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 27, 2020

SUBJECT: Revised Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on July 29, 2020. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #48765_RV1:

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

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

41,407 pages-ADV Attachment 1

St	age 2B/4 (client Select) EDD	LD	C #	487	765	(W	ind	waı	rd E	nv	iror	nme	nta	l, LL	_C -	Se	att	le V	VA.	/ Dı	JWa	ami	sh	AO	C4)									
LDC	SDG#	DATE REC'D	(3) DATE DUE		OA 70E)		Hs 70E M)	(² P∈ (808	est	PC (808	:Bs 82A)	Me (602	tals 20A)	Met (602 UCT-	20A-	H (747	g '1B)	Dio:	xins I3B)	TC (906		Sol	tal lids l0G)												
Matr	ix: 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
Α	20F0212	07/29/20	08/19/20	0	8	0	8	0	8	0	9	0	8	0	9	0	8	-	-	0	9	0	9												
В	20F0218	07/29/20	08/19/20	0	11	0	11	0	11	0	11	0	11	0	11	0	11	0	3	0	11	0	11												
С	20F0233	07/29/20	08/19/20	0	7	0	7	0	7	0	10	0	7	0	10	0	7	0	4	0	10	0	10												
D	20F0235	07/29/20	08/19/20	0	10	0	10	0	10	0	11	0	10	0	10	0	10	_	-	0	10	0	10												
Е	20F0288	07/29/20	08/19/20	0	8	0	8	0	8	0	12	0	8	0	8	0	8	0	4	0	12	0	12												
F	20F0293	07/29/20	08/19/20	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	3	0	12	0	12												
G	20F0295	07/29/20	08/19/20	0	2	0	6	0	2	0	13	0	2	0	9	0	2	0	3	0	13	0	13												
Н	20F0300	07/29/20	08/19/20	0	11	0	11	0	11	0	11	0	11	0	11	0	11	0	4	0	11	0	11												
1	20F0337	07/29/20	08/19/20	-	-	-	-	-	-	0	7	-	-	0	6	-	-	0	1	0	6	0	6												
J	20F0361	07/29/20	08/19/20	•	-	-	-	-	-	0	2] -	-	0	1	-	•	-	- [0	1	0	1												
Κ	20F0405	07/29/20	08/19/20	-	-	0	1	-	-	0	7	-	-	0	4	-	-	0	1	0	4	0	4												
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 15.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0666-SRM1	Anthracene	50.6 (57-143)	All samples in SDG 20F0212	J (all detects)	Р

X. Field Duplicates

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

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

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

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0212

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

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765A2a

SDG #: 20F0212

Stage 2B

Reviewer: 2nd Reviewer

Laboratory: Analytical Resources, Inc.

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
1.	Sample receipt/Technical holding times	A	Temp (Sgix1/5.40C - Same decy
II.	GC/MS Instrument performance check	A_	
III.	Initial calibration/ICV	AA	\$50 < 50%. Y = 1015-35%
IV.	Continuing calibration	Ø	\$50 ≤ 2070. Y = 1 < V < >270
V.	Laboratory Blanks	A	V
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	\triangle	
IX.	Laboratory control samples	Sku	Les
X.	Field duplicates	W	8=2+3
XI.	Internal standards	*	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	X-	

Note: A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT248	20F0212-01	Sediment	06/11/20
2,	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
10	LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20
11				
12				
13	BIFOGGO BAL			
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
i. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.



A/K W) Y)

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: _	<u></u>
Reviewer:	9_
2nd Reviewer:	R

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

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

N N/A Was a LCS required?

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

#	Date_	LCS/LCSD ID	Compound	LCS SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BH0666-5841	VV	90.6 (57.43)	()	()	\$11 (dets)	VUL/P
				()	()	()		7 / 1
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LDC#: 48765A2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Reviewer: 3VC 2nd Reviewer: 7

METHOD: GCMS SVOA (EPA SW 846 Method 8270E)
YN NA
Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentrat		
Compound	2	3	RPD
S	19.8U	5.9	NC
w	19.8U	6.2	NC
GG	29.9	30.2	1
JJ	6.3	7.9	23
NN	10.1	8.4	18
UU	36.2	24.0	41
W	20.3	8.7	80
YY	113	149	27
ZZ	87.4	114	26
AAA	19.8U	9.3	NC
CCC	50.3	31.9	45
DDD	95.9	38.8	85
EEE	37.9	43.9	15
ZZZZ	84.0	71.5	16
111	33.1	23.5	34
JJJ	22.8	17.9	24
KKK	7.4	19.9U	NC
LLL	23.8	21.9	8

V:\FIELD

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 15.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0212	J (all detects) UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
07/09/20	Benzoic acid Pentachlorophenol	33.8 40.3	All samples in SDG 20F0212	J (all detects) UJ (all non-detects) J (all detects)	Α
	T Gridding optional	10.0		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 with the following exceptions:

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

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

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

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

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0666-SRM2	2,4-Dimethylphenol	20.5 (40-160)	All samples in SDG 20F0212	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

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

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

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

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

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0212

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

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

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

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

No Sample Data Qualified in this SDG

LDC #: 48765A2b VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0212 Stage 2B Page: of ______ Laboratory: Analytical Resources, Inc. METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

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

	Validation Area		ak 129 Comments
I.	Sample receipt/Technical holding times	4	Karp Q 86-15.4° c - say Save duy
II.	GC/MS Instrument performance check	A	'
111.	Initial calibration/ICV	A WII	RS0 = 20/0. Y2 /eV = 20/0
IV.	Continuing calibration	w	ac/ < 50%
V.	Laboratory Blanks	W	
VI.	Field blanks		
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	5X	
IX.	Laboratory control samples /=RM	AW	105
X.	, Field duplicates	w	B=2+3
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT248	20F0212-01	Sediment	06/11/20
2 ,	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20
10	LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20
11				
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Reviewer

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

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

Was an initial calibration verification standard analyzed after each ICAL for each instrument.

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

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

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 30.0%)	Associated Samples	Qualifications
	6/26/20	-5150393-SCV)	I.D	41.9	All (dets+ND)	VU/A
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VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page: ____of /_ Reviewer: _____ 2nd Reviewer: ______

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

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

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

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

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	19/20	NT102007090X	PPP	33.8 40.3		\$11 (dets+No)	VWA
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VALIDATION FINDINGS WORKSHEET Blanks

Page:_	/of_/_
Reviewer:	9
2nd Reviewer:	1

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

F	ગ્રહ	ease see	qualifications	below for all	guestions answered	"N". Not applicable of	questions are identified as "N/A".
٠.	_	(9		9400000000	. v vot applicable c	acciding are lacining as 14/71.

Was a method blank analyzed for each matrix?

Was a method blank analyzed for each concentration preparation level?

Blank analysis date:____

Was a method blank associated with every sample?

Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 65560 Blank analysis date: 79/20

conc. units: <u>//</u>	stes /	 7/	Associated Samples:	Al.

Compound	Blank ID				s	ample Identifica	ition			
$\mathcal{B}I$	0.8	K-2	/	a	3	4	5	6	7	8
٤	0.8		1.0/1	0.44	0.8/4	10/4	10/4	19/4	1.1/4	1.1/11
F	0.9		07/V	/ /			, , ,			/ (

Conc. units:		Associated Samples:							
Compound	Blank ID				S	ample Identifica	ntion		

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".

Blank extraction date:



VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

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

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

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG.

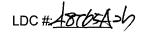
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated

MS/MSD. Soil / Water.

Was a MS/MSD analyzed every 20 samples of each matrix?

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	9/10	0	()	()	37.2 (< 30)	3 (NO)	LLA
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VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: _	
Reviewer:	9_
2nd Reviewer:	1

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

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

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

#	Date	LCS/LCSD ID	Compound	LCS SKM	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BITOGGG-BAND	0	20.5 (40-16)	()	()	All (Sobs+NO)	JAN/P
		7		()	()	()		7 1
				()	()	()		
				()	()	()		
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LDC#: 48765A2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

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

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)
YNNA Were field duplicate pairs identified in this SDG? YN NA YN NA

Were target analytes detected in the field duplicate pairs?

	Concentr	ation (ug/Kg)	
Compound	2	3	RPD
Е	0.6	0.8	29
PPP	53.8	45.7	16

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 15.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

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

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

X. Field Duplicates

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

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 20F0212

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

SDG	#:48765A3a VALIDATIC #:20F0212 ratory:_ <u>Analytical Resources, Inc.</u>		LET stage			WORKSHEE	ĒΤ		Date: 2/3/2 Page:of _/ Reviewer:
MET	2nd Reviewer: At 1975								
	camples listed below were reviewed for ea ation findings worksheets.	ach of the fo	ollowi	ng v	⁄alida	tion areas. Valida	ation fin	idings are	noted in attached
	Validation Area					0/159 Con	nments		
ı.	Sample receipt/Technical holding times	A	Tre	usp	P.	\$ 0-154	0	Sauce	days_
II.	GC Instrument Performance Check	A		/					J
III.	Initial calibration/ICV	AA	RS0<20/0 KeV=20/1)						
IV.	Continuing calibration	1				1		l	
V.	Laboratory Blanks	A							
VI.	Field blanks	N							
VII.	Surrogate spikes / ‡3	A/B							
VIII.	Matrix spike/Matrix spike duplicates	A							
IX.	Laboratory control samples	A	40	===	18				
X.	Field duplicates	ND	10=	<u> </u>	<h 1<="" =="" td=""><td><u> </u></td><td></td><td></td><td></td></h>	<u> </u>			
XI.	Compound quantitation/RL/LOQ/LODs	N							
XII.	Target compound identification	N							
XIII.	System Performance	N							
XIV	Overall assessment of data	Δ							
lote:									
	Client ID					Lab ID	м	atrix	Date
1	LDW20-IT248					20F0212-01	s	ediment	06/11/20
2	LDW20-IT253					20F0212-02	s	ediment	06/11/20
3	LDW20-IT253FD					20F0212-03	s	ediment	06/11/20
4	LDW20-IT272		20F0212-04	s	ediment	06/11/20			
5	LDW20-SC269B					20F0212-05	s	ediment	06/11/20
6	LDW20-SC261B		20F0212-06	s	ediment	06/11/20			
7	LDW20-SC255B					20F0212-07	S	ediment	06/11/20
3	LDW20-SC245B	20F0212-08	S	ediment	06/11/20				
9	LDW20-IT253MS	20F0212-02MS	S	ediment	06/11/20				
10	LDW20-IT253MSD					20F0212-02MSD	S	ediment	06/11/20
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 9.1°C and 15.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0212	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

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

	Concentra		
Compound	LDW20-IT253	LDW20-IT253FD	RPD
Aroclor-1248	27.4	9.3	99
Aroclor-1254	22.7	8.6	90
Aroclor-1260	25.7	12.7	68

X. Compound Quantitation

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

Sample	Compound	RPD	Flag	A or P
LDW20-IT253	Aroclor-1248	55.7	J (all detects)	Α

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

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

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

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

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

20F0212

	#: <u>48765A3b</u> VALIDATIC #: <u>20F0212</u>		LETEN tage 2l	IESS WORKSHEE	т	Date: 🗷	
	ratory: Analytical Resources, Inc.		-	_		Reviewer: 0	
MET	IETHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)						
	samples listed below were reviewed for ea ation findings worksheets.	ach of the fo	ollowing	validation areas. Valida	tion findings are	noted in attache	
	Validation Area			9/139 Com	ments		
I.	Sample receipt/Technical holding times		Teesp	@86-15.40c	- saugetal	al	
11.	Initial calibration/ICV	A M	₽≥	50≤3870.	1C/<2	<i>₹</i>	
III.	Continuing calibration	4	00V	< 20/2			
IV.	Laboratory Blanks	$\downarrow A$		l			
V.	Field blanks	<i>N</i> .					
VI.	Surrogate spikes / 15	AA					
VII.	Matrix spike/Matrix spike duplicates	A					
VIII	Laboratory control samples / SRU	A	10	÷			
IX.	Field duplicates	KI1/	70=:	>t>			
X.	Compound quantitation/RL/LOQ/LODs	√N					
XI.	Target compound identification	N					
XII	Overall assessment of data	4					
lote:	N = Not provided/applicable R = Rir	lo compounds nsate ield blank	detected	D = Duplicate TB = Trip blank EB = Equipment bl	SB=Sourd OTHER: ank	ce blank	
	Client ID			Lab ID	Matrix	Date	
1	LDW20-IT248			20F0212-01	Sediment	06/11/20	
2	LDW20-IT253			20F0212-02	Sediment	06/11/20	
3	LDW20-IT253FD			20F0212-03	Sediment	06/11/20	
4	LDW20-IT272			20F0212-04	Sediment	06/11/20	
5	LDW20-SC269B			20F0212-05	Sediment	06/11/20	
6	LDW20-SC261B			20F0212-06	Sediment	06/11/20	
7	LDW20-SC255B			20F0212-07	Sediment	06/11/20	
8	LDW20-SC245B			20F0212-08	Sediment	06/11/20	
9	LDW20-IT268			20F0212-09	Sediment	06/11/20	
10	LDW20-IT253FDMS	20F0212-03MS	Sediment	06/11/20			
11	LDW20-IT253FDMSD	20F0212-03MSD	Sediment	06/11/20			
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VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	Z	of
Reviewer:_	\subseteq	2
2nd Reviewer:_		2

LDC #: 48765 / GC _ HPLC

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

What type of initial calibration verification calculation was performed? ___%D or ___%R

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
	410/20	SHOITESV	2B3520	BB	21.0	An (dots)	-VAJA
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LDC#: 48765A3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

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

METHOD: GC PCB (EPA SW 846 Method 8082A)
YN NA
Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

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

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

LDC #: 4876-436

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: _		/
Reviewer:	Q	
2nd Reviewer:	d	

METHOD: __GC __ HPLC

Level IV/D Only

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

	If no, please see findings bellow.						
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications			
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 25, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

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

Introduction

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

The analyses were performed by the following methods:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Silver	0.02 ug/L	LDW20-IT248 LDW20-IT248DUP

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

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-IT248	Silver	0.14 mg/Kg	0.14U mg/Kg
LDW20-IT248DUP	Silver	0.14 mg/Kg	0.14U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

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

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

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

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

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

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

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

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

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0212

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

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

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

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

No Sample Data Qualified in this SDG

LDC #: 48765A4a	VALIDATION COMPLETENESS WORKSHEET	Date: \$17/20
SDG #: 20F0212	Stage 2B	Page: <u>∖</u> of <u></u>
Laboratory: Analytical Resour	ces, Inc.	Reviewer:
		2nd Reviewer:

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

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

	Validation Area		Comments
l.	Sample receipt/Technical holding times	AA	
11.	ICP/MS Tune	A	
III.	Instrument Calibration	$ \mathcal{A} $,
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	5W	
VI.	Field Blanks	\mathcal{N}	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	\mathcal{N}	
X.	Laboratory control samples	A	LCS.
XI.	Field Duplicates	SW	(7.3)
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Sample Result Verification	N	
XIV	Overall Assessment of Data	LA	

A = Acceptable N = Not provided/applicable SW = See worksheet Note:

ND = No compounds detected R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank EB = Equipment blank

SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT248MS	20F0212-01MS	Sediment	06/11/20
10	LDW20-IT248MSD	20F0212-01MSD	Sediment	06/11/20
11	LDW20-IT248DUP	20F0212-01DUP	Sediment	06/11/20
12	LOW 20- IT268	20F0212-09	1	1
13				

Notes:

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

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

Analysis Method

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

LDC #: 48765A4a

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

Page 1 of 1 Reviewer:CR

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

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg

Associated Samples: 1

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

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

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

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

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
9, 10	s	Hg	132		75-125			1 to 8 \\	Jdet/A	Det
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Comments:

LDC #: 48765A4a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

Method: Metals

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Wet Chemistry

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0212

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

Introduction

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

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

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

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

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

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

	Concent		
Analyte	LDW20-IT253	LDW20-IT253FD	RPD
Total organic carbon	0.57	0.56	2

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

SDG #: 20F0212 Laboratory: Analytical Resources, Inc.	Stage 2B	Date: 01 00 Page: 0f \ Reviewer: 2nd Reviewer:			
METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G) The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.					
Validation Area	Comm				

	Validation Area		Comments
I.	Sample receipt/Technical holding times	1/A	
Ш	Initial calibration	TA	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LES
IX.	Field duplicates	SW	(7,3)
X.	Sample result verification	Ŋ	
XI	Overall assessment of data	LX	

Note:

A = Acceptable N = Not provided/applicable SW = See worksheet

ND = No compounds detected R = Rinsate FB = Field blank

D = Duplicate TB = Trip blank EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT248	20F0212-01	Sediment	06/11/20
2	LDW20-IT253	20F0212-02	Sediment	06/11/20
3	LDW20-IT253FD	20F0212-03	Sediment	06/11/20
4	LDW20-IT272	20F0212-04	Sediment	06/11/20
5	LDW20-SC269B	20F0212-05	Sediment	06/11/20
6	LDW20-SC261B	20F0212-06	Sediment	06/11/20
7	LDW20-SC255B	20F0212-07	Sediment	06/11/20
8	LDW20-SC245B	20F0212-08	Sediment	06/11/20
9	LDW20-IT268	20F0212-09	Sediment	06/11/20
10	LDW20-IT272MS	20F0212-04MS	Sediment	06/11/20
11	LDW20-IT272DUP	20F0212-04DUP	Sediment	06/11/20
12				
13				
14				
15				

Notes:_	 			

LDC #: 48765A6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

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

LDC#: 48765A6

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

	Concent	RPD	
Analyte	2	3	
Total solids	74.06	75.99	3
TOC	0.57	0.56	2

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0666-SRM1	Anthracene	50.6 (57-143)	All samples in SDG 20F0218	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

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

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

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

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0218

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765B2a SDG #: 20F0218

Stage 2B

Reviewer: 2nd Reviewer:

Laboratory: Analytical Resources, Inc.

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 M	Temp @ 9.50c - same day
II.	GC/MS Instrument performance check	A	/
III.	Initial calibration/ICV	AA	\$50 × 2070. Y= 101 × 380
IV.	Continuing calibration	\forall	\$50 \times 2070. \(\rightarrow \text{ eV \times 390} \) \[\text{cev} = 2070. \]
V.	Laboratory Blanks	A	,
VI.	Field blanks	\mathbb{N}	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A KW	LCS, SRM
X.	Field duplicates	/w	105, SRM 5=5+6
XI.	Internal standards	4	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	★	

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5 1	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: _	
Reviewer:	4
2nd Reviewer:	7

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

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

Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	LES SRM %R (Limits)	LCSD %R (Limits)		RPD (Limits)	Associated Samples	Qualifications
		BH-0666-8RM1	VV	50.6 (57-143)	()		()	All (dots+NO)	VAVA
		/		(/)	()		()	,	
				()	()		()		
				()	()		()		
				()	()		()		
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				()	()	\perp	()		
				()	()	\perp	()		
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LDC#: 48765B2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1
Reviewer:

2nd Reviewer:

Page: 1 of 1

Reviewer:

2nd Revie

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

YNNA

Were field duplicate pairs identified in this SDG?

YNNA Were target analytes detected in the field duplicate pairs?

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

V:\FIELD

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0218	J (all detects) UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
07/09/20	Benzoic acid Pentachlorophenol	33.8 40.3	LDW20-SS169	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Α
07/10/20	Benzyl alcohol	26.8	LDW20-SS113 LDW20-SS146 LDW20-SS139 LDW20-SS127 LDW20-SS127-FD LDW20-SS133 LDW20-SS140 LDW20-SS142 LDW20-SS144 LDW20-SS144 LDW20-SS144	J (all detects) UJ (all non-detects)	А

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

V. Laboratory Blanks

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

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

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

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were not within QC limits. No data were qualified since there were no associated samples in this SDG.

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0666-SRM2	2,4-Dimethylphenol	20.5 (40-160)	All samples in SDG 20F0218	UJ (all non-detects)	Р

X. Field Duplicates

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

	Concentra	Concentration (ug/Kg)				
Compound	LDW20-SS127	LDW20-SS127-FD	RPD			
1,4-Dichlorobenzene	0.6	4.9U	Not calculable			
Benzyl alcohol	16.2	16.1	1			
Benzoic acid	53.9	42.6	23			

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

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

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0218

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

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

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

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

No Sample Data Qualified in this SDG

LDC #: 48765B2b

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0218

Stage 2B

Laboratory: Analytical Resources, Inc.

