6	30.1	2
VV	10.4	10.5	1
YY	60.3	501	157

LDC#: 48680l2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GC MS SVOA (EPA SW 846 Method 8270E)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	11	12	
ZZ	81.4	65.7	21
AAA	19.9U	10.4	NC
CCC	28.3	25.0	12
DDD	45.9	65.8	36
EEE	66.8	61.0	9
A2	85.8	71.1	19
III	34.8	27.6	23
JJJ	24.0	19.9	19
LLL	25.6	25.8	1

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LDC #: 48680l2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E)

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 (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	06/26/20	Phenol (DCB)	1.56542	1.56542	1.51555	1.51555	6.8	6.8
			Naphthalene (NPT)	1.02917	1.02917	0.98495	0.98495	4.3	4.3
	NT10		Fluorene (ANT)	1.74545	1.74545	1.53228	1.53228	9.1	9.1
			Phenanthrene (PHN)	1.09634	1.09634	1.07498	1.07498	3.3	3.3
			Fluoranthene (CRY)	1.79823	1.79823	1.73035	1.73035	6.4	6.4
			BEHP (DNOP)	0.51752	0.51752	0.48659	0.48659	4.2	4.2
			Benzo(g,h,i)perylene (PRY)	1.28998	1.28998	1.23261	1.23261	4.9	4.9

LDC # 48680l2a

VALIDATION FINDINGS WORSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E)

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT1020062902	6/29/2020	Phenol (DCB)	1.51555	1.61191	1.61191	6.4	6.4
			Naphthalene (NPT)	0.98495	1.01749	1.01749	3.3	3.3
	NT10		Fluorene (ANT)	1.53228	1.70139	1.70139	11.0	11.0
			Phenanthrene (PHN)	1.07498	1.09561	1.09561	1.9	1.9
			Fluoranthene (CRY)	1.73035	1.81567	1.81567	4.9	4.9
			BEHP (DNOP)	0.48659	0.50856	0.50856	4.5	4.5
			Benzo(g,h,i)perylene (PRY)	1.23261	1.22650	1.22650	0.5	0.5

LDC #: 48680 I2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	5.00	3.732	66.6	66.6	0
2-Fluorobiphenyl	↓	3.594	71.9	71.9	↓
Terphenyl-d14	↓	3.650	73.0	73.0	↓
Phenol-d5	7.50	4.567	60.9	60.9	↓
2-Fluorophenol	↓	4.603	61.4	61.4	↓
2,4,6-Tribromophenol	↓	5.912	78.8	78.5	↓
2-Chlorophenol-d4	↓	5.081	67.7	67.7	↓
1,2-Dichlorobenzene-d4	5.00	3.246	64.9	64.9	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 48680 I2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: 4

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD samples: 14/15

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	500	500	0	438	425	87.6	87.6	85.1	85.0	2.93	3.01
~~N-Nitroso-di-n-propylamine~~											
4-Chloro-3-methylphenol											
Acenaphthene	500	500	0	428	421	85.7	85.6	84.2	84.2	1.76	1.65
~~Pentachlorophenol~~											
Pyrene	500	500	39.8	480	468	88.1	88.0	85.7	85.6	2.56	2.53

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 4868I2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: d

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BIF0662-BS1

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	500	NA	433	NA	86.5	86.6				
~~N-Nitroso-di-n-propylamine~~										
~~4-Chloro-3-methylphenol~~										
Acenaphthene	500		427		84.4	84.4				
~~Pentachlorophenol~~										
Pyrene	500		474		94.7	94.8				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48680 I2a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

(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 = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

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).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #2, YY:

Conc. = $\frac{(1974332)(4.0)(1mL)(1000)}{(459524)(1.730346)(25.98g)(0.385)}$
393527

= 1159.5
≈ 1160 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	2	YY	1160	1160	—

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS135MS	20F0194-13MS	Sediment	06/10/20
LDW20-SS135MSD	20F0194-13MSD	Sediment	06/10/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. 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 20F0194	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

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
BIF0662-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene	32.0 (34-166) 29.8 (36-164)	All samples in SDG 20F0039	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P

X. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-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-SS338	LDW20-SS338-FD	
Benzyl alcohol	25.4	34.2	30

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS338	LDW20-SS338-FD	
Benzoic acid	58.9	51.5	13
Pentachlorophenol	2.4	2.6	8

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS123	LDW20-SS123-FD	
1,4-Dichlorobenzene	17.7	5.0U	Not calculable
Benzyl alcohol	9.3	7.3	24

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS130	LDW20-SS130-FD	
1,4-Dichlorobenzene	1.9	1.7	11
Benzyl alcohol	4.7	20.0U	Not calculable

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

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 SRM %R, 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
Semivolatiles – Data Qualification Summary - SDG 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	N-Nitrosodiphenylamine	UJ (all non-detects)	A	Initial calibration verification (%D)
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	1,4-Dichlorobenzene 1,2-Dichlorobenzene	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 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680I2b

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 08/06/20

SDG #: 20F0194

Page: 1 of 2

Laboratory: Analytical Resources, Inc.