500AS METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

Reviewer: 2nd Reviewer:

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
1.	Sample receipt/Technical holding times	*	Treat 9.50c - save day
11.	GC/MS Instrument performance check	A	7 0
III.	Initial calibration/ICV	A M	RS5 < 20/0. V 1CV < 30/0
IV.	Continuing calibration	w/	RSB < 20/0. V 1CV < 30/0
V.	Laboratory Blanks	A	
VI.	Field blanks	//	
VII.	Surrogate spikes	∆ ∑	
VIII.	Matrix spike/Matrix spike duplicates	W	RPD out - No assid spl
IX.	Laboratory control samples / S&M	A/W	RPD out - No assid spl
X.	Field duplicates	W	D=5+6
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	, z	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	4	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5 ₁	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

WILTHOD. GONNO GVOA				
A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachiorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

2nd Reviewer:_

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

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

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

Were all %D within the validation criteria of ≤30 %D?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 30.0%)	Associated Samples	Qualifications
	6/26/20	540393-SCV1	RB	41.9	All (dots+NO)	1/4/A
<u> </u>	/ /					
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VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page: /of/ Reviewer: // 2nd Reviewer: //

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

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

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

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

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/9/20	NT10200T09035	PPP TT	33.8 40.3		Bek, 1 (Lets+NO)	-VW/50
				70.2			/
	7/0/20	NT1026071007 S	QBB	26.8		2-11. MB (deBH)2) Var/A
	/						
						-	
						-	



VALIDATION FINDINGS WORKSHEET Blanks

Page:_	
Reviewer:	9
nd Reviewer:	1

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

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

MN N/A Was a method blank analyzed for each matrix?

Was a method blank analyzed for each concentration preparation level?

Y N N/A Was a method blank associated with every sample?

Y/N N/A Was the blank, contaminated? If yes, please see qualification below.

Blank extraction date: 6/25/20 Blank analysis date: 7/9/20

Conc. units: 10/29 Associated Samples: 4 / /

Blank analysis date:____

	Compound	Blank ID		Sample Identification							
	BIFOS	66 BX	5	8	9						,
6		0.8		0.7/4	1.8/4						
F		0.9									

Conc. units:	onc. units: Associated Samples:								
Compound	Blank ID				s	ample Identifica	ation		

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".

Blank extraction date:___



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

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

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

Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	tes SRW %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B17066-5RM=	- 0	20.5 (40-160)	()	()	BN (ND)	MAS
		/		()	()	()	•	
				()	()	()		
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LDC#: 48765B2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

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

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)
YN NA
Were field duplicate pairs identified in this SDG?

YN NA YN NA Were target analytes detected in the field duplicate pairs?

	Concentrat		
Compound	5	6	RPD
E	0.6	4.9U	NC
QQQ	16.2	16.1	1
PPP	53.9	42.6	23

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765B2b windward duwamish.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

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

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

X. Field Duplicates

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

	Concentra		
Compound	LDW20-SS127	LDW20-SS127-FD	RPD
Hexachlorobenzene	1.03	1.00	3

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

LDC #: 48765B3a VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0218

Stage 2B

Laboratory: Analytical Resources, Inc.

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

Date: 2/3/20
Page: __of /_
Reviewer: ____
2nd Reviewer: ____

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
1.	Sample receipt/Technical holding times	A	Trent (9.5°C - same del
II.	GC Instrument Performance Check	A	/
III.	Initial calibration/ICV	AIA	R50< 20%. 101=200
IV.	Continuing calibration	\checkmark	R50 < 20%. Rel < 20%
V.	Laboratory Blanks	A	(
VI.	Field blanks	N	
VII.	Surrogate spikes / ± 5	1/4	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	100/0
X.	Field duplicates	M	D=5+6
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data		

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

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

LDC#: 48765B3a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	1	_of_	1
Reviewer:	F	PG	
2nd Reviewer: -		N	
			_

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

Y N NA

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

	Concentra			
Compound	5 6		RPD	
Hexachlorobenzene	1.03	1.00	3	

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765B3a windward duwamish.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
06/10/20	SIF0176-SCV1	2C	Aroclor-1260	21.0	All samples in SDG 20F0218	J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

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

	Concentra		
Compound	LDW20-SS127	LDW20-SS127-FD	RPD
Aroclor-1248	15.5	16.8	8
Aroclor-1254	28.8	28.1	2
Aroclor-1260	51.8	47.6	8

X. Compound Quantitation

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

Sample	Compound	RPD	Flag	A or P
LDW20-SS146	Aroclor-1248	62.6	J (all detects)	A
LDW20-SS139	Aroclor-1248	52.1	J (all detects)	А
LDW20-SS127-FD	Aroclor-1248	48.9	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

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

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

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

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

Duwamish AOC4

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

No Sample Data Qualified in this SDG

Duwamish AOC4

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

No Sample Data Qualified in this SDG

DG #	: 48765B3b VALIDATIO t: 20F0218 atory: Analytical Resources, Inc.		LETEN tage 2		WORKSHEET		Date: Blank Page: Seviewer: Ceviewer: Ceviewer
ETH	OD: GC Polychlorinated Biphenyls (EP	A SW846 M	ethod 80	082A)			
	amples listed below were reviewed for eation findings worksheets.	ach of the fo	llowing	validat	ion areas. Validatio	n findings are ı	noted in attach
	T						
	Validation Area	A	Tio	eeß (v	Comm	enis Savo dau	1 -
<u>l.</u> 11	Sample receipt/Technical holding times Initial calibration/ICV	A W	De	250	207- 1	21/-20 D	
<u>II.</u>	Continuing calibration	2/100	7.3	<u>, </u>	20/0 . /C		·
III.		A	250				
<u>IV.</u> V.	Laboratory Blanks Field blanks	1 7/					
v. VI.	Surrogate spikes	A					
VI. VII.	Matrix spike/Matrix spike duplicates	\ \\/\ \					
VII. VIII.	Laboratory control samples / SRM	\overline{A}	100				
IX.	Field duplicates	W	A=				
X.	Compound quantitation/RL/LOQ/LODs	N		_ 1			
Λ. XI.	Target compound identification	N					
XII.	Overall assessment of data	À					
te:	N = Not provided/applicable R = Ri SW = See worksheet FB = F	No compounds nsate Field blank	detected	Т	D = Duplicate TB = Trip blank EB = Equipment blank	<u> </u>	
19	Client ID				Lab ID	Matrix	Date
_ _	.DW20-SS169				20F0218-01	Sediment	06/11/20
	DW20-SS113				20F0218-02	Sediment	06/11/20
	.DW20-SS146				20F0218-03	Sediment	06/11/20
L	DW20-SS139				20F0218-04	Sediment	06/11/20
┦┞	.DW20-SS127				20F0218-05	Sediment	06/11/20
L	DW20-SS127-FD				20F0218-06	Sediment	06/11/20
	DW20-SS133				20F0218-07	Sediment	06/11/20
	LDW20-SS140				20F0218-08	Sediment	06/11/20
L	LDW20-SS142				20F0218-09	Sediment	06/11/20
<u> </u>	_DW20-SS144				20F0218-10	Sediment	06/11/20
L	DW20-SS148				20F0218-11	Sediment	06/11/20
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VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:		

LDC #: 48165B36

VALIDATION FINDINGS WORKSHEET <u>Initial Calibration Verification</u>

Page:_	<u>_</u> of
Reviewer:_	9
2nd Reviewer:	h

METHOD: /GC __ HPLC

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

What type of initial calibration verification calculation was performed? ___%D or ___%R

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

Yr N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	6/10/20	SHO1765011	<u> </u>	BB	21.0	Associated Samples All (Set =)	VWA
	//)					
							+ And Z. AA. BB
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LDC#: 48765B3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1_of_1_ Reviewer: PG 2nd Reviewer:

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

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

Were target analytes detected in the field duplicate pairs?

	Concentrat			
Compound	5	6	RPD	
Aroclor 1248	15.5	16.8	8	
Aroclor 1254	28.8	28.1	2	
Aroclor 1260	51.8	47.6	8	

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LDC #: 1876336

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	<u></u>
Reviewer:	9
2nd Reviewer:	9

Level IV/D Only
Y N (N/A)

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors ≤40%?

If no, please see findings bellow.

1	If no, please see findings	bellow.		
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	3	62.6	1613/A
<u> </u>	Z	4	52./	
	2	6	48.9	
ļ				
<u> </u>				
		7-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1		-

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

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

The analyses were performed by the following methods:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT248MS/MSD (All samples in SDG 20F0218)	Mercury	132 (75-125)	145 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

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

	Concentra	tion (mg/Kg)	
Analyte	LDW20-SS127	LDW20-SS127-FD	RPD
Arsenic	10.8	12.1	11
Cadmium	0.19U	0.07	Not calculable
Chromium	19.1	21.7	13
Copper	38.3	45.1	16
Lead	18.6	21.9	16
Mercury	0.124	0.317	88
Silver	0.09	0.11	20
Zinc	60.8	75.2	21

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

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

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0218

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

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0218

No Sample Data Qualified in this SDG

LDC #: 48765B4a VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0218 Stage 2B

Page: (_of_\ Reviewer: _____ 2nd Reviewer: _____

Laboratory: Analytical Resources, Inc.

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	AA	
11.	ICP/MS Tune	A	
111.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	\mathcal{N}_{\perp}	
VII.	Matrix Spike/Matrix Spike Duplicates (SW	
VIII.	Duplicate sample analysis	1	
IX.	Serial Dilution	\mathcal{N}	
X.	Laboratory control samples	LA	LCS.
XI.	Field Duplicates	5W	(96)
XII.	Internal Standard (ICP-MS)	\mathcal{N}	not texend
XIII.	Sample Result Verification	, N	
XIV	Overall Assessment of Data	LA	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12				
13				

Notes:			

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Target Analyte List
As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
Analysis Method

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

Bir on a skipting

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:

								Associated		
	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Samples	Qualification	Det/ND
LDW20-IT248MS/MSD	S	Hg	132	145	75-125			All	Jdet/A	Det
				,						
			!							
								<u>L</u>		

Comments:

LDC #: 48765B4a

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

Method: Metals

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

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

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

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

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

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

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

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

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

LDC #: 48765B6 VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: <u>\$17176</u>
Page: <u></u> _of <u>\</u> _
Reviewer:
2nd Reviewer:

Laboratory: Analytical Resources, Inc.

SDG #: 20F0218

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
l.	Sample receipt/Technical holding times	AA	
li li	Initial calibration	A	
111.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	\mathcal{N}_{\perp}	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS(30 FOZIZ)
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A.	US
IX.	Field duplicates	5W	(S,6)
Х.	Sample result verification	N_	- /
LxL	Overall assessment of data	$\perp \Lambda$	

Note:

Notes:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS169	20F0218-01	Sediment	06/11/20
2	LDW20-SS113	20F0218-02	Sediment	06/11/20
3	LDW20-SS146	20F0218-03	Sediment	06/11/20
4	LDW20-SS139	20F0218-04	Sediment	06/11/20
5	LDW20-SS127	20F0218-05	Sediment	06/11/20
6	LDW20-SS127-FD	20F0218-06	Sediment	06/11/20
7	LDW20-SS133	20F0218-07	Sediment	06/11/20
8	LDW20-SS140	20F0218-08	Sediment	06/11/20
9	LDW20-SS142	20F0218-09	Sediment	06/11/20
10	LDW20-SS144	20F0218-10	Sediment	06/11/20
11	LDW20-SS148	20F0218-11	Sediment	06/11/20
12	LDW20-SS169DUP	20F0218-01DUP	Sediment	06/11/20
13				
14				
15				

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

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

LDC#: 48765B6

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0218

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

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

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

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

III. Initial Calibration and Initial Calibration Verification

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0218

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

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

VI. Field Blanks

No field blanks were identified in this SDG.

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

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

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW20-SS146DUP (LDW20-SS146)	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	28.3 (≤25) 40.4 (≤25) 45.6 (≤25) 48.2 (≤25)	J (all detects) J (all detects) J (all detects) J (all detects)	A

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

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

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

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

X. Labeled Compounds

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

XI. Compound Quantitation

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

Sample	Compound	Flag	A or P
All samples in SDG 20F0218	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А
All samples in SDG 20F0218	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	А
All samples in SDG 20F0218	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	Α

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to DUP RPD, compounds reported as EMPC, and CDPE interference, data were qualified as estimated in three samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

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

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

Sample	Compound	Flag	A or P	Reason
LDW20-SS146	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	J (all detects) J (all detects) J (all detects) J (all detects)	А	Duplicate sample analysis (RPD)
LDW20-SS146 LDW20-SS127 LDW20-SS127-FD LDW20-SS146DUP	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А	Compound quantitation (EMPC)
LDW20-SS146 LDW20-SS127 LDW20-SS127-FD LDW20-SS146DUP	0-SS127 estimated maximum possible concentration (EMPC) and less		А	Compound quantitation (EMPC)
LDW20-SS146 LDW20-SS127 LDW20-SS127-FD LDW20-SS146DUP	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А	Compound quantitation

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

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

Duwamish AOC4

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

No Sample Data Qualified in this SDG

SDG # _abor	#:20F0218 atory: <u>Analytical Resources, Inc.</u>	S	tage 2B		WORKSHEE	F	Date: 8/8/2 Page: / of// Reviewer: Reviewer:
	IOD: HRGC/HRMS Polychlorinated Dioxi amples listed below were reviewed for ea		•		ŕ	tion findings are	noted in attached
	tion findings worksheets.				non arous. Vanda	go uro	
	Validation Area				Com	ments	
l.	Sample receipt/Technical holding times	A	Fool	\$ -(D 950 -	Same Low	-0
II.	HRGC/HRMS Instrument performance check	A	/				
III.	Initial calibration/ICV	DIA	R50=	<->	9/3570. 10	ey < oclin	nils
IV.	Continuing calibration	A	cel e	< k	aclimits		
V.	Laboratory Blanks	W.					
VI.	Field blanks	//					
VII.	Matrix spike/Matrix spike duplicates	NKI	C5				
VIII.	Laboratory control samples	A	1CS				
IX.	Field duplicates	MI	75==	2+	.3		-
Х.	Labeled Compounds						
XI.	Compound quantitation RL/LOQ/LODs	ŹN	-JUDI	7	lesalts-	Jets/A	-
XII.	Target compound identification	N			12112	4017	
					·········		
XIII. XIV.	System performance Overall assessment of data	N					
ote:	N = Not provided/applicable R = Rins	o compounds sate eld blank	detected		D = Duplicate TB = Trip blank EB = Equipment bla	SB=Sour OTHER: ank	ce blank
	Client ID				Lab ID	Matrix	Date
1 [_DW20-SS146				20F0218-03	Sediment	06/11/20
	_DW20-SS127				20F0218-05	Sediment	06/11/20
- / 1	_DW20-SS127-FD				20F0218-06	Sediment	06/11/20
	_DW20-SS146DUP				20F0218-03DUP	Sediment	06/11/20
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VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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

Notes:	 	 	

LDC #: 48765B21

VALIDATION FINDINGS WOR/UHEET Blanks

Reviewer: PG	Page:	<u>1</u> of 1
2nd Reviewer:	Reviewer:	PG
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METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

Blank extraction date: 7/6/20

Blank analysis date: 7/9/20

Conc. units: ng/kg

Associated samples: All qual U

Zone, units, higher												
Compound	Blank ID		Sample Identification									
	BIF0803-BLK1	5X	1	<u> </u>		<u> </u>						
0	0.140	0.7										
Р	0.0330	0.165	0.968) 		
F	0.535	2.675										
Q	1.37	6.85						<u> </u>				
G	6.33	31.65										
U	0.284	1.42										
			4									
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VALIDATION FINDINGS WORKSHEET <u>Duplicate Analysis</u>

Page: / of /
Reviewer: 2nd Reviewer: 7

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".

Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) < 35?

		ere all duplicate sampl	e relative pere	ent dinerence	3 (141 B) <u>-</u> 00:		
#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		4	25 9	0	28.3 (EVS) 40.4 45.6 48.2	(dots)	17dds Vols/A
				文	40.4		
<u> </u>				2	45.6		
				4	48.2		V
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LDC#: 48765B21

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1
Reviewer: 3VGQ
2nd Reviewer: 4

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

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

Were target analytes detected in the field duplicate pairs?

	Concentration (ng/Kg)			
Compound	2	3	RPD	
Н	0.635	0.951	40	
Α	0.351	0.364	4	
1	0.604	0.502	18	
J	0.886	0.849	4	
В	0.940	0.871	8	
К	1.99	2.05	3	
L	0.850	0.802	6	
М	1.00	1.08	8	
N	0.420	0.472	12	
С	0.899	0.949	5	
D	3.04	3.26	7	
E	2.40	2.29	5	
0	18.8	18.9	1	
Р	1.49	1.38	8	
F	90.1	118	27	
Q	46.8	48.1	3	
G	743	1090	38	
V	14.5	13.0	11	
R	2.54	1.59	46	
w	11.6	11.3	3	
S	1.68	5.79	110	
x	25.3	24.5	3	
Т	23.5	33.0	34	
Υ	61.9	61.5	1	
U	197	339	53	

LDC #: 487665

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported RLs</u>

Page	: <u>l of l</u>
Reviewe	r:
2nd Reviewe	r:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

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

Y N N/A Y N N/A

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		411	All results flagged as EMPC → R ← R ←		Jdets/A
		*	t -RL		u/A
		\$ 11	All results flagged "X" by the lab due to chlorinated		Jdets/A
		<u>'</u>	diphenyl ether (CDPE) interference	L	

Comments:	See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 6.5°C and 9.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r2) were greater than or equal to 0.990.

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0719-SRM1	Acenaphthylene Anthracene Bis(2-ethylhexyl)phthalate	51.4 (52-148) 51.8 (57-143) 61.5 (62-138)	All samples in SDG 20F0233	J (all detects) UJ (all non-detects)	А

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0233

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

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

				S WORKSHEET		Date: <u>8 13 2</u>
	#: <u>20F0233</u>	S	stage 2B		_	Page: /of/
Labor	atory: Analytical Resources, Inc.					Reviewer:A
METH	IOD: GC/MS Semivolatiles (EPA SW 84	6 Method 8	270E)		Ziiu N	reviewer/
	·		·			
	amples listed below were reviewed for ea	ach of the fo	ollowing valida	tion areas. Validatio	n findings are i	noted in attached
valida	tion findings worksheets.					
	Validation Area			Comm	ents	
١.	Sample receipt/Technical holding times	A	Teupa	65, 950 -	sane da	y
II.	GC/MS Instrument performance check	A				7
III.	Initial calibration/ICV	AA	R50 =	20/0.12	c/=>5/	3
IV.	Continuing calibration		COVE	70 %		
V.	Laboratory Blanks	$\bot A$	2	<i>U</i>		
VI.	Field blanks	\mathcal{N}				
VII.	Surrogate spikes	A				
VIII.	Matrix spike/Matrix spike duplicates	N	09			
IX.	Laboratory control samples	A Fall	100			
X.	Field duplicates	/N				
XI.	Internal standards	A				
XII.	Compound quantitation RL/LOQ/LODs	N				
XIII.	Target compound identification	N_			<u> </u>	
XIV.	System performance	N_				
XV.	Overall assessment of data					
lote:	N = Not provided/applicable R = Rir	lo compounds nsate ïeld blank	detected	D = Duplicate TB = Trip blank EB = Equipment blant	SB=Sourc OTHER:	ce blank
	Client ID			Lab ID	Matrix	Date
1	_DW20SC230B			20F0233-04	Sediment	06/12/20
	_DW20-SC223A			20F0233-05	Sediment	06/12/20
	_DW20-SC222B			20F0233-06	Sediment	06/12/20
	_DW20-SC220A			20F0233-07	Sediment	06/12/20
	_DW20-SC217A			20F0233-08	Sediment	06/12/20
	_DW20-SC219C			20F0233-09	Sediment	06/12/20
7	_DW20-SC212A			20F0233-10	Sediment	06/12/20
8						
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otes:						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: _/ of/ Reviewer: ______ d Reviewer: ________

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

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

Was a LCS required?
YN N/A
Were the LCS/LCSD required?

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

#	Date	LCS/LCSD ID	Compound	Les ⊅RM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B170719-5RM1	250	51. (5248)	()	()	DI (detS+ND)	-VM/A
			VV	4.8 5147	()	()		1
			EZZ	61.5 (62-138)	()	()		
				()	()	()		
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 6.5°C and 9.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0233	J (all detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
07/10/20	Benzoic acid	32.0	All samples in SDG 20F0233	J (all detects) UJ (all non-detects)	Α
	Pentachlorophenol	50.0		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 with the following exceptions:

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

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

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0719-SRM2	2,4-Dimethylphenol	34.2 (40-160)	All samples in SDG 20F0233	UJ (all non-detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

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

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0233

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

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

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

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

No Sample Data Qualified in this SDG

SDG #Labora METH The sa	e: 20F0233 atory: Analytical Resources, Inc. SIGN OD: GC/MS Polynuclear Aromatic Hydromoles listed below were reviewed for e	S recarbons (I	· ·	Date:
validat	ion findings worksheets. Validation Area		Comments	
1.	Sample receipt/Technical holding times	A	1007 @ 65-95°C-50	uf day
11.	GC/MS Instrument performance check	A	/	7 0
III.	Initial calibration/ICV	A rup	P50 < >0/2. γ ≥ /	c1=337
IV.	Continuing calibration	1 Sui	- 1/- - 1 /2.	/
	Continuing cambration	1 m	CC1 = 05/8	•
V.	Laboratory Blanks	W	ECV = 38/8	
V. VI.		W	2012 7018	·
	Laboratory Blanks	W N	2012 7018	·
VI.	Laboratory Blanks Field blanks	M N A A	cc/= 38/8	·
VI.	Laboratory Blanks Field blanks Surrogate spikes	M N A N	CS 2005	·

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=Sourc OTHER:	ce blank
	Client ID		Lab ID	Matrix	Date
1	LDW20SC230B		20F0233-04	Sediment	06/12/20
2	LDW20-SC223A		20F0233-05	Sediment	06/12/20
3	LDW20-SC222B	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	20F0233-06	Sediment	06/12/20
4	LDW20-SC220A		20F0233-07	Sediment	06/12/20
5	LDW20-SC217A		20F0233-08	Sediment	06/12/20
6	LDW20-SC219C		20F0233-09	Sediment	06/12/20
7	LDW20-SC212A		20F0233-10	Sediment	06/12/20
8					
9					
Votes:					

Ν

Ν

Ν

XI.

XII.

XIII.

XIV.

XV.

Internal standards

System performance

Compound quantitation RL/LOQ/LODs

Target compound identification

Overall assessment of data

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

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

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

Was an initial calibration verification standard analyzed after each ICAL for each instrument with the validation criteria of ≤30 %D?

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 30.0%)	Associated Samples	Qualifications
	G\$6/20	5170395-5CV1	RK	65.7	All (dots)	YW/A
	6/26/20	7/7-293	- AR	790		
	apple	S40393-5011		41.90		
				-		



VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page:_	<u>/</u> of_/
Reviewer:_	9_
2nd Reviewer:_	1

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

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

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%) 3⊋.	Finding RRF (Limit)		Qualifications
	Date 7/19/20	Standard ID N714200710035	7PP 7T	32.0		Associated Samples All (dets+NB)	- MAX
	<u> </u>		77	50.0			
						<u> </u>	
				L			
		41.4					
				A			
					L	<u> </u>	

LDC #: 15/Locals

VALIDATION FINDINGS WORKSHEET Blanks

Page:_	of
Reviewer:	9
2nd Reviewer:	2

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

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

MN N/A Was a method blank analyzed for each matrix?

N N/A Was a method blank analyzed for each concentration preparation level?

NN 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: 4/20 Blank analysis date: 1/9/20

Blank extraction date:_____ Blank analysis date:____

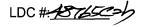
Conc. units: Associated Samples:

Compound	Blank iD		Sample Identification						
BE	0719-B4=	/	_2	3	4	5	6	7	
~	0.7	1.3/U	0.8/U	1.5/4	1.7/11	1.8/11	14/4	1.3/11	
					/	/ /	/ /		

Conc. units:	onc. units: Associated Samples:									
Compound	Blank ID				s	ample Identifica	ition			

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".



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: _/of/ Reviewer: ______ nd Reviewer: _______

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

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

N N/A Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	168 SKM %R (Limits) 34.2 40-160)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B170719-SRM>	0	34.2 40-160)	()	()	AII (NO)	VIIIA
		,		()	()	()		7
				()	()	()		
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				()_	()	()		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 6.5°C and 9.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

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

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765C3a SDG #: 20F0233 Stage 2B Laboratory: Analytical Resources, Inc. 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 Sample receipt/Technical holding times GC Instrument Performance Check 11. III. Initial calibration/ICV IV. Continuing calibration Laboratory Blanks Field blanks VI. 'IS VII. Surrogate spikes VIII. Matrix spike/Matrix spike duplicates IX. Laboratory control samples X. Field duplicates XI. Compound quantitation/RL/LOQ/LODs Ν XII. Target compound identification Ν XIII. System Performance Ν ΧIV Overall assessment of data SB=Source blank Note: A = Acceptable ND = No compounds detected D = Duplicate 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 20F0233-04 LDW20SC230B Sediment 06/12/20 LDW20-SC223A 20F0233-05 Sediment 06/12/20 LDW20-SC222B 20F0233-06 Sediment 06/12/20 LDW20-SC220A 20F0233-07 Sediment 06/12/20 LDW20-SC217A 20F0233-08 Sediment 06/12/20 5 LDW20-SC219C 20F0233-09 Sediment 06/12/20 LDW20-SC212A 20F0233-10 Sediment 06/12/20 10 Notes:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 27, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 6.5°C and 9.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0233	J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample LDW20-SC230B. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

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

VII. Matrix Spike/Matrix Spike Duplicates

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

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

Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

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

Sample	Compound	RPD	Flag	A or P
LDW20-IT258	Aroclor-1260	55.8	J (all detects)	А
LDW20-IT266	Aroclor-1260	54.4	J (all detects)	А
LDW20-SC230B	Aroclor-1254 Aroclor-1260	41.2 43.1	J (all detects) J (all detects)	А
LDW20-SC222B	Aroclor-1248 Aroclor-1260	42.3 47.5	J (all detects) J (all detects)	А
LDW20-SC220A	Aroclor-1254	49.7	J (all detects)	А
LDW20-SC217A	Aroclor-1248 Aroclor-1260	46.2 48.1	J (all detects) J (all detects)	А

Sample	Compound	RPD	Flag	A or P
LDW20-SC219C	Aroclor-1260	52.2	J (all detects)	А
LDW20-SC212A	Aroclor-1254	47.7	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

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

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

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

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

Duwamish AOC4

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

No Sample Data Qualified in this SDG

Duwamish AOC4

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

No Sample Data Qualified in this SDG

DG#	: 48765C3b VALIDAT t: 20F0233 atory: Analytical Resources, Inc.		PLETENES Stage 2B	S WORKSH		Date: Alexander Page: / of Reviewer:
IETH	OD: GC Polychlorinated Biphenyls (E	PA SW846 M	lethod 8082A))	2nc	Reviewer: 1
	amples listed below were reviewed for ion findings worksheets.	each of the fo	ollowing valida	ation areas. Va	alidation findings ar	e noted in attac
	Validation Area				Comments	
I.	Sample receipt/Technical holding times	A	Tous	@ 6.5-	9.5° - Sour	= Sout
II.	Initial calibration/ICV	AA	750kg.	∑7o.	101 = 20%	
III.	Continuing calibration	\triangle	act =	20/0	7	
IV.	Laboratory Blanks	\$		7		
V.	Field blanks	· / /				
VI.	Surrogate spikes	Way	¥			
VII.	Matrix spike/Matrix spike duplicates	XV.				
∕III.	Laboratory control samples	A .	109			
IX.	Field duplicates	N				
X.	Compound quantitation/RL/LOQ/LODs	ŹN				
XI.	Target compound identification	N				
XII	Overall assessment of data	$\perp \mathcal{R} \perp$			· · · · · · · · · · · · · · · · · · ·	
te:	N = Not provided/applicable R =	= No compounds Rinsate = Field blank	s detected	D = Duplicate TB = Trip blar EB = Equipmo	nk OTHE	ource blank ⋜:
С	Client ID			Lab ID	Matrix	Date
L	DW20SC230B			20F0233-04	Sediment	06/12/20
L	DW20-SC223A			20F0233-05	Sediment	06/12/20
L	DW20-SC222B			20F0233-06	Sediment	06/12/20
L	DW20-SC220A			20F0233-07	Sediment	06/12/20
L	LDW20-SC217A			20F0233-08	Sediment	06/12/20
L	LDW20-SC219C			20F0233-09	Sediment	06/12/20
L	DW20-SC212A			20F0233-10	Sediment	06/12/20
L	DW20-IT266MS			20F0233-03MS	Sediment	06/12/20
L	LDW20-IT266MSD			20F0233-03MS	D Sediment	06/12/20
) 1	DW-20-IT-257			101		1
	DW20-IT>57 DW20-IT>58			02		
- 1	15 W- 24- 17-266			1000		

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

Notes:

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	
Reviewer:_	, <u>I</u>
2nd Reviewer:	A
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LDC #: 48765e36

METHOD: \(\sqrt{GC} \) HPLC

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

What type of initial calibration verification calculation was performed? ___%D or ___%R

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

YIN N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	7/2/20	5140056-5011	10	BB	4.8	All (dots)	Jan/A
	7/					7. (281)	72.7
							1340 2 AA BB/
 							
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LDC #:48765C3b

VALIDATION FINDINGS WORKSHEET <u>Surrogate Recovery</u>

Page:_	<u></u>
Reviewer:	4
2nd Reviewer:	1

METHOD: / GC HPLC

1.4-Difluorobenzene (DFB)

Are surrogates required by the method? Yes___ or No___

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

Bromobenzene

Were surrogates spiked into all samples and blanks?

Y N/N/A

Did all surrogate recoveries (%R) meet the QC limits?

#	Sample Detector/ ID Column				Surrogate Compound		%R (Limits)			Qualifications		
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	Surrogate Compound			Surrogate Compound			Surrogate Compound		Surrogate Compound			Surrogate Compound
Α	Chlorobenzene (CBZ)		G	Octacosane		М	Benzo(e)Pyrene	s	1-Chloro-3-Ni	trobenzene	Υ	Tetrachloro-m- xylene
В	4-Bromofluorobenzene (BF	B)	Н	Ortho-Terphenyl		N	Terphenyl-D14	T	3,4-Dinitrotoluene		Z	1,2-Dinitrobenzene
С	a,a,a-Trifluorotoluene			Fluorobenzene (FBZ)		0	Decachlorobiphenyl (DCB)	U	Tripentyltin			
P	Bromochlorobenene		_ J	n-Triacontane		P	1-methylnaphthalene	V	Tri-n-propyltin		<u> </u>	
E	1,4-Dichlorobutane		K	H	lexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate			Í

Triphenyl Phosphate

LDC#:48765C3b

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Reviewer 2nd Reviewer:

METHOD: / GC HPLC

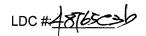
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? Ø∩N N/A

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

Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	8/9	BB	H2 68-120)	142 (58-120)	()	12 (Sets)	Jols/A
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VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	
Reviewer:	9
2nd Reviewer:	Ø

METHOD: /GC __ HPLC

Level IV/D Only

Y N M/A) Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	B	#2 11	¥ 55. ₹	Jet=/3
 	BB	2	<i>5</i> 4.4	
	χ Λ		1	
	AA		41.2	
	88		43.1	
	2	3	42.3	
	B13		42.3 4T.9	
			·	
	· AA	4	49.7	
	2	5	46.2	
	超		18.1	
	#2	6	52.2	
	AA	7	47.7	V

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 25, 2020

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following methods:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT258MS/MSD (LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC219C LDW20-SC212A LDW20-IT258DUP)	Zinc	55.7 (75-125)	53.7 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 2B validation.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to MS/MSD %R and DUP RPD, data were qualified as estimated in eight samples.

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

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0233

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

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

DC #: <u>48765C4</u>	VALIDATION COMPLETENESS WORKSHEET	Date: <u>8</u> 1
SDG #: 20F0233	Stage 2B	Page: _of
.aboratory: Analytic	cal Resources, Inc.	Reviewer: 6
•		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	
li.	ICP/MS Tune	ÍΑ	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	SW	
IX.	Serial Dilution	\mathcal{N}	
X.	Laboratory control samples	A	ILS
XI.	Field Duplicates	\mathcal{N}	
XII.	Internal Standard (ICP-MS)	\mathcal{N}	not reviewed
XIII.	Sample Result Verification	Ŋ	
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

mas detected

T

D = Duplicate TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

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

SDG Labo	DC #: 48765C4a VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0233 Stage 2B aboratory: Analytical Resources, Inc.			Date: 201/1 Page: 20f Reviewer: 2	
MET	HOD: Metals (EPA SW 8	346 Method 6020A/7471B)	Lab ID	Matrix	Date
16	LDW20SC230BDUP		20F0233-04DUP	Sediment	06/12/20
17					
18					a - 54
19_					
Note	3:				13
			- 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 197		

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

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

Analysis Method

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

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

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

								Associated		
MS/MSD ID	Matrix		MS %R	MSD %R	%R Limit	RPD	RPD Limit	Samples	Qualification	Det/ND
11, 12	S	Zn	55.7	53.7	75-125			4 to 10 , 13	J/UJ/A	Det
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Comments:

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.

			RPD	RPD Limit	Difference (units)	Difference Limit	Associated Samples	Qualification	Det/ND
13	s	Pb	21.1	20			4 to 10 13	J/UJ/A	Det
		Zn	34.5	20			4 to 10 13	J/UJ/A	Det
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Comments:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	LDW20-IT258 LDW20-IT266 LDW20-SC230B LDW20-SC223A LDW20-SC222B LDW20-SC220A LDW20-SC217A LDW20-SC217C LDW20-SC219C LDW20-SC212A

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

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

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765C6

SDG #: 20F0233

Stage 2B

Laboratory: Analytical Resources, Inc.

Page: Reviewer: 6 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
l.	Sample receipt/Technical holding times	AIA	
II	Initial calibration	A	
111.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	\mathcal{N}	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	_
VIII.	Laboratory control samples	A	1.5
IX.	Field duplicates	\mathcal{N}	
X.	Sample result verification	N	
ΧI	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT257	20F0233-01	Sediment	06/12/20
2	LDW20-IT258	20F0233-02	Sediment	06/12/20
3	LDW20-IT266	20F0233-03	Sediment	06/12/20
4	LDW20SC230B	20F0233-04	Sediment	06/12/20
5	LDW20-SC223A	20F0233-05	Sediment	06/12/20
6	LDW20-SC222B	20F0233-06	Sediment	06/12/20
7	LDW20-SC220A	20F0233-07	Sediment	06/12/20
8	LDW20-SC217A	20F0233-08	Sediment	06/12/20
9	LDW20-SC219C	20F0233-09	Sediment	06/12/20
10	LDW20-SC212A	20F0233-10	Sediment	06/12/20
11	LDW20-IT257MS	20F0233-01MS	Sediment	06/12/20
12	LDW20-IT257DUP	20F0233-01DUP	Sediment	06/12/20
13				
14				
15				

Notes:	 		

LDC #: 48765C6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	Total solids, TOC
QC: 11, 12	тос

LDC #: 48765C6

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

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: 2-10

					Sample Identification						
Analyte	PB (units)	Maximum ICB/CCB (%)	Action Level	No qualifiers	5						
TOC		0.02	0.2								

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised at 57

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 6.5°C and 9.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

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

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

III. Initial Calibration and Initial Calibration Verification

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0233

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

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

XI. Compound Quantitation

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

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

Sample	Compound	Finding	Criteria	Flag	A or P
LDW20-IT257	OCDD	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	Р

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to compounds reported as EMPC, CDPE interference, and results exceeding calibration range, data were qualified as estimated in four samples.

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

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

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

Duwamish AOC4

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

No Sample Data Qualified in this SDG

Duwamish AOC4

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

No Sample Data Qualified in this SDG

SDG Labor METI The s	#:48765C21VALIDATIO #:20F0233 ratory:_Analytical Resources, Inc. HOD: HRGC/HRMS Polychlorinated Dioxical camples listed below were reviewed for eaction findings worksheets.	S ins/Dibenzo	tage 2B ofurans (E	BPA N	,	F 2nd F	Date: 2/2/2 Page:
	Validation Area				Comn	nents	
I.	Sample receipt/Technical holding times	A	Temp (a a	6.5- 9.5°C	- sane	doup
II.	HRGC/HRMS Instrument performance check	4	/				đ
III.	Initial calibration/ICV	AM	K50	<u>~</u>	20/25/0.	ICYERC	-amits
IV.	Continuing calibration	A	GCV.	30	de limits.		
V.	Laboratory Blanks	W	I				
VI.	Field blanks						
VII.	Matrix spike/Matrix spike duplicates	N	05				
VIII.	Laboratory control samples SRM	A	10-	>			
IX.	Field duplicates	N					
X.	Labeled Compounds	\Rightarrow					
XI.	Compound quantitation RL/LOQ/LODs	χN					
XII.	Target compound identification	N					
XIII.	System performance	N					
XIV.	Overall assessment of data	1					
lote:	N = Not provided/applicable R = Rin	o compounds sate eld blank	detected		D = Duplicate TB = Trip blank EB = Equipment blar	SB=Sour OTHER: ık	ce blank
	Client ID				Lab ID	Matrix	Date
1	LDW20-IT257				20F0233-01	Sediment	06/12/20
2	LDW20-IT258				20F0233-02	Sediment	06/12/20
3	LDW20-IT266				20F0233-03	Sediment	06/12/20
4	LDW20-SC212A				20F0233-10	Sediment	06/12/20
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VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

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

Notes:	 	

LDC #: 48765C21

VALIDATION FINDINGS WOR/UHEET Blanks

Page:_	<u>1</u> of <u>1</u>
Reviewer:	PG
2nd Reviewer:_	9

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

Blank extraction date: 7/6/20 Blank analysis date: 7/9/20

Conc. units: ng/kg Associated samples: All qual U (> Pc)

Compound	Blank ID	Sample Identification								
	BIF0803-BLK1	5X								
0	0.140	0.7								
Р	0.0330	0.165								
F	0.535	2.675	i							
Q	1.37	6.85								
G	6.33	31.65								
U	0.284	1.42								
								i	i	

LDC #: 48765C2

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported RLs</u>

Page: _	<u></u>
Reviewer:	9
2nd Reviewer:	90
	_

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

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

Y N NVA

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		\$1	All results flagged as EMPC		Jdets/A
		•	All results flagged as EMPC > P -		U/A
					/ 7
		114	All results flagged "X" by the lab due to chlorinated		Jdets/A
		·	diphenyl ether (CDPE) interference		
		//	# > calib lange	2	Hots 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 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 7.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0719-SRM1	Acenaphthylene Anthracene Bis(2-ethylhexyl)phthalate	51.4 (52-148) 51.8 (57-143) 61.5 (62-138)	All samples in SDG 20F0235	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

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

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

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

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

The quality control criteria reviewed, considered acceptable.	, other than those	e discussed above, w	ere met and are
			·

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0235

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765D2a SDG #: 20F0235

Stage 2B

Laboratory: Analytical Resources, Inc.