Reviewer: JVG

2nd Reviewer:

METHOD: GC/MS P~~olynuclear Aromatic Hydrocarbon~~s SVOA (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 13.6°C, 15.6°C, 20.1°C (Insufficient time to cool)
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS, SRM
X.	Field duplicates	SW	D = 3/4, 8/9, 11/12
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
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-SS356		20F0194-01	Sediment	06/10/20
2	LDW20-SS364		20F0194-02	Sediment	06/10/20
3	LDW20-SS338	D1	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	D1	20F0194-04	Sediment	06/10/20
5	LDW20-SS336		20F0194-05	Sediment	06/10/20
6	LDW20-SS106		20F0194-06	Sediment	06/10/20
7	LDW20-SS121		20F0194-07	Sediment	06/10/20
8	LDW20-SS123	D2	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	D2	20F0194-09	Sediment	06/10/20
10	LDW20-SS125		20F0194-10	Sediment	06/10/20
11	LDW20-SS130	D3	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	D3	20F0194-12	Sediment	06/10/20
13	LDW20-SS135		20F0194-13	Sediment	06/10/20
14	LDW20-SS135MS		20F0194-13MS	Sediment	06/10/20

LDC #: 48680I2b **VALIDATION COMPLETENESS WORKSHEET** Date: 08/06/20
SDG #: 20F0194 Stage 4 Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

15	LDW20-SS135MSD	20F0194-13MSD	Sediment	06/10/20
16				
17				
18				

Notes:

—	BIF0662-BLK2						

LDC #: 48680 + 26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Semivolatiles (EPA SW 846 Method 8270E-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?		✓		
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~15%~~ 20 and relative response factors (RRF) ≥ 0.05?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~20~~ 30%?		✓		
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	

LDC #: 48680 I 26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. 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?	✓			
IX. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), 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?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 48680 I26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A — Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (N) N/A — Were all %D within the validation criteria of ≤~~20~~/30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤20.0%~~/(30%))	Associated Samples	Qualifications
	06/26/20	SIF0393-SCV1	QQ	41.9	All (ND)	J/UJ/A

ICVsvoa.wpd

LDC #: 48680I26

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS) / SRM

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
[✓ Y] N N/A Was a LCS required?
[✓ Y] N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIF0662-SRM2	E	32.0 (34-166)	( )	( )	All (ND + Det)	J/UJ/P
		F	29.8 (36-164)	( )	( )	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 48680I2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	3	4	
QQQ	25.4	34.2	30
PPP	58.9	51.5	13
TT	2.4	2.6	8

Compound	Concentration (ug/Kg)		RPD
	8	9	
E	17.7	5.0U	NC
QQQ	9.3	7.3	24

Compound	Concentration (ug/Kg)		RPD
	11	12	
E	1.9	1.7	11
QQQ	4.7	20.0U	NC

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LDC #: 48680l2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs, — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 5 std)	Recalculated RRF (RRF 5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SIM NT10	06/26/20	1,4-DCB (DCB)	1.37648	1.37648	1.36262	1.36262	2.6	2.6
			1,2,4-TCB (NPT)	0.39447	0.39447	0.41526	0.41526	7.6	7.6
			N-Nitrosodiphenylamine (PHN)	0.46933	0.46933	0.48124	0.48124	6.7	6.7

LDC # 48680I2a

VALIDATION FINDINGS WORSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270E-SIM)

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	NT1020062902	6/29/2020	1,4-DCB (DCB)	1.36262	1.33210	1.33210	2.2	2.2
			1,2,4-TCB (NPT)	0.41526	0.40708	0.40708	2.0	2.0
	NT10		Pentachlorophenol (PHN)	0.48124	0.49999	0.49999	3.9	3.9

LDC #: 48680I26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270C)- SIM

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14	5.00	3.445	68.9	68.9	0
Phenol-d5					
2-Fluorophenol	7.50	4.619	61.6	61.6	0
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 48680 I26

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS ~~PAH~~ SVOA (EPA SW 846 Method 8270~~C~~ E-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = | MSC - MSC | * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD samples: 14/15

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Acenaphthene											
Pyrene											
PG	1500	1500	0	1310	1300	87.1	87.1	86.8	86.7	0.703	0.77

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48680 I26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: (1)

METHOD: GC/MS ~~PAH~~ SVOA (EPA SW 846 Method 8270~~C~~E-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BIF0662-BS2

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
Acenaphthene										
Pyrene										
PCP	1500	NA	1300	NA	86.8	86.8				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48680I26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: G

METHOD: GC/MS ~~PAH~~ SVOA (EPA SW 846 Method 8270~~C~~ E-SIM)

(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 = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

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).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 7 , 1,4-DCB

Conc. = $\frac{(1037)(4.0)(1\,mL)(1600)}{(157111)(1.36262)(17.35g)(0.5777)}$

= 1.93 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	7	1,4-DCB	1.9		-

LDC Report# 48680I3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 7, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS356MS	20F0194-01MS	Sediment	06/10/20
LDW20-SS356MSD	20F0194-01MSD	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. 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-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-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 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680I3a
SDG #: 20F0194
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 08/04/20
Page: 1 of 1
Reviewer: SW
2nd Reviewer:

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temps = 13.6°, 15.6°C, 20.1°C (Insufficient time to cool)
II.	GC Instrument Performance Check	N	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes TCS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 3/4, 8/9, 11/12
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-SS356		20F0194-01	Sediment	06/10/20
2	LDW20-SS364		20F0194-02	Sediment	06/10/20
3	LDW20-SS338	D1	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	D1	20F0194-04	Sediment	06/10/20
5	LDW20-SS336		20F0194-05	Sediment	06/10/20
6	LDW20-SS106		20F0194-06	Sediment	06/10/20
7	LDW20-SS121		20F0194-07	Sediment	06/10/20
8	LDW20-SS123	D2	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	D2	20F0194-09	Sediment	06/10/20
10	LDW20-SS125		20F0194-10	Sediment	06/10/20
11	LDW20-SS130	D3	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	D3	20F0194-12	Sediment	06/10/20
13	LDW20-SS135		20F0194-13	Sediment	06/10/20
14	LDW20-SS356MS		20F0194-01MS	Sediment	06/10/20
15	LDW20-SS356MSD		20F0194-01MSD	Sediment	06/10/20

- BLF0599-BLK1

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS364MS	20F0194-02MS	Sediment	06/10/20
LDW20-SS364MSD	20F0194-02MSD	Sediment	06/10/20

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 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

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. 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.

Retention time windows were established as required by the method.

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	Affected Compound	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0194	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) 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.

Retention times of all compounds in the calibration standards were within the established retention time windows.

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-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-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-SS338	LDW20-SS338-FD	
Aroclor 1248	26.2	26.3	0
Aroclor 1254	33.8	33.8	0
Aroclor 1260	55.3	36.8	40

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS123	LDW20-SS123-FD	
Aroclor 1248	25.0	27.2	8
Aroclor 1254	32.8	34.8	6
Aroclor 1260	36.7	130	112

Compound	Concentration (ug/Kg)		RPD
	LDW20-SS130	LDW20-SS130-FD	
Aroclor 1248	37.3	35.4	5
Aroclor 1254	53.3	46.1	14
Aroclor 1260	99.6	132	28

X. Compound Quantitation

All compound quantitations met validation criteria.

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-SS106	Aroclor-1248	42.5	J (all detects)	A

XI. Target Compound Identification

All target compound identifications met validation criteria.

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 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 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Initial calibration verification (%D)
LDW20-SS106	Aroclor-1248	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680I3b
SDG #: 20F0194
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/04/20
Page: 1 of 1
Reviewer: DG
2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments (Insufficient time to cool)
I.	Sample receipt/Technical holding times	SW / A	Cooler temps = 13.6°C, 15.6°C, 20.1°C (Text)
II.	Initial calibration/ICV	A /	ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes (15)	A / A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS/D, SRM
IX.	Field duplicates	SW	D = 3/4, 8/9, 11/12
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	A	
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-SS356		20F0194-01	Sediment	06/10/20
2	LDW20-SS364		20F0194-02	Sediment	06/10/20
3	LDW20-SS338	D1	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	D1	20F0194-04	Sediment	06/10/20
5	LDW20-SS336		20F0194-05	Sediment	06/10/20
6	LDW20-SS106		20F0194-06	Sediment	06/10/20
7	LDW20-SS121		20F0194-07	Sediment	06/10/20
8	LDW20-SS123	D2	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	D2	20F0194-09	Sediment	06/10/20
10	LDW20-SS125		20F0194-10	Sediment	06/10/20
11	LDW20-SS130	D3	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	D3	20F0194-12	Sediment	06/10/20
13	LDW20-SS135		20F0194-13	Sediment	06/10/20
14	LDW20-SS364MS		20F0194-02MS	Sediment	06/10/20
15	LDW20-SS364MSD		20F0194-02MSD	Sediment	06/10/20
16					
17	BIF0602-BLK1				

LDC #: 48680I3b

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?		✓		
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?			✓	
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?			✓	
Were endrin and 4,4'-DDT breakdowns ≤ 15% for individual breakdown in the Evaluation mix standards?			✓	
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?				
Were all percent relative standard deviations (%RSD) ≤ 20%?				
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?				
Were the RT windows properly established?				
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?				
Were all percent differences (%D) ≤ 20%?				
IV. Continuing calibration				
Was a continuing calibration analyzed daily?				
Were all percent differences (%D) ≤ 20%?				
Were all the retention times within the acceptance windows?				
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?	✓			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	

LDC #: 46680 I36

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Were internal standard area counts within ± 50% of the average area calculated during calibration?	✓			
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?	✓			
IX. 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?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	✓			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?		✓		
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. trans–Heptachlor epoxide
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. Mirex
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ cis-Chlordane
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. trans-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. cis–Heptachlor epoxide	XX.