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

Reviewer: 2nd Reviewer:

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
l.	Sample receipt/Technical holding times	A	Tent & 7,50c - same dies
II.	GC/MS Instrument performance check	A	
111.	Initial calibration/ICV	AA	150 5 20/0. 12 10/430/0
IV.	Continuing calibration	A	R50 < 20/0. 1 - 10/230/0
V.	Laboratory Blanks	A	
VI.	Field blanks	λl	
VII.	Surrogate spikes	4	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples / #M	A/W	105
X.	Field duplicates	an	0=4+5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	Ņ	
XV.	Overall assessment of data	A	

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1)	LDW20-SS253	20F0235-01	Sediment	06/12/20
21	LDW20-SS248	20F0235-02	Sediment	06/12/20
3 /	LDW20-SS272	20F0235-03	Sediment	06/12/20
4,	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
72		20F0235-07	Sediment	06/12/20
87	LDW20-SS156	20F0235-08	Sediment	06/12/20
92		20F0235-09	Sediment	06/12/20
102	LDW20-SS166	20F0235-10	Sediment	06/12/20
117	LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
123	LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	l1.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: __/of_/ Reviewer: _____ 2nd Reviewer: ______

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

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

Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	+ES SRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B40719-SAMI	05	51.4 (52-148)	()	(AN (dots+N/b)	
			W	51.8 (57-143)	()	(7,77
			22	61.5 (62-138)	()	()	a l
				()	()	()	
				()	()	()	
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LDC#: 48765D2a

VALIDATION FINDINGS WORKSHEET Field Duplicates

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

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

YNNA

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

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

V:\FIELD

DUPLICATES\Field Duplicates\FD_Organics\2020\48765D2a windward duwamish.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 7.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20 (SIF0395-SCV1)	N-Nitrosodiphenylamine	65.7	LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150	J (all detects) UJ (all non-detects)	A
06/26/20 (SIF0393-SCV1)	N-Nitrosodiphenylamine	41.9	LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	J (all detects) UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
07/10/20 (NT1420071003S)	Benzoic acid Pentachlorophenol	32.0 50.0	LDW20-SS253 LDW20-SS248 LDW20-SS272 LDW20-SS151 LDW20-SS151-FD LDW20-SS150	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	А
07/10/20 (NT1020071003S)	Benzyl alcohol	26.8	LDW20-SS155 LDW20-SS156 LDW20-SS162 LDW20-SS166	J (all detects) UJ (all non-detects)	Α

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

V. Laboratory Blanks

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

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

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

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

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

X. Field Duplicates

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

	Concentra		
Compound	LDW20-SS151	LDW20-SS151-FD	RPD
Benzyl alcohol	33.8	22.0	42
Benzoic acid	85.6	63.8	29
N-Nitrosodiphenylamine	1.9	1.7	11

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

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

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0235

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

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

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

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

No Sample Data Qualified in this SDG

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
1.	Sample receipt/Technical holding times	A	Feet 7.5°C - saw does
II.	GC/MS Instrument performance check	4	()
III.	Initial calibration/ICV	It in	RS0 < 20/6. Y, 10/4 > 0/0
IV.	Continuing calibration	â	CCV = 28/0
V.	Laboratory Blanks	w	
VI.	Field blanks	Λ	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples / RM	A/SW	104
X.	Field duplicates	w	D=4+5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	Ŋ	
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-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4 1	LDW20-SS151	20F0235-04	Sediment	06/12/20
5_	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
2 7	LDW20-SS155	20F0235-07	Sediment	06/12/20
د 8	LDW20-SS156	20F0235-08	Sediment	06/12/20
9 🔾	LDW20-SS162	20F0235-09	Sediment	06/12/20
102	LDW20-SS166	20F0235-10	Sediment	06/12/20
11	LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
12	LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

		· · · · · · · · · · · · · · · · · · ·		
A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

LDC #:487650 - 4

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

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

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

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

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

#	Date,	Standard ID	Compound	Finding %D (Limit: <u><</u> 30.0%)	Associated Samples	Qualifications
	6/26/20	SIF0395-9CV/	00	65.7	1-6. MB (dik+Nb)	J/W/A
	/ /	(NT4)	4 - M - M - M - M - M - M - M - M - M -		/	, /
	6/26/20	5170393-5CV1	RR	41.9	7-10. 11-12 (dot+ND)	VA/A
	/ /	('NT10)				
			Sandara NAMA	Name and the state of the state		
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VALIDATION FINDINGS WORKSHEET Continuing Calibration

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

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

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

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

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/10/23	NT14200710075	FPP TT	32.0 50.0		1-6.MR	JAN/K
	/		//	50.0		(dobst ND)	, V
	7/11/20	NT 10200711035	DRR	<i>₩.</i> /		11-102.	7/41/2
	-7-7	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	77	21.1 28.6		777	
	7/10/20	NT10200710035	ODR	26.8		7-10. (dots+ND)	-/W/A
	,						
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				11 10 40			
			·				

LDC #: 487660-1/

VALIDATION FINDINGS WORKSHEET Blanks

Page:_	<u></u>
Reviewer:	
2nd Reviewer:	2

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

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

Was a method blank analyzed for each matrix? WN N/A

N N/A Was a method blank analyzed for each concentration preparation level?

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: Blank analysis date: 7/10/20

Blank extraction date: _____ Blank analysis date: _____

Conc. units:	Associated Samples:	A1/

Compound	Blank ID		Sample Identification						
BIFO	19-BA2	3	7	10					
4	0.7	0.6/4	0.9/11	0.9/11					
		/ '	,						

Conc. units:		Associa	ted Samples:						
Compound	Blank ID	 Sample Identification							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: ___of__ Reviewer: _____ 2nd Reviewer: _____

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

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

W N/A Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	LGS SQM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BH0719-5PM2	0	%R (Limits) 34.2 (40/60)	()		AN (NO)	VU/8
		1 1 1		()	()	()	73.7. (7.8. /	/ */ *
				()	()	()		
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LDC#: 48765D2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1_of_1_ Reviewer: PG 2nd Reviewer:

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

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

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

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F235

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 7.5°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

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

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

X. Field Duplicates

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

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F235

No Sample Data Qualified in this SDG

Duwamish AOC4

Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F235

No Sample Data Qualified in this SDG

Duwamish AOC4

Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F235

No Sample Data Qualified in this SDG

LDC #: 48765D3a VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0235

Stage 2B

Laboratory: Analytical Resources, Inc.

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
l.	Sample receipt/Technical holding times	-#	Texp @ 7.50c - Save day
II.	GC Instrument Performance Check	4	/
111.	Initial calibration/ICV	AA	PSD < 2070. PEV < 2070
IV.	Continuing calibration	A	CV = 270
V.	Laboratory Blanks	A	7
VI.	Field blanks	\mathcal{N}	
VII.	Surrogate spikes	X	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	\triangle	105/0
X.	Field duplicates	NP	D=4+5
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data	\sqrt{1}	

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:

			T	
	Client ID	Lab ID	Matrix	Date
1	LDW20-SS253	20F0235-01	Sediment	06/12/20
2	LDW20-SS248	20F0235-02	Sediment	06/12/20
3	LDW20-SS272	20F0235-03	Sediment	06/12/20
4 ,	LDW20-SS151	20F0235-04	Sediment	06/12/20
5	LDW20-SS151-FD	20F0235-05	Sediment	06/12/20
6	LDW20-SS150	20F0235-06	Sediment	06/12/20
7	LDW20-SS155	20F0235-07	Sediment	06/12/20
8	LDW20-SS156	20F0235-08	Sediment	06/12/20
9	LDW20-SS162	20F0235-09	Sediment	06/12/20
10	LDW20-SS166	20F0235-10	Sediment	06/12/20
11_	LDW20-SS166MS	20F0235-10MS	Sediment	06/12/20
12	LDW20-SS166MSD	20F0235-10MSD	Sediment	06/12/20
13				
14				
15				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 7.5 C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0235	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

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

	Concentra		
Compound	LDW20-SS151	LDW20-SS151-FD	RPD
Aroclor-1248	18.6	18.5	1
Aroclor-1254	22.4	23.3	4
Aroclor-1260	29.7	30.9	4

X. Compound Quantitation

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

Sample	Compound	RPD	Flag	A or P
LDW20-SS248	Aroclor-1248	54.5	J (all detects)	А
LDW20-SS272	Aroclor-1254 Aroclor-1260	41.1 58.5	J (all detects) J (all detects)	А
LDW20-SS151	Aroclor-1260	56	J (all detects)	А
LDW20-SS151-FD	Aroclor-1260	57	J (all detects)	Α
LDW20-SS150	Aroclor-1254	46.9	J (all detects)	А

Sample	Compound	RPD	Flag	A or P
LDW20-SS155	Aroclor-1260	52.1	J (all detects)	Α
LDW20-SS155DL	Aroclor-1260	46	J (all detects)	Α

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

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

Sample	Compound	Reason	Flag	A or P
LDW20-SS155	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-SS155DL	All compounds except Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-

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

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

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

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

Duwamish AOC4

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

No Sample Data Qualified in this SDG

Duwamish AOC4

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

No Sample Data Qualified in this SDG

SDG ; Labor METH The sa	#: 48765D3b VALIDAT #: 20F0235 atory: Analytical Resources, Inc. HOD: GC Polychlorinated Biphenyls (Eamples listed below were reviewed for findings worksheets.	S EPA SW846 M	tage 2 ethod 8	B 082A)	WORKSHEET tion areas. Validation	2nd F	Date:
	Validation Area				Comm	ents	
I.	Sample receipt/Technical holding times	A	Ter	esp (€ 7.50C		
II.	Initial calibration/ICV	A MM	RS	<i>b</i> ≤	20/0.1	eV = 20)	3
III.	Continuing calibration	X	ec	V≤	2070	/	
IV.	Laboratory Blanks	Â			7		
V.	Field blanks	N					
VI.	Surrogate spikes / 75	AA					· · · · · · · · · · · · · · · · · · ·
VII.	Matrix spike/Matrix spike duplicates	N	ac				
VIII.	Laboratory control samples /SRM	A/B	10	5	.,		
IX.	Field duplicates	M	≯ ≥	4+0	2		
X.	Compound quantitation/RL/LOQ/LODs	N N					
XI.	Target compound identification	N					
XII	Overall assessment of data	W					
Note:	N = Not provided/applicable R =	= No compounds Rinsate = Field blank	detected		D = Duplicate TB = Trip blank EB = Equipment blank	SB=Source OTHER:	ce blank
	Client ID				Lab ID	Matrix	Date
1	_DW20-SS253				20F0235-01	Sediment	06/12/20
2 L	_DW20-SS248				20F0235-02	Sediment	06/12/20
3 l	_DW20-SS272				20F0235-03	Sediment	06/12/20
4 1 L	_DW20-SS151				20F0235-04	Sediment	06/12/20
5 L	_DW20-SS151-FD				20F0235-05	Sediment	06/12/20
6 L	DW20-SS150				20F0235-06	Sediment	06/12/20
7 L	LDW20-SS155 20F0235-07 Sediment 06/12/20						06/12/20
8 L						06/12/20	
9 L	LDW20-SS162 20F0235-09 Sediment 06/12/20					06/12/20	
10 L	LDW20-SS166 20F0235-10 Sediment 06/12/20						
	#7DL				107DL	L	4
12							
otes:				<u> </u>			
				1			

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

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

METHOD: \(\square\) GC \(\text{HPLC} \)

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	of_	<u>/</u>
Reviewer:	P	
2nd Reviewer:	A	

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

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
	1/2/20	SIGOSTOSVI		BB	2.8	All (dofs)	VW/A
	//	/					A K Pa
\vdash							+ Just Z. A.A. BE
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LDC#: 48765D3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1_of_1_ Reviewer:_ 2nd Reviewer:

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

Y N NA

Y N NA

Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentration (ug/Kg)		
Compound	4	5	RPD
Aroclor 1248	18.6	18.5	1
Aroclor 1254	22.4	23.3	4
Aroclor 1260	29.7	30.9	4

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

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

	Page: _	_/of
	Reviewer:	9
2nd	Reviewer:	CX

METHOD: VGC HPLC

Level IV/D Only

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

	If no, please see findings beliew.						
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (<u><</u> 40%)	Qualifications			
	Z	2	54.5	Vets/A			
	AA	3	41.1				
	BB		38.5				
							
	BB	4	56.				
	BB	5	57				
		<u></u>					
	AA	6	46.9				
	BB	7	52.				
	BB		46	V			

METHOD: GC _ HPLC

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page: _	/of/
Reviewer:	9
2nd Reviewer:	9

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?

f 				
#	Compound Name	Finding	Associated Samples	Qualifications
	7	BB realis unge All except BB		NRX
	311	All except BB		ď
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Comments:	 			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Metals

Validation Level: Stage 2B & 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0233

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

Introduction

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

The analyses were performed by the following methods:

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

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT258MS/MSD (All samples in SDG 20F0235)	Zinc	55.7 (75-125)	53.7 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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

XI. Field Duplicates

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

	Concentra	ition (mg/Kg)	
Analyte	LDW20-SS151	LDW20-SS151-FD	RPD
Arsenic	10.2	10.6	4
Cadmium	0.13	0.17	27
Chromium	26.8	27.3	2
Copper	47.2	46.6	1
Lead	17.4	17.2	1
Mercury	0.122	0.120	2
Silver	0.17	0.33	64
Zinc	91.7	94.5	3

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

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

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

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0233

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

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0233

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0235

LDC #: 48765D4a

Stage 2B/4

Reviewer: 2nd Reviewer

Laboratory: Analytical Resources, Inc.

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	AA	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	\sim	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A_{i}	
IX.	Serial Dilution	\mathcal{N}	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	SW	(4,5)
XII.	Internal Standard (ICP-MS)	N_{\perp}	not reviewed
XIII.	Sample Result Verification	À	Not reviewed for 6020A validation.
XIV	Overall Assessment of Data	A	

Note: A = Acceptable

N = Not provided/applicable

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

SW = See worksheet Mercury underwent Stage 4 validation **Client ID** Lab ID Matrix Date LDW20-SS253 20F0235-01 Sediment 06/12/20 LDW20-SS248 20F0235-02 Sediment 06/12/20 LDW20-SS272 20F0235-03 Sediment 06/12/20 LDW20-SS151 20F0235-04 Sediment 06/12/20 20F0235-05 5 LDW20-SS151-FD Sediment 06/12/20 20F0235-06 Sediment 06/12/20 6 LDW20-SS150 LDW20-SS155 20F0235-07 Sediment 06/12/20 8 LDW20-SS156 20F0235-08 Sediment 06/12/20 9 LDW20-SS162 20F0235-09 Sediment 06/12/20 10 LDW20-SS166 20F0235-10 Sediment 06/12/20 11 LDW20-SS253MS 20F0235-01MS Sediment 06/12/20 12 LDW20-SS253MSD 20F0235-01MSD Sediment 06/12/20 LDW20-SS253MSD 13 20F0235-01DUP Sediment 06/12/20

Notes:

METHOD: Trace Matala /FDA SM/ SAC Mathada	6010/	6020	/7000)	
METHOD: Trace Metals (EPA SW 846 Methods Validation Area	Yes	No	NA	Comments
I. Technical holding times	res	INO	INA	Comments
Were all technical holding times met?	Ιx	1		T
Were all water samples preserved to a pH of	+^-	 		
<2.			x	
II. ICP-MS Tune		1		
Were mass resolutions within 0.1 amu for all	T	1	T	
isotopes in the tuning solution?			x	
Were %RSDs of isoptoes in the tuning solution	+	 	+^	
\less \\ \less \\ \rest{55%} \\ \rightarrow \\ \r			x	
III. Calibration	<u> </u>	1		
Were all instuments calibrated daily?	x	1	T	
Were the proper standards used?	x	 	-	
Were all initial and continuing calibration	 ^-			
verifications within the 90-110% (80-120% for				
mercury) QC limits?	x			
Were the low level standard checks within 70-				
130%?	1		x	
Were all initial calibration correlation		† <u> </u>		
coefficients within limits as specifed by the				
method?	Х	l	İ	
IV. Blanks				
Was a method blank associated with every				
sample in this SDG?	x	ł		
Was there contamination in the method				
blanks?		Х		
Was there contamination in the initial and				
continuing calibration blanks?		х		
V. Interference Check Sample				
Were the interference check samples		Į.		
performed daily?		ļ	Х	
Were the AB solution recoveries within 80-		Ī		
120%?	<u> </u>	<u> </u>	X	
VI. Matrix Spike/Matrix Spike Duplicates/Labo	ratory	Dup	licates	
Were MS/MSD recoveries with the QC limits?				
(If the sample concentration exceeded the				
spike concentration by a factor of 4, no action				
was taken.)	<u> X</u>	 	-	
Were the MS/MSD or laboratory duplicate				
relative percent differences (RPDs) within the		1		
QC limits?	X	<u> </u>		
VII. Laboratory Control Samples	Tv	1		<u> </u>
Was a LCS analyzed for each batch in the SDG?	X	┼	-	
Were the LCS recoveries and RPDs (if				
lapplicable) within QC limits?	IX	1	1	

METHOD: Trace Metals (EPA SW 846 Methods	6010/	6020/	7000)	
Validation Area	Yes	No	NA	Comments
VIII. Internal Standards				
Were all percent recoveries within the 30-120%		1		
(60-125% for EPA Method 200.8) QC limits?			x	
If the recoveries were outside the limits, was a				
reanalysis performed?			x	
IX. Serial Dilution				
Were all percent differences <10%?			Х	
Was there evidence of negative interference?				
If yes, professional judgement will be used to				
qualify the data.			x	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect				
sample dilutions?	X			
Were all soil samples dry weight corrected?	Х			
XI. Overall Assessment of Data				
Was the overall assessment of the data found				
to be acceptable?	Х			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?	X			
Were target analytes detected in the field				
duplicates?	Χ			
XIII. Field Blanks				
Were field blanks identified in this SDG?		Х		
Were target analytes detected in the field				
blanks?			Х	

ICP-MS

CVAA

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 11, 12	Hg
·	
	
	Analysis Method
ICD	Allalysis Mctilou

As, Cd, Cr, Cu, Pb, Ag, Zn

Hg

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

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

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualific ation	Det/ND
LDW20-IT258MS/MSD	s	Zn	55.7		75-125			All	J/UJ/A	Det
(SDG: 20F0233)										
		1	 			 			 	
		 							<u> </u>	
			 			+	 			
						<u> </u>				<u> </u>
			 			-	 		 	
	-	 				+	<u> </u>			<u> </u>
						+	<u> </u>			
						+				
						 				
	+	 				+	+	 	+	
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	ļ					 		ļ		

Comments:

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

Method: Metals

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

Page 1 of 1

Reviewer:CR

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

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

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

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

Reviewer:CR

VALIDATION FINDINGS CHECKLIST Quality Control Sample Recalculations

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

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

 $%R = (Found/True) \times 100$

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

True = concentration of each analyte in the source

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

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

S = Original sample concentration

D = Duplicate sample concentration

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

 $%D = (Absolute value (I - SDR)) \times 100 / (I)$

I = Initial sample result

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

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

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

Analytes were recalculated and verified using the following equation:

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

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0235

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

Introduction

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

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

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

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

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

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

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

	Concen		
Analyte	LDW20-SS151	LDW20-SS151-FD	RPD
Total solids	38.60	38.78	0
Total organic carbon	3.15	3.06	3

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765D6

SDG #: 20F0235

Stage 2B

Laboratory: Analytical Resources, Inc.

Reviewer: 4 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	1 A	
Ш	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	5	
V	Field blanks	\mathcal{N}_{\perp}	
VI.	Matrix Spike/Matrix Spike Duplicates	APS	ms (20F0233)
VII.	Duplicate sample analysis	A_	OP L
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(4,5)
X.	Sample result verification	N	,)
XI	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

Matrix Date **Client ID** Lab ID LDW20-SS253 20F0235-01 Sediment 06/12/20 LDW20-SS248 20F0235-02 Sediment 06/12/20 3 LDW20-SS272 20F0235-03 Sediment 06/12/20 LDW20-SS151 20F0235-04 Sediment 06/12/20 20F0235-05 Sediment 06/12/20 LDW20-SS151-FD 6 LDW20-SS150 20F0235-06 Sediment 06/12/20 LDW20-SS155 20F0235-07 Sediment 06/12/20 20F0235-08 Sediment 06/12/20 LDW20-SS156 LDW20-SS162 20F0235-09 Sediment 06/12/20 20F0235-10 Sediment 10 LDW20-SS166 06/12/20 11 12 13 14

Notes:	 	 	

LDC #: 48765D6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 10	Total solids, TOC
	·

LDC #: 48765D6

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

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: All

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

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised at 53

LDC #: 48765D6

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

	Concent	RPD	
Analyte	4	5	
Total solids	38.60	38.78	0
TOC	3.15	3.06	3

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 7.8°C and 8.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0816-SRM1	Acenaphthene Anthracene	47.3 (52-148) 46.4 (57-143)	All samples in SDG 20F0288	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

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

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

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

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

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

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

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0288

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

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

No Sample Data Qualified in this SDG

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

No Sample Data Qualified in this SDG

LDC #: 48765E2a VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0288

Stage 2B

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
l.	Sample receipt/Technical holding times	A	Temp @ 7.8-8.60c- same down
11.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	DA	RSD < 20%. Y 104 < 30%
IV.	Continuing calibration	\triangleleft	ec/s and
V.	Laboratory Blanks	A	201
VI.	Field blanks	\mathcal{N}	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples /===M	X/W	109
X.	Field duplicates	W	D=3+5
XI.	Internal standards	4	
XII.	Compound quantitation RL/LOQ/LODs	N _	
XIII.	Target compound identification	N	
XIV.	System performance	N,	
XV.	Overall assessment of data	4	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349 🕭	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD 7	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
10	LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
11				
12				
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14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

VILITIOD. GC/IVIS SVOA				
A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	l1.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: _	
Reviewer:	9
2nd Reviewer:	4

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

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

Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	Les BRM %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		B4F0876-FRM/	44	47.3 (52-148)	()	()	All (detS+ND)	VALAS
			VV	46.4 57-143	()	()		
				()	()	()		
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LDC#: 48765E2a

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

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

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

Were field duplicate pairs identified in this SDG?

NA

Were target analytes detected in the field duplicate pairs?

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

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

Introduction

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

The analyses were performed by the following method:

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

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

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

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 7.8°C and 8.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0288	J (all detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

Date	Compound	%D	Associated Samples	Flag	A or P
07/03/20	Pentachlorophenol	30.9	All samples in SDG 20F0288	J (all detects) UJ (all non-detects)	А

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0816-SRM2	2,4-Dimethylphenol	35.0 (40-160)	All samples in SDG 20F0288	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC349 LDW20-SC349FD		RPD
1,4-Dichlorobenzene	1.4	1.4	0
Benzyl alcohol	51.8	45.6	13
Benzoic acid	71.7	43.5	49
2,4-Dimethylphenol	2.4	2.2	9
N-Nitrosodiphenylamine	3.7	3.3	11
Pentachlorophenol	2.4	2.0U	Not calculable

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0288

Sample	Compound	Flag	A or P	Reason
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC210B	N-Nitrosodiphenylamine	J (all detects)	А	Initial calibration verification (%D)
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	Pentachlorophenol	J (all detects) UJ (all non-detects)	А	Continuing calibration (%D)
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC204B	2,4-Dimethylphenol	J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765E2b

Stage 2B

SDG #: 20F0288 Laboratory: Analytical Resources, Inc.

Reviewer 2nd Reviewer

SVOAS

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A	Temp @ 7.8-860C - Sand deel
II.	GC/MS Instrument performance check	Å	
III.	Initial calibration/ICV	A farl	RS0 = 270. Y 10/= 30/0
IV.	Continuing calibration	av	RS0 = 270. Y = 101 = 2070
V.	Laboratory Blanks	A	
VI.	Field blanks	N.	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	4	
IX.	Laboratory control samples	A KW	LCS
X.	Field duplicates	W	X-3+5
XI.	Internal standards	-A_	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
10	LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
11				
12				
13				-
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

WILTHOD, GC/MS SVOA	_=_			
A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	11.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	01.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

LDC #: 4876500

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page: ___of ___ Reviewer: _____ 2nd Reviewer: _____

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y(D) N/A	Were all	%D within	the validation	criteria o	of ≤30 %D 1
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#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 30.0%)	Associated Samples	Qualifications
	426/20	51F0395-50V1	O.D.	657	All (dola)	1/H/A
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VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page: / of / Reviewer: 2nd Reviewer: 7

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y(N) Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/2/20	NT14200707045		30.9		All (dots+NB)	VUIA
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VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Samples (LCS)</u>

Page: _	_ _ _of_	_
Reviewer:	a	
2nd Reviewer:	4	

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	ECS SKY %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BA-0816-5-RM>	0	350 401B)	()	()	All Idets+NO)	7/11/26
		7		()	()	()		7.59
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LDC#: 48765E2b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1 of 1 Reviewer: PG 2nd Reviewer:__

METHOD: GCMS SVOA (EPA SW 846 Method 8270E-SIM)
YN NA
Were field duplicate pairs identified in this SDG? Y N NA YN NA

Were target analytes detected in the field duplicate pairs?

	Concentra		
Compound	3	5	RPD
E	1.4	1.4	0
QQQ	51.8	45.6	13
PPP	71.7	43.5	49
О	2.4	2.2	9
QQ	3.7	3.3	11
ТТ	2.4	20.0U	NC

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765E2b windward duwamish.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC345MS	20F0288-04MS	Sediment	06/15/20
LDW20-SC345MSD	20F0288-04MSD	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 7.8°C and 8.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

SDG i	#:48765E3a VAL #:20F0288 atory:_Analytical Resources, Inc				Γ EN e 2E		S WORKSHEET	-		Date: 8/13/ Page: //of / Reviewer: // Reviewer: //
Γhe sa	HOD: GC Hexachlorobenzene (amples listed below were review tion findings worksheets.				•	/alida	ation areas. Validati	on fi		
	Validation Area						Comn	nent		
1.	Sample receipt/Technical holding tin	nes	A	ス	eus	(v)	7.8-8.60C-			/
II.	GC Instrument Performance Check		4	,	7					
III.	Initial calibration/ICV		A/A	X	252	> <	20/0.10	V =	£20/8	
IV.	Continuing calibration		\triangleleft			<u> </u>	50%		-	
V.	Laboratory Blanks		A				1			
VI.	Field blanks		\mathcal{N}							
VII.	Surrogate spikes		Ø							
VIII.	Matrix spike/Matrix spike duplicates		A							
IX.	Laboratory control samples		A	1	a.	3				
X.	Field duplicates		NO	0	ΞΞ	3+				
XI.	Compound quantitation/RL/LOQ/LOI	Ds	N							
XII.	Target compound identification		N							
XIII.	System Performance		N.							
XIV	Overall assessment of data		A							
ote:	A = Acceptable N = Not provided/applicable SW = See worksheet	R = Rins	o compounds sate eld blank	dete	cted		D = Duplicate TB = Trip blank EB = Equipment blan	nk	SB=Sour OTHER:	
	Client ID						Lab ID		Matrix	Date
	LDW20-SC346						20F0288-03	!	Sediment	06/15/20
2 1	LDW20-SC345						20F0288-04		Sediment	06/15/20
	LDW20-SC349						20F0288-05	Ş	Sediment	06/15/20
	LDW20-SC351						20F0288-08		Sediment	06/15/20
	LDW20-SC349FD						20F0288-09		Sediment	06/15/20
	LDW20-SC160C						20F0288-10		Sediment	06/15/20
	LDW20-SC210B						20F0288-11		Sediment	06/15/20
	LDW20-SC204B						20F0288-12		Sediment	06/15/20
	_DW20-SC345MS						20F0288-04MS	Ţ	Sediment	06/15/20
							20F0288-04MSD		Sediment	06/15/20
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC340	20F0288-01	Sediment	06/15/20
LDW20-SC342	20F0288-02	Sediment	06/15/20
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC348	20F0288-06	Sediment	06/15/20
LDW20-SC353	20F0288-07	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
LDW20-SC340MSD	20F0288-01MSD	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 7.8°C and 8.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0288	J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC349	LDW20-SC349FD	RPD
Aroclor-1248	33.4	36.4	9
Aroclor-1254	42.7	50.1	16
Aroclor-1260	52.2	56.6	8

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC340	Aroclor-1260	43.8	J (all detects)	А
LDW20-SC342	Aroclor-1260	45.5	J (all detects)	Α
LDW20-SC346	Aroclor-1260	48.1	J (all detects)	Α
LDW20-SC345	Aroclor-1248 Aroclor-1260	41.3 46.5	J (all detects) J (all detects)	А
LDW20-SC349	Aroclor-1260	50.1	J (all detects)	А

Sample	Compound	RPD	Flag	A or P
LDW20-SC348	Aroclor-1260	48.2	J (all detects)	А
LDW20-SC353	Aroclor-1260	47.1	J (all detects)	А
LDW20-SC351	Aroclor-1248 Aroclor-1260	42.8 45.7	J (all detects) J (all detects)	А
LDW20-SC349FD	Aroclor-1248 Aroclor-1260	43.9 48.5	J (all detects) J (all detects)	А
LDW20-SC160C	Aroclor-1248 Aroclor-1260	46 44.1	J (all detects) J (all detects)	А
LDW20-SC204B	Aroclor-1254	40.3	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and RPD between two columns, data were qualified as estimated in twelve samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0288

				_
Sample	Compound	Flag	A or P	Reason
LDW20-SC340 LDW20-SC342 LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC353 LDW20-SC351 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC210B	Aroclor-1260	J (all detects)	А	Initial calibration verification (%D)
LDW20-SC340 LDW20-SC342 LDW20-SC346 LDW20-SC349 LDW20-SC348 LDW20-SC353	Aroclor-1260	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC345 LDW20-SC351 LDW20-SC349FD LDW20-SC160C	Aroclor-1248 Aroclor-1260	J (all detects) J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SC204B	Aroclor-1254	J (all detects)	А	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

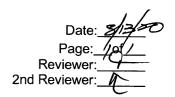
VALIDATION COMPLETENESS WORKSHEET

LDC #: 48765E3b SDG #: 20F0288

Stage 2B

Laboratory: Analytical Resources, Inc.

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	Treep @ 7.8-8.60e - save day
II.	Initial calibration/ICV	A LOW	pto = 20/0. CV= 20/0
III.	Continuing calibration	$\leq \Delta$	\$50 = 20/0. CV = 20/0 /
IV.	Laboratory Blanks	A	/ '
V.	Field blanks	λ	
VI.	Surrogate spikes / エラ	A/A	IS out on 20 No USALTS NE ated.
VII.	Matrix spike/Matrix spike duplicates	*	/
VIII.	Laboratory control samples /==RM	A/A	Lado
IX.	Field duplicates	/w/	5=5+9
X.	Compound quantitation/RL/LOQ/LODs	ŹN	,
XI.	Target compound identification	N	
XII	Overall assessment of data	A	

Note:

A = Acceptable N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC340	20F0288-01	Sediment	06/15/20
2	LDW20-SC342	20F0288-02	Sediment	06/15/20
3	LDW20-SC346	20F0288-03	Sediment	06/15/20
4	LDW20-SC345	20F0288-04	Sediment	06/15/20
5	LDW20-SC349 D	20F0288-05	Sediment	06/15/20
6	LDW20-SC348	20F0288-06	Sediment	06/15/20
7	LDW20-SC353	20F0288-07	Sediment	06/15/20
8	LDW20-SC351	20F0288-08	Sediment	06/15/20
9	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
10	LDW20-SC160C	20F0288-10	Sediment	06/15/20
11	LDW20-SC210B	20F0288-11	Sediment	06/15/20
12	LDW20-SC204B	20F0288-12	Sediment	06/15/20
13	LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
14	LDW20-SC340MSD	20F0288-01MSD	Sediment	06/15/20
15				
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

Notes:

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	of
Reviewer:	9
2nd Reviewer:_	9

LDC #48765236

METHOD: V GC _ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? ___%D or ___%R

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 FIGUS 6-501	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	7/2/20	\$150056-5011	10	BB	21.8	Associated Samples All (Lacts)	1/4/2
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LDC#: 48765E3b

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	<u>1</u> _of_	<u>1</u>
Reviewer:_	PG	
2nd Reviewer:_	A	

METHOD: GC PCB (EPA SW 846 Method 8082A)

Y N NA YN NA

Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentration (ug/Kg)		
Compound	5	9	RPD
Aroclor 1248	33.4	36.4	9
Aroclor 1254	42.7	50.1	16
Aroclor 1260	52.2	56.6	8

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2020\48765E3b windward duwamish.wpd

LDC #: 48765236

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	of
Reviewer:	9_
2nd Reviewer:	X

METHOD: VGC __ HPLC

Level,IV/D Only

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	BB	/	13.8	Jots/11
	BB	2	45.5	
	部	3	48/	
	Z	4	46.5	
	BB		46.5	
	BB	5	50./	
	BB	6	48.2	
	BB	7	47.	
	Z	8	42.8	
	B		45.7	
	2	9	43.9 48.5	
	超		185	V

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: _	<u> ユofユ</u>
Reviewer:	9
2nd Reviewer:]	R

METHOD: __GC __HPLC

Level IV/D Only

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no please see findings bellow.

	If no, please see finding	s dellow.		
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Z	10	46	Jos A
	BB		46 44.1	
<u></u>				
	AA	/2	40.3	/
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 25, 2020

Parameters: Metals

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
LDW20-SC346DUP	20F0288-03DUP	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Chromium	0.17 mg/Kg	All samples in SDG 20F0212
ICB/CCB	Silver	0.026 ug/L	LDW20-SC345

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SC345	Silver	0.27 mg/Kg	0.27U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC346MS/MSD (All samples in SDG 20F0235)	Silver	55.7 (75-125)	51.1 (75-125)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-SC346DUP (All samples in SDG 20F0235)	Arsenic	32.7 (≤20)	J (all detects)	А

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Analyte	LDW20-SC349	LDW20-SC349FD	RPD
Arsenic	19.3	20.0	4
Cadmium	0.33	0.43	26

	Concentra		
Analyte	LDW20-SC349	LDW20-SC349FD	RPD
Chromium	31.8	33.7	6
Copper	72.1	72.2	0
Lead	26.1	26.6	2
Mercury	0.165	0.171	4
Silver	0.25	0.27	8
Zinc	120	121	1

XII. Internal Standards (ICP-MS)

Raw data were not reviewed for Stage 4 validation.

XIII. Sample Result Verification

All sample result verifications were acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and DUP RPD, data were qualified as estimated in nine samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0288

Sample	Analyte	Flag	A or P	Reason
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC210B LDW20-SC204B LDW20-SC346DUP	Silver	J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)
LDW20-SC346 LDW20-SC345 LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC160C LDW20-SC210B LDW20-SC210B LDW20-SC204B LDW20-SC346DUP	Arsenic	J (all detects)	А	Duplicate sample analysis (RPD)

Duwamish AOC4

Metals - Laboratory Blank Data Qualification Summary - SDG 20F0288

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SC345	Silver	0.27U mg/Kg	Α

Duwamish AOC4

Metals - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E4a	VALIDATION COMPLETENESS WORKSHEET	Date: 8/1/20
SDG #: 20F0288	Stage 4	Page: <u></u> of <u></u>
Laboratory: Analytical Resource	ces, Inc.	Reviewer:
		2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	AA	
H	ICP/MS Tune	A_	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	Д	
V	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	SW	
IX.	Serial Dilution	\mathcal{N}	
X.	Laboratory control samples	A	LS.
XI.	Field Duplicates	SW	(36)
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
XIV	Overall Assessment of Data	A	

A = Acceptable Note:

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank

D = Duplicate TB = Trip blank EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC346	20F0288-03	Sediment	06/15/20
2	LDW20-SC345	20F0288-04	Sediment	06/15/20
3	LDW20-SC349	20F0288-05	Sediment	06/15/20
4	LDW20-SC351	20F0288-08	Sediment	06/15/20
5	LDW20-SC349FD	20F0288-09	Sediment	06/15/20
6	LDW20-SC160C	20F0288-10	Sediment	06/15/20
7	LDW20-SC210B	20F0288-11	Sediment	06/15/20
8	LDW20-SC204B	20F0288-12	Sediment	06/15/20
9	LDW20-SC346MS	20F0288-03MS	Sediment	06/15/20
10	LDW20-SC346MSD	20F0288-03MSD	Sediment	06/15/20
11	LDW20-SC346DUP	20F0288-03DUP	Sediment	06/15/20
12				
13				
14				

14		<u> </u>	<u> </u>
Votes	s:		

METHOD: Trace Metals (EPA SW 846 Methods	6010/	6020/	7000)	
Validation Area	Yes	No	NA	Comments
I. Technical holding times				
Were all technical holding times met?	Х			
Were all water samples preserved to a pH of				
<2.			X	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all				
isotopes in the tuning solution?	x			
Were %RSDs of isoptoes in the tuning solution				
≤5%?	х		ļ	
III. Calibration				
Were all instuments calibrated daily?	X			T
Were the proper standards used?	Х			
Were all initial and continuing calibration				
verifications within the 90-110% (80-120% for		Ì		
mercury) QC limits?	X			
Were the low level standard checks within 70-		1		
130%?			Х	
Were all initial calibration correlation				
coefficients within limits as specifed by the]		
method?	X			
IV. Blanks				
Was a method blank associated with every				
sample in this SDG?	x			
Was there contamination in the method				
blanks?	x			
Was there contamination in the initial and				
continuing calibration blanks?	Х			
V. Interference Check Sample				
Were the interference check samples				
performed daily?	X			
Were the AB solution recoveries within 80-				
120%?	<u>X</u>			
VI. Matrix Spike/Matrix Spike Duplicates/Labo	ratory	/ Dupl	icates	.
Were MS/MSD recoveries with the QC limits?				
(If the sample concentration exceeded the				
spike concentration by a factor of 4, no action	1			
was taken.)		Х		
Were the MS/MSD or laboratory duplicate	1			
relative percent differences (RPDs) within the		ł		
QC limits?		Х	<u></u>	
VII. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	Χ			·
Were the LCS recoveries and RPDs (if				
applicable) within QC limits?	x	1		

METHOD: Trace Metals (EPA SW 846 Methods				
Validation Area	Yes	No	NA	Comments
VIII. Internal Standards				
Were all percent recoveries within the 30-120%	ŀ		İ	
(60-125% for EPA Method 200.8) QC limits?	X			
If the recoveries were outside the limits, was a				
reanalysis performed?			Χ	
IX. Serial Dilution				
Were all percent differences <10%?			Х	
Was there evidence of negative interference?				
If yes, professional judgement will be used to		Ĭ		
qualify the data.			x	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect				
sample dilutions?	Χ			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found				***
to be acceptable?	X			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?	X			
Were target analytes detected in the field	ļ			
duplicates?	x	<u> </u>		
XIII. Field Blanks		.,		
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field				
blanks?			х	

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 8	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 9-11	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP		
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn	
CVAA	Hg	

Page 1 of 1 Reviewer:CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg

Associated Samples: All

					Sample Identification						
Analyte	PB (mg/Kg)	Maximum ICB/CCB (ug/L)	Action Level	No qualifier	s						
Cr	0.17										

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 2

					Sample Identification							
Analyte	PB (mg/Kg)	Maximum ICB/CCB (ug/L)	Action Level	2								
Ag		0.026		0.27								

Comments: The listed analyte concentration 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.

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			MSD %R	RPD	RPD Limit	Associated Samples	Qualification	Det/ND
9, 10	S	Ag	55.7	51.1			All	J/UJ/A	Det
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Comments:

VALIDATION FINDINGS WORKSHEETS <u>Laboratory Duplicates</u>

Page 1 of 1 Reviewer: CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Laboratory duplicate analysis was performed by the laboratory. All laboratory duplicates were with the relative percent difference (RPD) for samples >5X the reporting limits with the exceptions listed below. If samples were <5X the reporting limits, the difference was within 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

		Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Associated Samples	Qualification	Det/ND
11	s	As	32.7	20			All	J/UJ/A	Det
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Comments:

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

Method: Metals

	Concentrat	RPD	
Analyte	3	5	
Arsenic	19.3	20.0	4
Cadmium	0.33	0.43	26
Chromium	31.8	33.7	6
Copper	72.1	72.2	0
Lead	26.1	26.6	2
Mercury	0.165	0.171	4
Silver	0.25	0.27	8
Zinc	120	121	1

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check

sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

 $%R = (Found/True) \times 100$

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	ICP-MS	Ag	51.5	50	103	103	Υ
CCVB	ICP-MS	Cr	50.7	50	101	101	Υ
ICSAB	ICP-MS	Cd	19.29	20	96.5	96.5	Υ
ICV	CVAA	Hg	4.0515	4	101.3	101.3	Υ
CCV	CVAA	Hg	3.9381	4	98.5	98.5	Υ

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

 $%R = (Found/True) \times 100$

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

 $%D = (Absolute value (I - SDR)) \times 100 / (I)$

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

					Recalcuated	Reported	
Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	%R/RPD/%D	%R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Hg	0.499	0.5	99.8	99.8	Υ
9	MS	Ag	32.95	59.1	55.8	55.7	Υ
11	Duplicate	Cr	30.5	30.8	0.98	1.17	Υ
	PDS						
	Serial dilution						

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

								Recalcuated	
				,	Final Volume	Percent	Reported	Result	Acceptable
Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	(mL)	solids (%)	Result (mg/Kg)	(mg/Kg)	(Y/N)
1	Cr	12.873	20	1.017	50				Υ
2	Pb	8.575	20	1.073	50	37.29	21.4	21.4	Υ
3	Ag	0.109	20	1.086	50	40.38	0.25	0.25	Υ
4	As	8.6	20	1.047	50	40.22	20.4	20.4	Υ
5	Cd	0.173	20	1.012	50	39.39	0.43	0.43	Υ
6	Zn	49.574	20	1.063	50	60.29	77.4	77.4	Υ
7	Hg	0.3359	1	0.29	50	63.2	0.0916	0.0916	Υ
8	Hg	0.2047	1	0.209	50	63.72	0.0769	0.0769	Υ .

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC340	20F0288-01	Sediment	06/15/20
LDW20-SC342	20F0288-02	Sediment	06/15/20
LDW20-SC346	20F0288-03	Sediment	06/15/20
LDW20-SC345	20F0288-04	Sediment	06/15/20
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC348	20F0288-06	Sediment	06/15/20
LDW20-SC353	20F0288-07	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC160C	20F0288-10	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20
LDW20-SC204B	20F0288-12	Sediment	06/15/20
LDW20-SC340MS	20F0288-01MS	Sediment	06/15/20
LDW20-SC340DUP	20F0288-01DUP	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0288

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concent		
Analyte	LDW20-SC349	LDW20-SC349FD	RPD
Total solids	40.38	39.39	2
Total organic carbon	3.82	3.70	3

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

LDC #: 48765E6 VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0288 Laboratory: Analytical Resources, Inc.