Notes:_____

LDC #: 48680 I36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? /%D or ___%R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ (Column)	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/10/20	SIF0176-SCV1	2C	BB	21.0	All (Det)	J/UJ/A (qual = , AA, BB)

LDC#: 48680I3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: GC PCB (EPA SW 846 Method 8082A)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/Kg)		RPD
	3	4	
Aroclor 1248	26.2	26.3	0
Aroclor 1254	33.8	33.8	0
Aroclor 1260	55.3	36.8	40

Compound	Concentration (ug/Kg)		RPD
	8	9	
Aroclor 1248	25.0	27.2	8
Aroclor 1254	32.8	34.8	6
Aroclor 1260	36.7	130	112

Compound	Concentration (ug/Kg)		RPD
	11	12	
Aroclor 1248	37.3	35.4	5
Aroclor 1254	53.3	46.1	14
Aroclor 1260	99.6	132	28

LDC #: 48681 I35

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: / GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	6	42.5	J dets/A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 48680I3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC PCBs (EPA SW 846 Method 8082A)

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 (IS)	Reported RRF (250 std)	Recalculated RRF (250 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL ECD7	6/10/2020	1260-1 ZB5 (HBP)	0.03748	0.03748	0.03633	0.03633	1.944	1.946
			1260-1 ZB35 (HBP)	0.04683	0.04683	0.04865	0.04865	13.540	13.537

LDC # 48680I3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC PCBs (EPA SW 846 Method 8082A)

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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Conc	Reported Conc (CCV)	Recalculated Conc (CCV)	Reported % D	Recalculated %D
1	20062403ECD7	6/24/2020	1260-1 ZB5 (HBP)	250.0	270.6	270.6	8.2	8.2
			1260-1 ZB35 (HBP)	250.0	205.8	205.8	17.7	17.7
2	20062428ECD7	6/24/2020	1260-1 ZB5 (HBP)	250.0	286.1	286.1	10.6	14.5
			1260-1 ZB35 (HBP)	250.0	202.5	202.5	3.6	19.0

LDC #: 48680I3b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 1

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene	Col 1	40.0	30.6	~~88.2~~ 76.6	76.5	0
Tetrachloro-m-xylene						
Decachlorobiphenyl	Col 1	40.0	35.3	88.2	88.2	0
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:

LDC #: 48680 I36

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Concentration

RPD = I MS - MSD I * 2/(MS + MSD)

MS = Matrix spike percent recovery; MSD = Matrix spike duplicate percent recovery

MS/MSD samples: 14/15

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	-	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC											
4,4'-DDT											
Aroclor 1260	92.0	99.6	36.1	116	120	86.8	86.8	84.2	84.2	3.14	3.39

Comments: Refer ot Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48680 I36

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration
SA = Spike added
SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: BIFU602-BS1

Compound	Spike Added (ug/kg)		Spiked Sample Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC										
4,4'-DDT										
Aroclor 1260	101	101	98.5	98.1	97.7	97.5	97.3	97.1	0.427	0.507

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48680I36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

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 = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

A = Area of compound
Fv = Final Volume of extract
Df = Dilution Factor
RF = Average Response Factor of compound in ICal
Vs = Initial Volume of sample
Ws = Initial Weight of sample
%S = Percent Solid

Example:

Sample I.D. 12 1260 (Col 1)

1260-1

Conc. = $\frac{(32435)(80)}{(103753)(0.03633)}$

= 688.4

1260 Ave. = $\frac{688.4 + 558.7 + 642.1 + 579.9 + 852.6}{5}$

= 664.34

final conc. = $\frac{(664.34)(2.5\text{ml})}{(17.88\text{g})(0.7021)}$

= 132.3 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	12	1260	132	132	—

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS125MS	20F0194-10MS	Sediment	06/10/20
LDW20-SS125MSD	20F0194-10MSD	Sediment	06/10/20
LDW20-SS125DUP	20F0194-10DUP	Sediment	06/10/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Silver	0.02 mg/Kg	LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135
ICB/CCB	Silver	0.02 ug/L	All samples in SDG 20F0194

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS125	Silver	0.27 mg/Kg	0.27U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS130	Silver	0.14 mg/Kg	0.14U mg/Kg
LDW20-SS130-FD	Silver	0.13 mg/Kg	0.13U mg/Kg
LDW20-SS135	Silver	0.09 mg/Kg	0.09U mg/Kg
LDW20-SS356	Silver	0.17 mg/Kg	0.17U mg/Kg
LDW20-SS364	Silver	0.2 mg/Kg	0.2U mg/Kg
LDW20-SS338	Silver	0.24 mg/Kg	0.24U mg/Kg
LDW20-SS338-FD	Silver	0.27 mg/Kg	0.27U mg/Kg
LDW20-SS336	Silver	0.16 mg/Kg	0.16U mg/Kg
LDW20-SS106	Silver	0.18 mg/Kg	0.18U mg/Kg
LDW20-SS121	Silver	0.18 mg/Kg	0.18U mg/Kg
LDW20-SS123	Silver	0.17 mg/Kg	0.17U mg/Kg
LDW20-SS123-FD	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-IT379FDMS/MSD (LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD)	Silver	34.1 (75-125)	43.2 (75-125)	J (all detects)	A