Stage 2B

Reviewer:_ 2nd Reviewer:_

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	AIA	
11	Initial calibration	Δ	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	\mathcal{N}	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LES ~
IX.	Field duplicates	SW	(5,9)
X.	Sample result verification	Ŋ	J • /
ΧI	Overall assessment of data		

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

Client ID Lab ID Matrix Date LDW20-SC340 20F0288-01 Sediment 06/15/20 2 LDW20-SC342 20F0288-02 Sediment 06/15/20 LDW20-SC346 20F0288-03 Sediment 06/15/20 Sediment LDW20-SC345 20F0288-04 06/15/20 5 LDW20-SC349 20F0288-05 Sediment 06/15/20 20F0288-06 Sediment 6 LDW20-SC348 06/15/20 LDW20-SC353 20F0288-07 Sediment 06/15/20 8 LDW20-SC351 20F0288-08 Sediment 06/15/20 20F0288-09 Sediment 9 LDW20-SC349FD 06/15/20 LDW20-SC160C 20F0288-10 Sediment 06/15/20 10 11 LDW20-SC210B 20F0288-11 Sediment 06/15/20 20F0288-12 12 LDW20-SC204B Sediment 06/15/20 13 LDW20-SC340MS 20F0288-01MS Sediment 06/15/20 06/15/20 20F0288-01DUP Sediment 14 LDW20-SC340DUP

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID 1 to 10 Z	Target Analyte List
1 to 10 2	Total solids
1-6, 8-12-1-12	ТОС
QC: 13, 14	TOC

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (P3/ICB/CCB)</u>

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: All

					Sam	ple Identific	ation			
Analyte	PB (units)	Maximum ICB/CCB (%)	Action Level	No qualifier	·s					
TOC		0.02	0.2							

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised at 5%

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

	Concent	RPD	
Analyte	5	9	
Total solids	40.38	39.39	2
TOC	3.82	3.70	3

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Polychlorinated Dioxins/Dibenzofurans

Validation Level:

Stage 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0288

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC349	20F0288-05	Sediment	06/15/20
LDW20-SC351	20F0288-08	Sediment	06/15/20
LDW20-SC349FD	20F0288-09	Sediment	06/15/20
LDW20-SC210B	20F0288-11	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 7.8°C and 8.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0288

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

Samples LDW20-SC349 and LDW20-SC349FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentra		
Compound	LDW20-SC349	LDW20-SC349FD	RPD
2,3,7,8-TCDF	0.942	0.844	11
2,3,7,8-TCDD	0.997U	0.619	Not calculable
1,2,3,7,8-PeCDF	0.619	0.585	6

	Concentr				
Compound	LDW20-SC349	LDW20-SC349FD	RPD		
2,3,4,7,8-PeCDF	1.17	1.15	2		
1,2,3,7,8-PeCDD	1.35	1.14	17		
1,2,3,4,7,8-HxCDF	3.44	3.62	5		
1,2,3,6,7,8-HxCDF	1.34	1.28	5		
2,3,4,6,7,8-HxCDF	1.76	1.82	3		
1,2,3,7,8,9-HxCDF	0.760	0.699	8		
1,2,3,4,7,8-HxCDD	2.00	1.62	21		
1,2,3,6,7,8-HxCDD	6.09	5.64	8		
1,2,3,7,8,9-HxCDD	5.18	3.65	35		
1,2,3,4,6,7,8-HpCDF	32.9	32.4	2		
1,2,3,4,7,8,9-HpCDF	2.34	2.61	11		
1,2,3,4,6,7,8-HpCDD	224	234	4		
OCDF	128	116	10		
OCDD	2010	1930	4		
Total TCDF	11.9	3.04	119		
Total TCDD	1.43	1.04	32		
Total PeCDF	10.5	9.93	6		
Total PeCDD	3.46	0.676	135		
Total HxCDF	45.3	44.5	2		
Total HxCDD	62.0	63.1	2		
Total HpCDF	124	125	1		
Total HpCDD	697	850	20		

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Flag	A or P	
All samples in SDG 20F0288	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А
All samples in SDG 20F0288	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	А
LDW20-SC349FD	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to compounds reported as EMPC and CDPE interference, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0288

Sample	Compound	Flag	A or P	Reason
LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC210B	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А	Compound quantitation (EMPC)
LDW20-SC349 LDW20-SC351 LDW20-SC349FD LDW20-SC210B All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.		U (all non-detects)	А	Compound quantitation (EMPC)
LDW20-SC349FD	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А	Compound quantitation (CDPE interference)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0288

No Sample Data Qualified in this SDG

SDG # _abora	#:48765E21 VALIDATIO #:20F0288 atory:_Analytical Resources, Inc.	;	Stage 4	S WORKSHEET Method 1613B)		Date: 2/4/ Page:/of Reviewer: Reviewer:
	amples listed below were reviewed for eation findings worksheets.	ach of the f	ollowing valida	ition areas. Validatio	on findings are	noted in attache
	Validation Area	<u> </u>		Comm	ents	-
1.	Sample receipt/Technical holding times	A	Tax 7	18-8.60	- Saup	Say
11.	HRGC/HRMS Instrument performance check	A	/			<u> </u>
III.	Initial calibration/ICV	AA	RS0 <	20/35/0.	10V=	Relinit
IV.	Continuing calibration	A	COV <	Relimit	<u></u>	
V.	Laboratory Blanks	W				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates	N	<u>es</u>			
VIII.	Laboratory control samples	1-A	100			
IX.	Field duplicates	W	D=1+=	3		
Χ.	Labeled Compounds	A				
XI.	Compound quantitation RL/LOQ/LODs	W				
XII.	Target compound identification	4				
XIII.	System performance	A				
XIV.	Overall assessment of data	A				
lote:	N = Not provided/applicable R = Ri	No compounds nsate Field blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blan	SB=Sour OTHER: k	ce blank
	Client ID			Lab ID	Matrix	Date
1 L	_DW20-SC349			20F0288-05	Sediment	06/15/20
2 L	_DW20-SC351			20F0288-08	Sediment	06/15/20
3 L	LDW20-SC349FD			20F0288-09	Sediment	06/15/20
4 L	_DW20-SC210B			20F0288-11	Sediment	06/15/20
5						
6						
7						
8						
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10						
otes:						



VALIDATION FINDINGS CHECKLIST

Page: /of > Reviewer: / 2nd Reviewer: / A

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times		100 (100 (100 (100 (100 (100 (100 (100		
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?				
Illa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?				
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled compounds and \leq 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 \geq 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?			<u> </u>	
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?		<u> </u>		
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?			1	
Were target compounds detected in the field blanks?				
VII. Matrix spike/Matrix spike duplicates			بىيىلى ئازىرى	
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?			F	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				



VALIDATION FINDINGS CHECKLIST

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples			e i Politi Na S	
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?		D		
Were target compounds detected in the field duplicates?				
X. Labeled Compounds		2.5		
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?	1			
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?	0	/		
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	/		<u> </u>	
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 \pm 2 seconds (includes labeled standards)?	/			
For PCDF identification, was any signal (S/N \geq 2.5, at \pm 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:

VALIDATION FINDINGS WOR/UHEET Blanks

Page:	<u>1 of 1</u>
Reviewer:_	PG
2nd Reviewer:_	4

METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

Blank extraction date: 6/29/20 Blank analysis date: 7/2/20

Conc. units: ng/kg Associated samples: All qual U

Cono. anto. ng/	¥ =					1330Clated						
Compound	Blank ID		Sample Identification									
	BIF0780-BLK1	5X										
0	0.0726	0.363										
F	0.220	1.1										
Q	0.477	2.385										
G	1.66	8.3										
	!											
						<u></u>			 	<u></u>		
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VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: 1

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

YNNA Were field duplicate pairs identified in this SDG?

YNNA Were target analytes detected in the field duplicate pairs?

	Concentrat	tion (ng/Kg)	000	
Compound	1	3	RPD	
Н	0.942	0.844	11	
Α	0.997U	0.619	NC	
1	0.619	0.585	6	
J	1.17	1.15	2	
В	1.35	1.14	17	
К	3.44	3.62	5	
L	1.34	1.28	5	
М	1.76	1.82	3	
N	0.760	0.699	8	
С	2.00	1.62	21	
D	6.09	5.64	8	
E	5.18	3.65	35	
0	32.9	32.4	2	
Р	2.34	2.61	11	
F	224	234	4	
Q	128	116	10	
G	2010	1930	4	
V	11.9	3.04	119	
R	1.43	1.04	32	
w	10.5	9.93	6	
S	3.46	0.676	135	
Х	45.3	44.5	2	
Т	62.0	63.1	2	
Υ	124	125	1	
U	697	850	20	

LDC #. 48/652

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported RLs

Page: _	
Reviewer:	9
2nd Reviewer:	1

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

Please see qualifications below for a	ll questions answered "N".	Not applicable questions	are identified as "N/A".
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TY	N	N/A
\bigcirc	N	N/A

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All			Jdets/A
			All results flagged as EMPC > *<-		u/A
					/
		AH 3	All results flagged "X" by the lab due to chlorinated		Jdets/A
 		· · · · · · · · · · · · · · · · · · ·	diphenyl ether (CDPE) interference		
				<u></u>	
<u> </u>					
		L			

Comments:	See sample calculation verification worksheet for recalculations

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page:_	_1_of_1_
Reviewer:	PG
2nd Reviewer:	
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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

				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Average RRF (initial)	RRF (10 std)	RRF (10 std)	%RSD	%RSD
1	ICAL	7/1/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.8223	0.8117684	0.8117	6.7	6.7
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2310	1.212577	1.2125	11.4	11.4
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9576	1.02541	1.0254	10.8	10.8
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1246	1.193104	1.1930	12.3	12.3
			OCDF (13C-OCDF)	1.392	1.3922	1.362751	1.3628	8.0	8.0
2			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
			OCDF (13C-OCDF)						
3			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
			OCDF (13C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated
results.

LDC #: 48765E21

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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Reviewer:	PG	
2nd Reviewer:_	Q	
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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

Where: ave. RRF = initial calibration average RRF

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

RRF = continuing calibration RRF

 A_{ν} = Area of compound,

C, = Concentration of compound,

 A_{is} = Area of associated internal standard C_{is} = Concentration of internal standard

					Reported	Recalculated	Reported	Recalculated
#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Conc (CC)	Conc (CC)	%D	%D
1	20070202	7/2/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.7756249	0.7756	5.7	5.7
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2109160	1.2109	1.6	1.7
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9764576	0.9764	2.0	2.0
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1701800	1.1701	4.1	4.0
			OCDF (13C-OCDF)	1.392	1.3030900	1.3030	6.4	6.4
2	20070215	7/2/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.8055136	0.8055	2.0	2.0
	_		2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2570670	1.2570	2.1	2.2
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9913691	0.9913	3.5	3.5
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1863840	1.1864	5.5	5.5
			OCDF (13C-OCDF)	1.392	1.2640570	1.2644	9.2	9.2
3			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)					
			OCDF (13C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 48765E21

VALIDATION FINDINGS WORKSHEET <u>Laboratory Control Sample Results Verification</u>

Page:	<u>1</u> 0f <u>1</u>
Reviewer:	PG
2nd Reviewer:	M

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration

SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

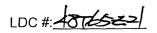
LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

	Spike Added		Spiked Sample Concentration		LCS		LCSD		I CS/I CSD	
Compound		g/kg)	Concen (ng/l		Percent Recovery		Percent Recovery		RPD	
	cs	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	20.0	NA	19.97	NA	99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105				
OCDF	200		182.39		91.2	91.2				
							.1			
<u> </u>									}	

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% or	<u>f the</u>
recalculated results.	



VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page: <u>/</u> of_/	
Reviewer:	
2nd reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Y N N/A	Were all reported results recalculated and verified for all level IV samples?
Y N N/A	Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concen	tration	$n = \frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$	Example:
A _x	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D;
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard	
ls	=	Amount of internal standard added in nanograms (ng)	Conc. = (6.769.05) (2000) (1) (5.3185) (1.125) (25.11) (25.14)
Vo	=	Volume or weight of sample extract in milliliters (ml) or grams (g).	
RRF	=	Relative Response Factor (average) from the initial calibration	= 223.6 AB/Kg
Df	=	Dilution Factor.	
%S	=	Percent solids, applicable to soil and solid matrices only.	

#	Sample ID	Compound	Reported Concentration	Calculated Concentration ()	Qualification
		†	234		
-					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for all samples in this SDG were reported between 7.3°C and 9.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F2a **VAI**

SDG #: 20F0293

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Laboratory: Analytical Resources, Inc.

Page: /of / 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	A	Texp @ 7.3-9.60C - some lay
11.	GC/MS Instrument performance check	- A	/
III.	Initial calibration/ICV	ALA	\$50=2070. Y2 QV = 3070
IV.	Continuing calibration	4	ecv ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	\triangleleft	
VIII.	Matrix spike/Matrix spike duplicates	N.	
IX.	Laboratory control samples / 5RM	AA	605
X.	Field duplicates	N_	
XI.	Internal standards	\triangle	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N,	
XV.	Overall assessment of data	\triangle	

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:

ļ	Client ID	Lab ID	Matrix	Date
1	LDW20-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7_	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
14	LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 7.3°C and 9.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	41.9	All samples in SDG 20F0293	J (all detects) UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples	
BIF0847-BLK2	06/29/20	Benzoic acid	17.3 ug/Kg	All samples in SDG 20F0293	

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SS215	Benzoic acid	50.6 ug/Kg	50.6U ug/Kg
LDW20-SS212	Benzoic acid	70.0 ug/Kg	70.0U ug/Kg
LDW20-SS202	Benzoic acid	28.5 ug/Kg	28.5U ug/Kg
LDW20-SS341	Benzoic acid	48.6 ug/Kg	48.6U ug/Kg
LDW20-SS217	Benzoic acid	21.4 ug/Kg	21.4U ug/Kg
LDW20-SS219	Benzoic acid	32.9 ug/Kg	32.9U ug/Kg
LDW20-SS220	Benzoic acid	24.4 ug/Kg	24.4U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, data were qualified as estimated in twelve samples.

Due to laboratory blank contamination, data were qualified as not detected in seven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0293

Sample	Compound	Flag	A or P	Reason
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS219 LDW20-SS220	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0293

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS215	Benzoic acid	50.6U ug/Kg	Α
LDW20-SS212	Benzoic acid	70.0U ug/Kg	Α
LDW20-SS202	Benzoic acid	28.5U ug/Kg	Α
LDW20-SS341	Benzoic acid	48.6U ug/Kg	А
LDW20-SS217	Benzoic acid	21.4U ug/Kg	Α
LDW20-SS219	Benzoic acid	32.9U ug/Kg	A
LDW20-SS220	Benzoic acid	24.4U ug/Kg	Α

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765F2b SDG #: 20F0293

Stage 2B

Reviewer: 2nd Reviewer:

Laboratory: Analytical Resources, Inc.

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	4	Trans @ 7.38.9.60c - same day
11.	GC/MS Instrument performance check	A	' / /
111.	Initial calibration/ICV	A mi	RSD < 20/0. Y2 ICV < 30/0
IV.	Continuing calibration	\rightarrow	and = 20/0
V.	Laboratory Blanks	W	2
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	AA	109
X.	Field duplicates	\mathcal{N}_{\perp}	
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	\triangleleft	

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

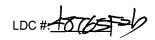
SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
14	LDW20-SS215MSD	20F0293-01MSD	Sediment	06/15/20

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine



VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page: /of / Reviewer: 2 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".

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y/ N/N/A Were all %D within the validation criteria of ≤20 %D?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Associated Samples	Qualifications
	6/20	SH0393-50/1	BB	41.9	All Ides +NO)	JAJA
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VALIDATION FINDINGS WORKSHEET **Blanks**

2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a method blank analyzed for each matrix?

N N/A Was a method blank analyzed for each concentration preparation level?

Was a method blank associated with every sample? ry N N/A

Was the blank contaminated? If yes, please see qualification below.

Blank extraction date:______ Blank analysis date:_____

Blank extraction date: Blank analysis date: 7/7/20 Conc. units: MSA'S

oone. units. Fee (5				ted Gamples.		DII				
Compound	Blank ID				s	ample Identifica	ition			
	F0 84T-B4	(ع	1	3	4	6	10	[]	1-2	
Bis(2-ethylhexyl)phthalate	<u> </u>							: 1		
 	17.3		50.6/u	TO. /U	28.5/u	18.5U	214/4	329/U	24.4/U	

Conc. units: Associated Samples:										
Compound	Blank ID		Sample Identification							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 7.3°C and 9.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Column	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
LDW20-SS217	1C	Decachlorobiphenyl	164 (30-160)	Hexachlorobenzene	NA	-

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F3a VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0293 Stage 2B

Laboratory: Analytical Resources, Inc.

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
l.	Sample receipt/Technical holding times	A	TOUT @ 7.3-960- same day
II.	GC Instrument Performance Check	A	
III	Initial calibration/ICV	AA	\$50 < 20%. c/ = 20%
IV.	Continuing calibration	' ♣	ecv=20/0
V.	Laboratory Blanks	A	· ·
VI.	Field blanks	N	
VII.	Surrogate spikes /	WA	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	105/0
X.	Field duplicates	KI	,
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:

		<u></u>		
	Client ID	Lab ID	Matrix	Date
1	LDW20-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
14	LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20
15				



VALIDATION FINDINGS WORKSHEET Surrogate Recovery

Page:_	<u></u>
Reviewer:_	9
2nd Reviewer:	7

N	METHOD:	GC HPLC
		es required by the method? Yes or No
F	Jease see q	ualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
<u>N</u>	N/A	Were surrogates spiked into all samples and blanks?
<u> </u>	N/N/A	ualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Were surrogates spiked into all samples and blanks? Did all surrogate recoveries (%R) meet the QC limits?
F		

#_	Sample ID	Detector/ Column	Surrogate Compound	%R (Lim		Qualifications
	10 (NB)	10	0	164	(30-160)	1030
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	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
Α	Chlorobenzene (CBZ)	G	Octacosane	М	Benzo(e)Pyrene	s	1-Chloro-3-Nitrobenzene	Υ	Tetrachioro-m- xylene
В	4-Bromofluorobenzene (BFB)	Н	Ortho-Terphenyl	N	Terphenyl-D14	Т	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
С	a,a,a-Trifluorotoluene		Fluorobenzene (FBZ)	0	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	У	Tri-n-propyltin	<u> </u>	
E	1,4-Dichlorobutane	к	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	w	Tributyl Phosphate		
F	1.4-Difluorobenzene (DFB)	<u> </u>	Bromobenzene	R	4-Nitrophenol	х	Triphenvl Phosphate		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 7.3°C and 9.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0293	J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/04/20	20070427ECD7	2C	Aroclor-1254	21.8	LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	J (all detects)	A

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS215	Aroclor-1260	45.8	J (all detects)	А
LDW20-SS214	Aroclor-1248 Aroclor-1254 Aroclor-1260	41.9 47 43.4	J (all detects) J (all detects) J (all detects)	A
LDW20-SS341	Aroclor-1248 Aroclor-1254 Aroclor-1260	43.9 43.6 47.6	J (all detects) J (all detects) J (all detects)	А
LDW20-SS347	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.5 49.6 53.2	J (all detects) J (all detects) J (all detects)	А
LDW20-SS350	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.7 49.9 58.8	J (all detects) J (all detects) J (all detects)	А

Sample	Compound	RPD	Flag	A or P
LDW20-SS352	Aroclor-1248 Aroclor-1254 Aroclor-1260	46.3 49.4 44.2	J (all detects) J (all detects) J (all detects)	А
LDW20-SS219	Aroclor-1254	41.8	J (all detects)	Α
LDW20-SS220	Aroclor-1254	41.3	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and RPD between two columns, data were qualified as estimated in twelve samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0293

Sample	Compound	Flag	A or P	Reason
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS331 LDW20-SS347 LDW20-SS350 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS217 LDW20-SS219 LDW20-SS220	Aroclor-1260	J (all detects)	А	Initial calibration verification (%D)
LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS220	Aroclor-1254	J (all detects)	А	Continuing calibration (%D)
LDW20-SS215	Aroclor-1260	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SS214 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS352	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SS219 LDW20-SS220	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F3b VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0293

Stage 2B

Laboratory: Analytical Resources, Inc.