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT334MS/MSD (LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD)	Mercury	-	127 (75-125)	J (all detects)	A
LDW20-SS125MS/MSD (LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135)	Mercury	138 (75-125)	143 (75-125)	J (all detects)	A
LDW20-SS125MS/MSD (LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135)	Silver	62.5 (75-125)	60.7 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-IT379FDMS/MSD (LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD)	Silver	23 (≤20)	J (all detects)	A

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-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-SS338	LDW20-SS338-FD	
Arsenic	17.0	16.5	3
Cadmium	0.26	0.30	14
Chromium	27.1	27.6	2
Copper	54.8	55.2	1
Lead	17.9	18.6	4
Mercury	0.143	0.161	12
Silver	0.24	0.27	12
Zinc	111	112	1

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SS123	LDW20-SS123-FD	
Arsenic	7.34	6.66	10
Cadmium	0.26	0.20	26
Chromium	20.1	19.0	6
Copper	34.4	30.4	12
Lead	14.3	12.2	16
Mercury	0.116	0.0777	40
Silver	0.17	0.14	19
Zinc	76.8	72.3	6

Analyte	Concentration (mg/Kg)		RPD
	LDW20-SS130	LDW20-SS130-FD	
Arsenic	6.16	5.68	8
Cadmium	0.18	0.20	11
Chromium	20.2	22.6	11
Copper	28.2	34.3	20
Lead	11.8	11.8	0
Mercury	0.0919	0.0684	29
Silver	0.14	0.13	7
Zinc	66.7	67.7	1

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 and RPD, data were qualified as estimated in thirteen samples.

Due to laboratory blank contamination, data were qualified as not detected in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 20F0194

Sample	Analyte	Flag	A or P	Reason
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD LDW20-SS125 LDW20-SS130 LDW20-SS130-FD LDW20-SS135	Silver Mercury	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW20-SS356 LDW20-SS364 LDW20-SS338 LDW20-SS338-FD LDW20-SS336 LDW20-SS106 LDW20-SS121 LDW20-SS123 LDW20-SS123-FD	Silver	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0194

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS125	Silver	0.27U mg/Kg	A
LDW20-SS130	Silver	0.14U mg/Kg	A
LDW20-SS130-FD	Silver	0.13U mg/Kg	A
LDW20-SS135	Silver	0.09U mg/Kg	A
LDW20-SS356	Silver	0.17U mg/Kg	A
LDW20-SS364	Silver	0.2U mg/Kg	A
LDW20-SS338	Silver	0.24U mg/Kg	A
LDW20-SS338-FD	Silver	0.27U mg/Kg	A
LDW20-SS336	Silver	0.16U mg/Kg	A

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS106	Silver	0.18U mg/Kg	A
LDW20-SS121	Silver	0.18U mg/Kg	A
LDW20-SS123	Silver	0.17U mg/Kg	A
LDW20-SS123-FD	Silver	0.14U mg/Kg	A

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680l4a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/30/20

SDG #: 20F0194

Laboratory: Analytical Resources, Inc.

Reviewer: ATL

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	(14,15), From SDG # 20F0191 (LDW20-IT334MS/MSD), SDG # 20F0186 (LDW20-IT379FD MS/MSD)
VIII.	Duplicate sample analysis	A	16, From SDG # 20F0191 (LDW20-IT334DUP), SDG # 20F0186 (LDW20-IT379FD DUP)
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS/SRM
XI.	Field Duplicates	SW	(3,4), (8,9), (11,12)
XII.	Internal Standard (ICP-MS)	N	
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-SS356	20F0194-01	Sediment	06/10/20
2	LDW20-SS364	20F0194-02	Sediment	06/10/20
3	LDW20-SS338	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
5	LDW20-SS336	20F0194-05	Sediment	06/10/20
6	LDW20-SS106	20F0194-06	Sediment	06/10/20
7	LDW20-SS121	20F0194-07	Sediment	06/10/20
8	LDW20-SS123	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
10	LDW20-SS125	20F0194-10	Sediment	06/10/20
11	LDW20-SS130	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
13	LDW20-SS135	20F0194-13	Sediment	06/10/20
14	LDW20-SS125MS	20F0194-10MS	Sediment	06/10/20

LDC #: 48680I4a **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0194 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer: ATL
2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

	Client ID	Lab ID	Matrix	Date
15	LDW20-SS125MSD	20F0194-10MSD	Sediment	06/10/20
16	LDW20-SS125DUP	20F0194-10DUP	Sediment	06/10/20
17				
18				
19				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 13	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg
QC	
14,15,16	Cr,Pb,Ag,As,Cd,Cu,Zn,Hg

Analysis Method

ICP	
ICP-MS	
CVAA	

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: 10 to 13

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	10	11	12	13					
Ag	0.02			0.27	0.14	0.13	0.09					

Sample Concentration, unless otherwise noted: mg/kg Associated Samples: all

				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	1	2	3	4	5	6	7	8	9
Ag		0.02		0.17	0.2	0.24	0.27	0.16	0.18	0.18	0.17	0.14
				Sample Identification								
Analyte	**PB (mg/kg)**	**Maximum ICB/CCB (ug/L)**	**Action Level**	10	11	12	13					
Ag		0.02		see above	see above	see above	see above					

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-IT379FD	S	Ag	34.1	43.2	75-125			1 to 9	J/UJ/A	Det
		Ag				23	20	1 to 9	J/UJ/A	Det
LDW20-IT334	S	Hg		127	75-125			1 to 9	Jdet/A	Det
14 & 15		Hg	138	143	75-125			10 to 13	Jdet/A	Det
		Ag	62.5	60.7	75-125			10 to 13	J/UJ/A	Det

Comments:

Method: Metals

Analyte	Concentration (mg/kg)		RPD	Qualifiers (Parents Only)
	3	4		
Arsenic	17.0	16.5	3	
Cadmium	0.26	0.30	14	
Chromium	27.1	27.6	2	
Copper	54.8	55.2	1	
Lead	17.9	18.6	4	
Mercury	0.143	0.161	12	
Silver	0.24	0.27	12	
Zinc	111	112	1	

Analyte	Concentration (mg/kg)		RPD	Qualifiers (Parents Only)
	8	9		
Arsenic	7.34	6.66	10	
Cadmium	0.26	0.20	26	
Chromium	20.1	19.0	6	
Copper	34.4	30.4	12	
Lead	14.3	12.2	16	
Mercury	0.116	0.0777	40	
Silver	0.17	0.14	19	
Zinc	76.8	72.3	6	

Analyte	Concentration (mg/kg)		RPD	Qualifiers (Parents Only)
	11	12		
Arsenic	6.16	5.68	8	
Cadmium	0.18	0.20	11	
Chromium	20.2	22.6	11	
Copper	28.2	34.3	20	
Lead	11.8	11.8	0	
Mercury	0.0919	0.0684	29	
Silver	0.14	0.13	7	
Zinc	66.7	67.7	1	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Wet Chemistry

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS364	20F0194-02	Sediment	06/10/20
LDW20-SS338	20F0194-03	Sediment	06/10/20
LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS106	20F0194-06	Sediment	06/10/20
LDW20-SS121	20F0194-07	Sediment	06/10/20
LDW20-SS123	20F0194-08	Sediment	06/10/20
LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
LDW20-SS125	20F0194-10	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
LDW20-SS135	20F0194-13	Sediment	06/10/20
LDW20-SS356DUP	20F0194-01DUP	Sediment	06/10/20

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 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. 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 method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SS338 and LDW20-SS338-FD, samples LDW20-SS123 and LDW20-SS123-FD, and samples LDW20-SS130 and LDW20-SS130-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW20-SS338	LDW20-SS338-FD	
Total solids	39.01	38.79	1
Total organic carbon	3.12	3.30	6

Analyte	Concentration (%)		RPD
	LDW20-SS123	LDW20-SS123-FD	
Total solids	62.87	61.53	2
Total organic carbon	1.03	1.14	10

Analyte	Concentration (%)		RPD
	LDW20-SS130	LDW20-SS130-FD	
Total solids	66.58	66.31	0
Total organic carbon	0.89	0.87	2

X. Sample Result Verification

All sample result verifications were acceptable.

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 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680I6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/30/20
SDG #: 20F0194 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: ATL
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	From SDG # 20F0191 (LDW20-IT228MS)
VII.	Duplicate sample analysis	A	14, From SDG # 20F0191 (LDW20-IT228DUP)
VIII.	Laboratory control samples	A	LCS/SRM
IX.	Field duplicates	SW	(3,4), (8,9), (11,12)
X.	Sample result verification	A	
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-SS356	20F0194-01	Sediment	06/10/20
2	LDW20-SS364	20F0194-02	Sediment	06/10/20
3	LDW20-SS338	20F0194-03	Sediment	06/10/20
4	LDW20-SS338-FD	20F0194-04	Sediment	06/10/20
5	LDW20-SS336	20F0194-05	Sediment	06/10/20
6	LDW20-SS106	20F0194-06	Sediment	06/10/20
7	LDW20-SS121	20F0194-07	Sediment	06/10/20
8	LDW20-SS123	20F0194-08	Sediment	06/10/20
9	LDW20-SS123-FD	20F0194-09	Sediment	06/10/20
10	LDW20-SS125	20F0194-10	Sediment	06/10/20
11	LDW20-SS130	20F0194-11	Sediment	06/10/20
12	LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
13	LDW20-SS135	20F0194-13	Sediment	06/10/20
14	LDW20-SS356DUP	20F0194-01DUP	Sediment	06/10/20
15				

Notes:

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
II. Calibration				
Were all instruments calibrated at the required frequency?	X			
Were the proper number of standards used?	X			
Were all initial and continuing calibration verifications within the QC limits?	X			
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
Were balance checks performed as required?	X			
III. 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		
IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries within 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			
V. 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			
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			

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
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 13	TS, TOC
QC	
14	TS

METHOD: Inorganics

Analyte	Concentration (%)		RPD	Qualifiers (Parents Only)
	3	4		
Total Solids	39.01	38.79	1	
Total Organic Carbons	3.12	3.30	6	

Analyte	Concentration (%)		RPD	Qualifiers (Parents Only)
	8	9		
Total Solids	62.87	61.53	2	
Total Organic Carbons	1.03	1.14	10	