Page: _/_q Reviewer: ____ 2nd Reviewer: ____

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
<u>I.</u>	Sample receipt/Technical holding times	A	toug@ 7.3-960- some day RSO = 20/0. ev=20/0
11.	Initial calibration/ICV	AM	RS0 = 20/0. /eV = 20/0
111.	Continuing calibration	W	acv = 20%
IV.	Laboratory Blanks	\triangleleft	6
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A A	LCS/D
IX.	Field duplicates	Λ	/
_X.	Compound quantitation/RL/LOQ/LODs	1/N	
XI.	Target compound identification	N	
LXIL	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS214MS	20F0293-02MS	Sediment	06/15/20
14	LDW20-SS214MSD	20F0293-02MSD	Sediment	06/15/20
15				
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:/_of <u>/</u>
Reviewer:
2nd Reviewer:

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

Was an initial calibration verification standard analyzed after each ICAL for each instrument? Y/N)N/A

Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	7/2/20	Standard ID	IC.	21.8		A11 (doB)	VW/A
<u> </u>	/ /						/ /
<u> </u>							
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							1

LDC #: 181	5736	
METHOD:	/cc	HDI C

VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:_	<u></u>
Reviewer:	9
nd Reviewer:	N

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A

Were continuing calibration standards analyzed at the required frequencies?

Level IV Only

Y M(N/A)

Did the continuing calibration standards meet the %D validation criteria of ≤20.0%?

Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Data	Standard ID	Detector/ Column	C	%D	DT //::4)	A	0 115 11
#	Date	Standard ID		Compound	(Limit)	RT (limit)	Associated Samples	Qualifications
	114/20	20047500	20	// /	≥1.8	()	9-12 (dets)	MYA
	' /	,				()		/ / .
						()		
						()		
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LDC #: 487/25

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: ____of___ Reviewer: _____ 2nd Reviewer: _____

METHOD: __GC __ HPLC

Level IV/D Only
Y N M/A

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

n no, please see finding			
Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (<u>≤</u> 40%)	Qualifications
BB	/	45.8	JA A
			/
	2		
		47	
<u></u> <u></u>		434	
Z	6	43.9	
AA		43.6	
		47.6	
Z	T	42.5	
AA		49.6	
		53.2	
2	8	42.T	
A Å		49.9	/
		58.8	V
	BB Z AM BB Z AM BB Z AM BB Z AM BB	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Compound Name Sample ID Limit (< 40%) BB



VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: __of __ Reviewer: ____ 2nd Reviewer: _____

METHOD: \angle GC _ HPLC

Level IV/D Only

Y N M/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

F	If no, please see findings bellow.				
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications	
	2	9	46.3	Jobs/A	
	AA	·	49.4		
	<u> </u>		44.2		
	<u> </u>		418		
		2	41.3	\	
-					
-					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Metals

Validation Level:

Stage 2B & 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Samula Identification	Laboratory Sample Identification	Matrix	Collection
Sample Identification	identification	IVIALITIX	Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Chromium	0.17 mg/Kg	All samples in SDG 20F0212
ICB/CCB	Silver	0.047 ug/L	LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS215	Silver	0.13 mg/Kg	0.13U mg/Kg
LDW20-SS214	Silver	0.2 mg/Kg	0.2U mg/Kg

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS212	Silver	0.08 mg/Kg	0.08U mg/Kg
LDW20-SS202	Silver	0.05 mg/Kg	0.05U mg/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-SC346MS/MSD (All samples in SDG 20F0235)	Zinc	55.7 (75-125)	51.1 (75-125)	J (all detects)	Α

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW20-SC346DUP (All samples in SDG 20F0235)	Arsenic	32.7 (≤20)	J (all detects)	А

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and DUP RPD, data were qualified as estimated in twelve samples.

Due to laboratory blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0293

Sample	Analyte	Flag	A or P	Reason
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS219	Zinc	J (all detects)	А	Matrix spike/Matrix spike duplicate (%R)
LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219 LDW20-SS219	Arsenic	J (all detects)	Α	Duplicate sample analysis (RPD)

Duwamish AOC4 Metals - Laboratory Blank Data Qualification Summary - SDG 20F0293

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS215	Silver	0.13U mg/Kg	А
LDW20-SS214	Silver	0.2U mg/Kg	А
LDW20-SS212	Silver	0.08U mg/Kg	А
LDW20-SS202	Silver	0.05U mg/Kg	А

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765F4a SDG #: 20F0293

Laboratory: Analytical Resources, Inc.

Stage 2B/4

Reviewer: 2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	AA	
II.	ICP/MS Tune	A	
111.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	<i>M</i> ,	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	SW	
IX.	Serial Dilution	<i>N</i>	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	\mathcal{N}	
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	Not reviewed for 7471B validation.
XIV	Overall Assessment of Data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

vietno	ethod 6020A undwewent Stage 4 review						
	Client ID	Lab ID	Matrix	Date			
1	LDW20-SS215	20F0293-01	Sediment	06/15/20			
2	LDW20-SS214	20F0293-02	Sediment	06/15/20			
3	LDW20-SS212	20F0293-03	Sediment	06/15/20			
4	LDW20-SS202	20F0293-04	Sediment	06/15/20			
5	LDW20-SS203	20F0293-05	Sediment	06/15/20			
6	LDW20-SS341	20F0293-06	Sediment	06/15/20			
7	LDW20-SS347	20F0293-07	Sediment	06/15/20			
8	LDW20-SS350	20F0293-08	Sediment	06/15/20			
9	LDW20-SS352	20F0293-09	Sediment	06/15/20			
10	LDW20-SS217	20F0293-10	Sediment	06/15/20			
11	LDW20-SS219	20F0293-11	Sediment	06/15/20			
12	LDW20-SS220	20F0293-12	Sediment	06/15/20			
13							
14							

Notes:

METHOD: Trace Metals (EPA SW 846 Methods	6010/	6020/	7000)	
Validation Area	Yes	No	NA	Comments
I. Technical holding times				
Were all technical holding times met?	Х			
Were all water samples preserved to a pH of				
<2.			x	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all				
isotopes in the tuning solution?	x		ļ	
Were %RSDs of isoptoes in the tuning solution				
≤5%?	Х			
III. Calibration				
Were all instuments calibrated daily?	Х			
Were the proper standards used?	Х			
Were all initial and continuing calibration				
verifications within the 90-110% (80-120% for]	1	
mercury) QC limits?	Х			
Were the low level standard checks within 70-				
130%?			х	
Were all initial calibration correlation				
coefficients within limits as specifed by the		İ		
method?	X			
IV. Blanks				
Was a method blank associated with every				
sample in this SDG?	x	1.		
Was there contamination in the method				
blanks?	x			
Was there contamination in the initial and				
continuing calibration blanks?	Χ			
V. Interference Check Sample				
Were the interference check samples				
performed daily?	X	ļ		
Were the AB solution recoveries within 80-				
120%?	X	<u> </u>	<u> </u>	
VI. Matrix Spike/Matrix Spike Duplicates/Labo	ratory	Dupl	icates	Ţ
Were MS/MSD recoveries with the QC limits?				
(If the sample concentration exceeded the				
spike concentration by a factor of 4, no action				
was taken.)		Х		
Were the MS/MSD or laboratory duplicate				
relative percent differences (RPDs) within the				
QC limits?	<u> </u>	X		<u> </u>
VII. Laboratory Control Samples	T	I	1	
Was a LCS analyzed for each batch in the SDG?	Х	<u> </u>		
Were the LCS recoveries and RPDs (if				
applicable) within OC limits?	lχ		1	Ĭ

METHOD: Trace Metals (EPA SW 846 Methods	6010/	6020/	7000)	
Validation Area	Yes	No	NA	Comments
VIII. Internal Standards		-		
Were all percent recoveries within the 30-120%	6			
(60-125% for EPA Method 200.8) QC limits?	х			
If the recoveries were outside the limits, was a				
reanalysis performed?			x	
IX. Serial Dilution				
Were all percent differences <10%?			Х	
Was there evidence of negative interference?				
If yes, professional judgement will be used to				
qualify the data.			x	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect				
sample dilutions?	Х			
Were all soil samples dry weight corrected?	Х			
XI. Overall Assessment of Data				
Was the overall assessment of the data found				
to be acceptable?	Х	<u> </u>		<u> </u>
XII. Field Duplicates				
Were field duplicates identifed in this SDG?		Х		
Were target analytes detected in the field		ŀ		
duplicates?		<u> </u>	X	<u> </u>
XIII. Field Blanks				
Were field blanks identified in this SDG?		Х		
Were target analytes detected in the field				
blanks?	<u>L</u>		х	

LDC #: 48765F4a

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 12	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
· · · · · · · · · · · · · · · · · · ·	
Lon	Analysis Method
ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer:CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: All

					Sample Identification							
Analyte	PB (mg/Kg)	Maximum ICB/CCB (ug/L)	Action Level	No qualifie	rs							
Cr	0.17											

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 1-4

				Sample Identification							
Analyte	PB (mg/Kg)	Maximum ICB/CCB (ug/L)	Action Level	1	2	3	4				
Ag		0.047		0.13	0.2	0.08	0.05				

Comments: The listed analyte concentration 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:

	1							Associated	Qualificatio	
MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Samples	n	Det/ND
DW20-SC346MS/MSD	S	Ag	55.7	51.1				All	J/UJ/A	Det
SDG: 20F0288)										
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<u></u>	1		<u> </u>	J				l		

Comments:

VALIDATION FINDINGS WORKSHEETS <u>Laboratory Duplicates</u>

Page 1 of 1 Reviewer: CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Laboratory duplicate analysis was performed by the laboratory. All laboratory duplicates were with the relative percent difference (RPD) for samples >5X the reporting limits with the exceptions listed below. If samples were <5X the reporting limits, the difference was within 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte		RPD Limit	Difference (units)	Difference Limit	Associated Samples	Qualification	Det/ND
LDW20-SC346DUP	S	As	32.7	20			All	J/UJ/A	Det
(SDG: 20F0288)									
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	<u> </u>	<u> </u>							
						 			
	 		 	 		 		+	

Comments:

Page 1 of 1 Reviewer:CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	ICP-MS	Cr	50.5	50	101	101	Υ
CCV3	ICP-MS	As	50.8	50	102	102	Υ
ICSAB	ICP-MS	Zn	18.634	20	93.2	93.2	Υ

Reviewer:CR

Quality Control Sample Recalculations

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

 $%R = (Found/True) \times 100$

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

%D = (Absolute value (I - SDR)) x 100 / (I)

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

					Recalcuated	Reported	
Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	%R/RPD/%D	%R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Ag	23.2	25	92.8	92.7	Υ
	MS						
	Duplicate						
	PDS						
	Serial dilution						

State of Late of the Argent Reviewer:CR

VALIDATION FINDINGS CHECKLIST Sample Calculation Verification

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

								Recalcuated	
					Final Volume	Percent	Reported	Result	Acceptable
Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	(mL)	solids (%)	Result (mg/Kg)	(mg/Kg)	(Y/N)
1	Cr	3.222	50	1.028	50	68.09	11.5	11.5	Υ
2	Pb	9.952	20	1.054	50	49.38	19.1	19.1	Υ
3	Ag	0.055	20	1.039	50	64.34	0.08	0.08	Υ
4	As	4.345	20	1.078	50	82.09	4.91	4.91	Υ
5	Cd	0.033	20	1.014	50	79.2	0.04	0.04	Υ
6	Cu	20.392	20	1.012	50	38.5	52.3	52.3	Υ
7	Zn	38.04	20	1.016	50	31.78	118	118	Υ
8	Hg	0.2602	1	0.249	50	32.53	0.161	0.161	Υ
9	Hg	0.2736	1	0.233	50	33.37	0.176	0.176	Υ
10	As	1.612	50	1.039	50	59.5	6.52	6.52	Υ
11	Hg	0.2095	1	0.204	50	53.06	0.0968	0.0968	Υ
12	Hg	0.2006	_ 1	0.216	50	57.03	0.0814	0.0814	Υ

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

-								Recalcuated	
					Final Volume	Percent	Reported	Result	Acceptable
Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	(mL)	solids (%)	Result (mg/Kg)	(mg/Kg)	(Y/N)
1	Cr	3.222	50	1.028	50	68.09	11.5	11.5	Υ
2	Pb	9.952	20	1.054	50	49.38	19.1	19.1	Υ
3	Ag	0.055	20	1.039	50	64.34	0.08	0.08	Υ
4	As	4.345	20	1.078	50	82.09	4.91	4.91	Υ
5	Cd	0.033	20	1.014	50	79.2	0.04	0.04	Υ
6	Cu	20.392	20	1.012	50	38.5	52.3	52.3	Υ
7	Zn	38.04	20	1.016	50	31.78	118	118	Υ
8	Cr	10.454	20	1.029	50	32.53	31.2	31.2	Υ
9	Cd	0.138	20	1.051	50	33.37	0.39	0.39	Υ
10	As	1.612	50	1.039	50	59.5	6.52	6.52	Υ
11	Ag	0.081	20	1.006	50	53.06	0.15	0.15	Υ
12	Zn	46.044	20	1.027	50	57.03	78.6	78.6	Υ

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS214	20F0293-02	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS202	20F0293-04	Sediment	06/15/20
LDW20-SS203	20F0293-05	Sediment	06/15/20
LDW20-SS341	20F0293-06	Sediment	06/15/20
LDW20-SS347	20F0293-07	Sediment	06/15/20
LDW20-SS350	20F0293-08	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20
LDW20-SS217	20F0293-10	Sediment	06/15/20
LDW20-SS219	20F0293-11	Sediment	06/15/20
LDW20-SS220	20F0293-12	Sediment	06/15/20
LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
LDW20-SS215DUP	20F0293-01DUP	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	LDW20-SS215 LDW20-SS214 LDW20-SS212 LDW20-SS202 LDW20-SS203 LDW20-SS341 LDW20-SS347 LDW20-SS350 LDW20-SS350 LDW20-SS352 LDW20-SS217 LDW20-SS219

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

LDC #: 48765F6 VALIDATION COMPLETENESS WORKSHEET D SDG #: 20F0293 Stage 2B Pa Laboratory: Analytical Resources, Inc.

Date: <u>8/17/</u> 2
Page: <u>(</u> of <u>)</u>
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	AIA	
	Initial calibration	A	
111.	Calibration verification	A	
IV	Laboratory Blanks	Sw/_	
V	Field blanks	N _	
VI.	Matrix Spike/Matrix Spike Duplicates	14	
VII.	Duplicate sample analysis	4	
VIII.	Laboratory control samples	A	LES
IX.	Field duplicates	N_	
X.	Sample result verification	N	
Χl	Overall assessment of data		

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1_	LDW20-SS215	20F0293-01	Sediment	06/15/20
2	LDW20-SS214	20F0293-02	Sediment	06/15/20
3	LDW20-SS212	20F0293-03	Sediment	06/15/20
4	LDW20-SS202	20F0293-04	Sediment	06/15/20
5	LDW20-SS203	20F0293-05	Sediment	06/15/20
6	LDW20-SS341	20F0293-06	Sediment	06/15/20
7	LDW20-SS347	20F0293-07	Sediment	06/15/20
8	LDW20-SS350	20F0293-08	Sediment	06/15/20
9	LDW20-SS352	20F0293-09	Sediment	06/15/20
10	LDW20-SS217	20F0293-10	Sediment	06/15/20
11	LDW20-SS219	20F0293-11	Sediment	06/15/20
12	LDW20-SS220	20F0293-12	Sediment	06/15/20
13	LDW20-SS215MS	20F0293-01MS	Sediment	06/15/20
14	LDW20-SS215DUP	20F0293-01DUP	Sediment	06/15/20
15				

NULES		 		 	 	 	 	_

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 12	Total solids, TOC	
QC: 13, 14	тос	

LDC #: 48765F6

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: 1-11

					Sample Identification							
Analyte	PB (units)	Maximum ICB/CCB (%)	Action Level	No qualifie	rs							
TOC		0.02	0.2									

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised at 52

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0293

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS215	20F0293-01	Sediment	06/15/20
LDW20-SS212	20F0293-03	Sediment	06/15/20
LDW20-SS352	20F0293-09	Sediment	06/15/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.0°C and 9.6°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Extractic Blank ID Date		Compound	Concentration	Associated Samples
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0293

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0293	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А
All samples in SDG 20F0293	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	А
LDW20-SS352	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to compounds reported as EMPC and CDPE interference, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0293

Sample	Compound	Flag	A or P	Reason
LDW20-SS215 LDW20-SS212 LDW20-SS352	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А	Compound quantitation (EMPC)
LDW20-SS215 LDW20-SS212 LDW20-SS352	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	Α	Compound quantitation (EMPC)
LDW20-SS352	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А	Compound quantitation (CDPE interference)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0293

No Sample Data Qualified in this SDG

					_	. 1.1
				S WORKSHEET	•	Date: 3/14/5
	#: <u>20F0293</u>	5	Stage 4		_	Page: / of /
Labor	atory: <u>Analytical Resources, Inc.</u>					Reviewer: 7
METH	IOD: HRGC/HRMS Polychlorinated Dioxi	ins/Dibenzo	ofurans (EPA	Method 1613B)	Zilu iv	coviewei
	amples listed below were reviewed for ea tion findings worksheets.	ch of the fo	ollowing valid	lation areas. Validati	on findings are ı	noted in attache
	Validation Area			Comr	nents	
ı.	Sample receipt/Technical holding times	A	TOUT	8.0- 9.60C	- Sauce	lous
II.	HRGC/HRMS Instrument performance check	A	/	·		3
III.	Initial calibration/ICV	AA	₹ \$\$0≾	20/3570.		2- lints
IV.	Continuing calibration	A	00X %	be limite		<u> </u>
V.	Laboratory Blanks	M				
VI.	Field blanks					
VII.	Matrix spike/Matrix spike duplicates	1/	4			
VIII.	Laboratory control samples	A	105			
IX.	Field duplicates	N		-		
X.	Labeled Compounds	A				
XI.	Compound quantitation RL/LOQ/LODs	TW				
XII.	Target compound identification	A				
XIII.	System performance	A				
XIV.	Overall assessment of data	(Λ)				
lote:	N = Not provided/applicable R = Rin	o compounds sate eld blank	detected	D = Duplicate TB = Trip blank EB = Equipment blan	SB=Sourc OTHER: nk	ce blank
	Client ID			Lab ID	Matrix	Date
1 [_DW20-SS215			20F0293-01	Sediment	06/15/20
2 1	_DW20-SS212			20F0293-03	Sediment	06/15/20
3 L	_DW20-SS352			20F0293-09	Sediment	06/15/20
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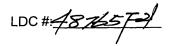


VALIDATION FINDINGS CHECKLIST

Page: /of Reviewer: 9
2nd Reviewer: 4

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.				
Cooler temperature criteria was met.				
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?				
Were the retention time windows established for all homologues?				
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?				
Is the static resolving power at least 10,000 (10% valley definition)?				
Was the mass resolution adequately check with PFK?				
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?				
Illa. 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		e Sue See S		
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 FINDINGS CHECKLIST

Page: of Reviewer: 2nd Reviewer:

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?	6			
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	<u> </u>			
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 \pm 2 seconds (includes labeled standards)?	/			
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?	/			
Was an acceptable lock mass recorded and monitored?	/			
XIII. System performance	<u> </u>			
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:

VALIDATION FINDINGS WOR/UHEET Blanks

Page: 1 of 1

Reviewer: PG

2nd Reviewer: ^(

METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

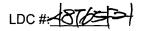
Blank extraction date: 6/29/20

Blank analysis date: 7/2/20

Conc. units: ng/kg

Associated samples: All gual U

Conc. units: ng/						SSOCIALEG	Samples	· / / II Y	uai o		
Compound	Blank ID		Sample Identification								
	BIF0780-BLK1	5X			<u></u>					 <u> </u>	
o	0.0726	0.363									
F	0.220	1.1									
Q	0.477	2.385									
G	1.66	8.3									
										 	1
							}				
]])	
			i								



VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported RLs

Pa	ge: _	2م	<u>f /</u>
Reviev	ver: _		}_
2nd Review	ver: _		/
		(

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

/	M_	Ŋ	N/A
1	Y	N	N/A

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		411	All results flagged as EMPC >R4		Jdets/A
			All results flagged as EMPC → R ←		u/A
					, ,
		3	All results flagged "X" by the lab due to chlorinated		Jdets/A
			diphenyl ether (CDPE) interference		
				: 	
 				·	
				·	

Comments:	See sample calculation verification worksheet for recalculations
_	

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page:_	_1_of_1_
Reviewer:	PG
2nd Reviewer:	9
_	