Analyte	Concentration (%)		RPD	Qualifiers (Parents Only)
	11	12		
Total Solids	66.58	66.31	0	
Total Organic Carbons	0.89	0.87	2	

LDC #: 48680IC6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: ATV
2nd Reviewer: 2

METHOD: Inorganics, Method TOC (EPA 9060A)

The correlation coefficient (r) for the calibration of N/A was recalculated. Calibration date: N/A

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found x 100 / True

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	% Found (units)	% True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	N/A	Blank			N/A	N/A	N/A
		Standard 1					
		Standard 2					
		Standard 3					
		Standard 4					
		Standard 5					
		Standard 6					
		Standard 7					
Calibration verification CCVA	TOC		44.782	44.446	101	101	Y
Calibration verification CCVB	TOC		44.927	44.446	101	101	Y
Calibration verification CCVC	TOC		45.155	44.446	102	102	Y

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

VALIDATION FINDINGS CHECKLIST

Quality Control Sample Recalculations

METHOD: Inorganics

Percent recoveries (%R) for the laboratory control sample (LCS) and matrix spike (MS) were recalcuated 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

Sample ID	Type of Analysis	Element	Found/S	True/D	Recalculated %R/RPD	Reported %R/RPD	Acceptable (Y/N)
LCS	LCS	TOC	44.48	44.4	100.1801802	100	Y
LDW20-IT228MS	MS	TOC	1.162	1.32	88.03030303	87.9	Y
14	Duplicate	TS	44.6896	44.571	0.265738747	0.266	Y

METHOD: Inorganics

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids (if applicable) x Initial weight or volume)

Sample ID	Analyte	Raw Data (%)	Dilution	Initial Weight/ Volume (g)	Final Volume (g)	Percent solids (%)	Reported Result (%)	Recalculated Result (%)	Acceptable (Y/N)
1	TS		1	5.2855	2.3558		44.57	44.57099612	Y
2	TOC	1.292	1	0.1926	0.1926	36.54	3.54	3.535851122	Y
3	TS		1	5.3274	2.0781		39.01	39.00777115	Y
4	TOC	1.28	1	0.2071	0.2071	38.79	3.3	3.299819541	Y
5	TS		1	5.3714	2.3906		44.51	44.5060878	Y
6	TOC	0.922	1	0.3038	0.3038	44.46	2.07	2.073774179	Y
7	TS		1	6.1452	3.4749		56.55	56.54657293	Y
8	TOC	0.646	1	0.2484	0.2484	62.87	1.03	1.027517099	Y
9	TS		1	6.3469	3.9052		61.53	61.5292505	Y
10	TOC	1.258	1	0.3344	0.3344	48.8	2.58	2.577868852	Y
11	TS		1	6.2133	4.1368		66.58	66.57975633	Y
12	TOC	0.577	1	0.191	0.191	66.31	0.87	0.870155331	Y
13	TS		1	6.2156	4.5569		73.31	73.31391981	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 10, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0194

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS356	20F0194-01	Sediment	06/10/20
LDW20-SS336	20F0194-05	Sediment	06/10/20
LDW20-SS130	20F0194-11	Sediment	06/10/20
LDW20-SS130-FD	20F0194-12	Sediment	06/10/20

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 at 13.6°C, 15.6°C, and 20.1°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The 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 20F0194

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. Ongoing Precision Recovery/Standard Reference Materials

Ongoing precision recovery (OPR) samples 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-SS130 and LDW20-SS130-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-SS130	LDW20-SS130-FD	
2,3,7,8-TCDF	0.397	0.418	5
2,3,7,8-TCDD	0343	0.254	30
1,2,3,7,8-PeCDF	0.278	0.995U	Not calculable

Compound	Concentration (ng/Kg)		RPD
	LDW20-SS130	LDW20-SS130-FD	
2,3,4,7,8-PeCDF	0.483	0.541	11
1,2,3,7,8-PeCDD	0.508	0.639	23
1,2,3,4,7,8-HxCDF	1.94	1.77	9
1,2,3,6,7,8-HxCDF	0.657	0.750	13
2,3,4,6,7,8-HxCDF	0.851	0.867	2
1,2,3,7,8,9-HxCDF	0.393	0.385	2
1,2,3,4,7,8-HxCDD	0.419	0.602	36
1,2,3,6,7,8-HxCDD	2.12	2.15	1
1,2,3,7,8,9-HxCDD	1.20	1.42	17
1,2,3,4,6,7,8-HpCDF	14.2	12.6	12
1,2,3,4,7,8,9-HpCDF	1.28	1.17	9
1,2,3,4,6,7,8-HpCDD	67.2	61.1	10
OCDF	41.4	34.5	18
OCDD	542	522	4
Total TCDF	3.42	5.08	39
Total TCDD	0.271	1.05	118
Total PeCDF	5.42	5.39	1
Total PeCDD	0.526	1.25	82
Total HxCDF	19.4	18.7	4
Total HxCDD	14.0	13.3	5
Total HpCDF	55.1	42.6	26
Total HpCDD	157	141	11

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 20F0194	All compounds reported as estimated maximum possible concentration (EMPC).	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, 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 20F0194

Sample	Compound	Flag	A or P	Reason
LDW20-SS356 LDW20-SS336 LDW20-SS130 LDW20-SS130-FD	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0194

No Sample Data Qualified in this SDG

LDC #: 48680I21 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/07/20
SDG #: 20F0194 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	SW/A	Cooler temp = 13.6, 15.6, 20.1 deg C (Insufficient time to cool)
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 20/35% ICV ≤ QC Limits
IV.	Continuing calibration	A	CCV ≤ QC Limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR, SRM
IX.	Field duplicates	SW	D = 3/4
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	A	EMPC = Jdets/A
XII.	Target compound identification	A	
XIII.	System performance	A	
XIV.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS356	20F0194-01	Sediment	06/10/20
2	LDW20-SS336	20F0194-05	Sediment	06/10/20
3	LDW20-SS130	20F0194-11	Sediment	06/10/20
4	LDW20-SS130-FD	20F0194-12	Sediment	06/10/20
5				
6				
7				
8				
9				
10				

Notes:

	BIF0780-BLK1						

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA 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 #: 48680I21

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y Were all samples associated with a method blank?
Y Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y Was the method blank contaminated?

Blank extraction date: 06/29/20 **Blank analysis date:** 07/02/20 **Associated samples:** All (>5X)

Conc. units: ng/Kg

Compound	Blank ID		Sample Identification								
	BIF0780-BLK1	(5x)									
O	0.0726*	0.36									
F	0.220*	1.10									
Q	0.477*	2.39									
G	1.66	8.30									

*EMPC

LDC#: 48680I21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)
Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ng/Kg)		RPD
	3	4	
H	0.397	0.418	5
A	0.343	0.254	30
I	0.278	0.995U	NC
J	0.483	0.541	11
B	0.508	0.639	23
K	1.94	1.77	9
L	0.657	0.750	13
M	0.851	0.867	2
N	0.393	0.385	2
C	0.419	0.602	36
D	2.12	2.15	1
E	1.20	1.42	17
O	14.2	12.6	12
P	1.28	1.17	9
F	67.2	61.1	10
Q	41.4	34.5	18
G	542	522	4
V	3.42	5.08	39
R	0.271	1.05	118
W	5.42	5.39	1
S	0.526	1.25	82
X	19.4	18.7	4
T	14.0	13.3	5
Y	55.1	42.6	26
U	157	141	11

LDC #: 48680I21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
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 (IS)	Reported RRF	Recalculated RRF	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL Autospec01	7/1/2020	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.8118	0.8117	0.8223	0.8223	6.7	6.7
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	1.2126	1.2125	1.2310	1.2310	11.4	11.4
			1,2,3,6,7,8-HxCDF (13C-1,2,3,6,7,8-HxCDF)	0.9856	0.9856	0.9154	0.9154	11.0	11.0
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.1931	1.1930	1.1246	1.1246	12.3	12.3
			OCDD (13C-OCDD)	1.0731	1.0732	1.2095	1.2095	12.4	12.4

LDC #: 48680I21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
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 (IS)	Reported RRF	Recalculated RRF	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL Autospec01	7/1/2020	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.8118	0.8117	0.8223	0.8223	6.7	6.7
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	1.2126	1.2125	1.2310	1.2310	11.4	11.4
			1,2,3,6,7,8-HxCDF (13C-1,2,3,6,7,8-HxCDF)	0.9856	0.9856	0.9154	0.9154	11.0	11.0
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.1931	1.1930	1.1246	1.1246	12.3	12.3
			OCDD (13C-OCDD)	1.0731	1.0732	1.2095	1.2095	12.4	12.4

LDC # 48680I21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
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 = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Ref IS)		Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	20070202 Autospec01	7/2/2020	2,3,7,8-TCDF	(13C-2,3,7,8-TCDF)	0.8223	0.8060	0.8060	2.0	2.0
			2,3,7,8-TCDD	(13C-2,3,7,8-TCDD)	1.2310	1.2380	1.2380	0.6	0.6
			1,2,3,6,7,8-HxCDF	(13C-1,2,3,6,7,8-HxCDF)	0.9154	0.9359	0.9359	2.2	2.2
			1,2,3,4,6,7,8-HpCDD	(13C-1,2,4,6,7,8,-HpCDD)	1.1246	1.1394	1.1394	1.3	1.3
			OCDD	(13C-OCDD)	1.2095	1.1641	1.1641	3.8	3.8

LDC #: 48680I21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS 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 = Laboratory 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	Recalc.
2,3,7,8-TCDD	20		19.97		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				

LDC #: 48680I21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS Dioxins/Dibenzofurans (Method 1613B)

Y Were all reported results recalculated and verified for all level IV samples?
Y 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 , OCDD :

Conc. = $\frac{(9.932e5+1.120e6)(200)(20uL)}{(4.626e5+4.974e5)(1.2095)(22.38g)(0.4483)}$

= 725.6

= 726 ng/Kg

#	Sample ID	Compound	Reported Concentration (ng/Kg)	Calculated Concentration (ng/Kg)	Acceptable (Y/N)
	1	OCDD	726	726	-