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

 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

%RSD = 100 * (S/X)

			Reported	Recalculated	Reported	_Recalculated_	Reported	Recalculated
Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Average RRF (initial)	RRF (10 std)	RRF (10 std)	%RSD	%RSD
ICAL	7/1/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.8223	0.8117684	0.8117	6.7	6.7
		2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2310	1.212577	1.2125	11.4	11.4
]	1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9576	1.02541	1.0254	10.8	10.8
		1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1246	1.193104	1.1930	12.3	12.3
		OCDF (13C-OCDF)	1.392	1.3922	1.362751	1.3628	8.0	8.0
		2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF) 2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)						
		1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD) 1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD) OCDE (¹³ C-OCDE)						
		2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF) 2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD) 1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD) 1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
			ICAL 7/1/20 2,3,7,8-TCDF (\frac{13}{2}C-2,3,7,8-TCDF) 2,3,7,8-TCDD (\frac{13}{3}C-2,3,7,8-TCDD) 1,2,3,6,7,8-HxCDD (\frac{13}{3}C-1,2,3,6,7,8-HxCDD) 1,2,3,4,6,7,8-HpCDD (\frac{13}{3}C-1,2,4,6,7,8,-HpCDD) OCDF (\frac{13}{3}C-OCDF) 2,3,7,8-TCDF (\frac{13}{3}C-2,3,7,8-TCDD) 1,2,3,6,7,8-HxCDD (\frac{13}{3}C-1,2,3,6,7,8-HxCDD) 1,2,3,4,6,7,8-HpCDD (\frac{13}{3}C-1,2,3,6,7,8-HxCDD) OCDF (\frac{13}{3}C-OCDF) 2,3,7,8-TCDF (\frac{13}{3}C-2,3,7,8-TCDF) 2,3,7,8-TCDD (\frac{13}{3}C-2,3,7,8-TCDD) 1,2,3,6,7,8-HxCDD (\frac{13}{3}C-2,3,7,8-TCDD) 1,2,3,6,7,8-HxCDD (\frac{13}{3}C-2,3,7,8-TCDD)	ICAL 7/1/20 2,3,7,8-TCDF (\frac{13}{3}\text{C-2,3,7,8-TCDF}) 0.822 2,3,7,8-TCDD (\frac{13}{3}\text{C-2,3,7,8-TCDD}) 1.231 1.231 1.231 1.23,6,7,8-HxCDD (\frac{13}{3}\text{C-1,2,3,6,7,8-HxCDD}) 0.958 1.2,3,4,6,7,8-HpCDD (\frac{13}{3}\text{C-1,2,4,6,7,8-HpCDD}) 1.125 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	ICAL 7/1/20 2,3,7,8-TCDF (13C-2,3,7,8-TCDF) 0.822 0.8223 2,3,7,8-TCDD (13C-2,3,7,8-TCDD) 1.231 1.2310 1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD) 0.958 0.9576 1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD) 1.125 1.1246 OCDF (13C-OCDF) 1.392 1.3922 2,3,7,8-TCDF (13C-2,3,7,8-TCDF) 2,3,7,8-TCDD (13C-2,3,7,8-TCDD) 1.2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (13C-1,2,3,6,7,8-HxCDD) 0.0CDF (13C-0CDF) 2.3,7,8-TCDF (13C-2,3,7,8-TCDF) 2.3,7,8-TCDF (13C-2,3,7,8-TCDF) 1.2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD) 1.2,3,7,8-TCDD (13C-2,3,7,8-TCDD) 1.2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (13C-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	ICAL 7/1/20 2,3,7,8-TCDF (\frac{13}{C}-2,3,7,8-TCDF) 0.822 0.8223 0.8117684 2,3,7,8-TCDD (\frac{13}{C}-2,3,7,8-TCDD) 1.231 1.2310 1.212577 1,2,3,6,7,8-HxCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 0.958 0.9576 1.02541 1,2,3,4,6,7,8-HpCDD (\frac{13}{C}-1,2,4,6,7,8,-HpCDD) 1.125 1.1246 1.193104 OCDF (\frac{13}{C}-OCDF) 1.392 1.3922 1.362751 2,3,7,8-TCDF (\frac{13}{C}-2,3,7,8-TCDF) 2,3,7,8-TCDD (\frac{13}{C}-2,3,7,8-HxCDD) 1.2,3,6,7,8-HxCDD) 1,2,3,4,6,7,8-HpCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 0.0CDF (\frac{13}{C}-0,2,3,7,8-TCDF) 2,3,7,8-TCDF (\frac{13}{C}-2,3,7,8-TCDF) 2.3,7,8-TCDF) 2,3,7,8-TCDF (\frac{13}{C}-2,3,7,8-TCDD) 1.2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (\frac{13}{C}-2,3,7,8-TCDD) 1.2,3,6,7,8-HxCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (\frac{13}{C}-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (\frac{13}{C}-1,2,4,6,7,8,-HpCDD) 1	ICAL 7/1/20 2,3,7,8-TCDF (¹³C-2,3,7,8-TCDF) 0.822 0.8223 0.8117684 0.8117 2,3,7,8-TCDD (¹³C-2,3,7,8-TCDD) 1.231 1.2310 1.212577 1.2125 1,2,3,6,7,8-HxCDD (¹³C-1,2,3,6,7,8-HxCDD) 0.958 0.9576 1.02541 1.0254 1,2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.125 1.1246 1.193104 1.1930 OCDF (¹³C-OCDF) 1.392 1.3922 1.362751 1.3628 2,3,7,8-TCDF (¹³C-2,3,7,8-TCDF) 2,3,7,8-TCDD (¹³C-2,3,7,8-TCDD)	ICAL 7/1/20 2,3,7,8-TCDF (¹³C-2,3,7,8-TCDF) 0.822 0.8223 0.8117684 0.8117 6.7 2,3,7,8-TCDD (¹³C-2,3,7,8-TCDD) 1.231 1.2310 1.212577 1.2125 11.4 1,2,3,6,7,8-HxCDD (¹³C-1,2,3,6,7,8-HxCDD) 0.958 0.9576 1.02541 1.0254 10.8 1,2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.125 1.1246 1.193104 1.1930 12.3 OCDF (¹³C-OCDF) 1.392 1.3922 1.362751 1.3628 8.0 2,3,7,8-TCDF (¹³C-2,3,7,8-TCDF) 2,3,7,8-TCDD (¹³C-2,3,7,8-TCDD) 1.2,3,6,7,8-HxCDD (¹³C-1,2,4,6,7,8-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8-HpCDD) 1.2,3,7,8-TCDF) 1.2,3,7,8-TCDF) 1.2,3,7,8-TCDF) 1.2,3,7,8-TCDF) 1.2,3,6,7,8-HxCDD (¹³C-2,3,7,8-TCDF) 1.2,3,6,7,8-HxCDD (¹³C-1,2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (¹³C-1,2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (¹³C-1,2,3,6,7,8-HxCDD) 1.2,3,6,7,8-HxCDD (¹³C-1,2,3,6,7,8-HxCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD) 1.2,3,4,6,7,8-HpCDD (¹³C-1,2,4,6,7,8,-HpCDD)

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalcula	ted
results.	

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

Page:_	<u>1</u> of <u>1</u>
Reviewer:	PG
2nd Reviewer:	1
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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

Where: ave. RRF = initial calibration average RRF

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

RRF = continuing calibration RRF

 A_x = Area of compound, A_{is} = Area of associated internal standard C_x = Concentration of compound, C_{is} = Concentration of internal standard

					Reported	Recalculated	Reported	Recalculated
#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Conc (CC)	Conc (CC)	%D	%D
1	20070202	7/2/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.7756249	0.7756	5.7	5.7
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2109160	1.2109	1.6	1.7
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9764576	0.9764	2.0	2.0
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1701800	1.1701	4.1	4.0
			OCDF (13C-OCDF)	1.392	1.3030900	1.3030	6.4	6.4
2	20070215	7/2/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.8055136	0.8055	2.0	2.0
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2570670	1.2570	2.1	2.2
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9913691	0.9913	3.5	3.5
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1863840	1.1864	5.5	5.5
			OCDF (¹³ C-OCDF)	1.392	1.2640570	1.2644	9.2	9.2
3			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)					
-			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	<u> </u>				
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD) 1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)					
	L		OCDF (13C-OCDF)	L		l	L	

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

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VALIDATION FINDINGS WORKSHEET Laboratory Control Sample Results Verification

Page: __	<u>1_of_1_</u>
Reviewer:	PG
2nd Reviewer:	4
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METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory 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 | * 2/(LCS + LCSD)

LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

	Sı	oike	Spiked S	Spiked Sample		:s	rc:	SD	L CS/I	CSD
Compound		ided g/kg)	Concen (ng/l		Percent F	Percent Recovery Percent Recovery		RPD		
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	20.0	NA	19.97	NA	99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105				
OCDF	200		182.39		91.2	91.2				
				,						

Comments: Refer	<u>to Laboratory C</u>	ontrol Sample find	ings worksheet for I	<u>list of qualifications a</u>	and associated sa	<u>amples when repo</u>	<u>rted results do not</u>	agree within 10.0	% of the
recalculated results	S.								
									

LDC #: 48765 [-2]

calibration

Dilution Factor.

Df

%S

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page: /of /
Reviewer: 2nd reviewer: 4

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Percent solids, applicable to soil and solid matrices

(X IA	N/A	vvere all recalculated results for detected ta	riget compounds agree within 10.0% of the reported results?
Conc	centration	$n = \frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(%S)}$	Example:
A _x	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D,
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard	
l _s	=	Amount of internal standard added in nanograms (ng)	Conc. = (6.90402) + 7.80862) (190 (20)(1) (6.89105+865905) (35) (07146)
Vo	=	Volume or weight of sample extract in milliliters (ml) or grams (g).	123 (0)710)
RRF	=	Relative Response Factor (average) from the initial	= 0.229115/1-

Were all reported results recalculated and verified for all level IV samples?

	_				
#	Sample ID	Compound	Reported Concentration	Calculated Concentration ()	Qualification
		,/	0.229		
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for all samples in this SDG were reported between 12.2°C and 16.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/08/20	Indeno(1,2,3-cd)pyrene	20.1	All samples in SDG 20F0295	J (all detects)	Α

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration %D, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-SC368 LDW20-IT388	Indeno(1,2,3-cd)pyrene	J (all detects)	Α	Continuing calibration (%D)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

	t: 20F0295 atory: <u>Analytical Resources, Inc.</u>		tage				Page:_/of Reviewer: Reviewer:}
ETH	OD: GC/MS Semivolatiles (EPA SW 846	6 Method 8	270E)			
	amples listed below were reviewed for eation findings worksheets.	ach of the fo	ollowi	ng valida	tion areas. Validatio	on findings are ı	noted in attac
	Validation Area				Comm	ents	
I.	Sample receipt/Technical holding times	A	Tie	ans W	122-164	C-Saw	lay
II.	GC/MS Instrument performance check	A		/			
11.	Initial calibration/ICV	MA	Q-	5000	20/0 /2	10/6:	20%
V.	Continuing calibration	W	4	-V =	20/0	·····	
V.	Laboratory Blanks	A		-			
/I.	Field blanks	1 1/					
/II.	Surrogate spikes	A		.,,,			
111.	Matrix spike/Matrix spike duplicates	Ã			The state of the s	<u></u>	
Χ.	Laboratory control samples	AA	2	19			
X.	Field duplicates	N.					
KI.	Internal standards	A					
al.	Compound quantitation RL/LOQ/LODs	N					
::: <u>.</u> :::::	Target compound identification	N					·
IV.	System performance	N		****			
۷۰. ۲۷.	Overall assessment of data	A-					
e:	A = Acceptable ND = N N = Not provided/applicable R = Rir	lo compounds nsate ield blank	detec	ted	D = Duplicate TB = Trip blank EB = Equipment blan	SB=Sourc OTHER: k	ce blank
7	Client ID				Lab ID	Matrix	Date
L	DW20-SC368				20F0295-05	Sediment	06/16/20
L	DW20-IT388				20F0295-11	Sediment	06/16/20
<u> L</u>	DW20-SC368MS				20F0295-05MS	Sediment	06/16/20
L	DW20-SC368MSD				20F0295-05MSD	Sediment	06/16/20
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s:							

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

WETHOD: GC/MS SVOA				
A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine



VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:_	<u>/</u> of <u>/</u>
Reviewer:	q
2nd Reviewer:	Ø

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument? Y(N)N/AWere percent differences (%D) \leq 20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/8/20	NT1420070804	W	20.1		A11 (dets)	-1/W/A
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Comple Identification	Laboratory Sample Identification	Matrix	Collection Date
Sample Identification			
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20
LDW20-IT421MS	20F0295-06MS	Sediment	06/16/20
LDW20-IT421MSD	20F0295-06MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 12.2°C and 16.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	LDW20-SC368 LDW20-IT388	J (all detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/08/20	Benzoic acid Pentachlorophenol	39.2 39.2	LDW20-SC368 LDW20-IT388	J (all detects) J (all detects)	Α

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0862-BLK2	06/30/20	1,4-Dichlorobenzene	0.7 ug/Kg	LDW20-SC368 LDW20-IT388

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SC368	1,4-Dichlorobenzene	1.6 ug/Kg	1.6U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and continuing calibration %D, data were qualified as estimated in two samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-SC368 LDW20-IT388	N-Nitrosodiphenylamine	J (all detects)	А	Initial calibration verification (%D)
LDW20-SC368 LDW20-IT388	Benzoic acid Pentachlorophenol	J (all detects) J (all detects)	А	Continuing calibration (%D)

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0295

Sample	Compound	Modified Final Concentration	A or P
LDW20-SC368	1,4-Dichlorobenzene	1.6U ug/Kg	Α

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

LDC #: 48765G2b VALIDATION COMPLETENESS WORKSHEET SDG #: 20F0295 Stage 2B

Date: 8/4/20
Page: ___of /
Reviewer: ____

Laboratory: Analytical Resources, Inc.

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	Teep @ 12-2-16.40 C-Sans day
11.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	AW	RSD = 20. 12 K/ 527.
IV.	Continuing calibration	W	act = 20%
V.	Laboratory Blanks	MI	2
VI.	Field blanks	L N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	AA	LCS
X.	Field duplicates	N	
XI.	Internal standards	À	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data		

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1 /	LDW20-SC368	20F0295-05	Sediment	06/16/20
2 ک	LDW20-IT421	20F0295-06	Sediment	06/16/20
3	L LDW20-IT409	20F0295-07	Sediment	06/16/20
4	LDW20-IT388	20F0295-11	Sediment	06/16/20
52	LDW20-IT390	20F0295-12	Sediment	06/16/20
6>	-LDW20-IT389	20F0295-13	Sediment	06/16/20
7]	LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
8	LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20
چ و	LDW20-IT421MS	20F0295-06MS	Sediment	06/16/20
₁₀ >	LDW20-IT421MSD	20F0295-06MSD	Sediment	06/16/20
11				
12	BIF0862-BAC=			
13 -	PIFORET BALL			
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC # 4876549

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page: ___of ___ Reviewer: ____ 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".

N N/A

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N/A Were all %D within the validation criteria of ≤20 %D?

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Associated Samples	Qualifications
	44/20	5170795-5CV1	R	65.7	1,4.7-8. MB (Asts)	WH/A
	, ,				(dets)	
_						
					 	
						1



VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page: / of / Reviewer: // 2nd Reviewer: //

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

YN N/A

Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID		Finding %D (Limit: ≤20.0%) 39. ≥ 39. ≥	Finding RRF (Limit)	Associated Samples	Qualifications
	7/8/20	Standard ID NT142008055	##	39.2		1.4.7-8.MB (dets)	WW/A
<u> </u>	//		77	39.2		(dets)	
<u> </u>							
 							
							
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VALIDATION FINDINGS WORKSHEET Blanks

Page:_	<i> </i> _of_ <i> </i>
Reviewer:	
2nd Reviewer:	4

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)	
Please see qualifications below for all questions answered "N"	. Not applicable questions are identified as "N/A".

★ N N/A Was a method blank analyzed for each matrix?

YN N/A Was a method blank analyzed for each concentration preparation level?

Blank analysis date:_

YN 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: 420 Blank analysis date: 7/8/10

Conc. units: Associated Samples:

Compound	Blank ID	Sample Identification						
#1FO	862-Bd	(2	1					
ح ا	0.7		1.4/4					

Conc. units: Associated Samples:								
Compound	Blank ID	Sample Identification						

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Blank extraction date:_____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-SC368MS	20F0295-05MS	Sediment	06/16/20
LDW20-SC368MSD	20F0295-05MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 12.2°C and 16.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765G3a Stage 2B SDG #: 20F0295 Laboratory: Analytical Resources, Inc. 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 Sample receipt/Technical holding times GC Instrument Performance Check II. III. Initial calibration/ICV IV. Continuing calibration V. Laboratory Blanks VI. Field blanks VII. Surrogate spikes VIII. Matrix spike/Matrix spike duplicates Les IX. Laboratory control samples X. Field duplicates XI. Compound quantitation/RL/LOQ/LODs Ν XII. Target compound identification Ν XIII. System Performance Ν XIV Overall assessment of data 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 Matrix Lab ID Date 20F0295-05 LDW20-SC368 Sediment 06/16/20 LDW20-IT388 20F0295-11 Sediment 06/16/20 LDW20-SC368MS 20F0295-05MS Sediment 06/16/20 LDW20-SC368MSD 20F0295-05MSD 06/16/20 Sediment 6 8 9 10 Notes:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SC324	20F0295-01	Sediment	06/16/20
LDW20-SC327	20F0295-02	Sediment	06/16/20
LDW20-SC326	20F0295-03	Sediment	06/16/20
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-SC381	20F0295-08	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT331	20F0295-10	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.2°C and 16.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0295	J (all detects) UJ (all non-detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/04/20	20070427ECD7	2C	Aroclor-1254	21.8	LDW20-SC324 LDW20-SC327 LDW20-SC326 LDW20-IT332 LDW20-SC368 LDW20-IT421	J (all detects)	A

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SC327	Aroclor-1260	41.1	J (all detects)	А
LDW20-IT421	Aroclor-1248 Aroclor-1254 Aroclor-1260	61.3 42 44.9	J (all detects) J (all detects) J (all detects)	А
LDW20-IT409	Aroclor-1248	54.5	J (all detects)	А
LDW20-IT330	Aroclor-1248 Aroclor-1254	76.9 81.6	J (all detects) J (all detects)	А
LDW20-IT331	Aroclor-1248	48.5	J (all detects)	А
LDW20-IT389	Aroclor-1254	41.5	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and RPD between two columns, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0295

Samula	Compound	Flag	A == D	Bassan
Sample	Compound	riag	A or P	Reason
LDW20-SC324 LDW20-SC327 LDW20-SC326 LDW20-IT332 LDW20-SC368 LDW20-IT421 LDW20-IT409 LDW20-SC381 LDW20-IT330 LDW20-IT331 LDW20-IT388 LDW20-IT388 LDW20-IT388	Aroclor-1260	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)
LDW20-SC324 LDW20-SC327 LDW20-SC326 LDW20-IT332 LDW20-SC368 LDW20-IT421	Aroclor-1254	J (all detects)	Α	Continuing calibration (%D)
LDW20-SC327	Aroclor-1260	J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT421	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT409 LDW20-IT331	Aroclor-1248	J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT330	Aroclor-1248 Aroclor-1254	J (all detects) J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT389	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765G3b

SDG #: 20F0295

Stage 2B

Laboratory: Analytical Resources, Inc.

Reviewer: 2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	Toup @ 82-16.40 - Same lay
II.	Initial calibration/ICV	A 1701	750 = 20%. KZY = 20%
111.	Continuing calibration	1W	ec/= 20/0
IV.	Laboratory Blanks	\triangle	
V.	Field blanks	\wedge	
VI.	Surrogate spikes	\bigcirc	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	AA	LC3
IX.	Field duplicates	<i>N</i>	
X.	Compound quantitation/RL/LOQ/LODs	Z	
XI.	Target compound identification	N	
XII	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SC324	20F0295-01	Sediment	06/16/20
2	LDW20-SC327	20F0295-02	Sediment	06/16/20
3	LDW20-SC326	20F0295-03	Sediment	06/16/20
4	LDW20-IT332	20F0295-04	Sediment	06/16/20
5	LDW20-SC368	20F0295-05	Sediment	06/16/20
6	LDW20-IT421	20F0295-06	Sediment	06/16/20
7	LDW20-IT409	20F0295-07	Sediment	06/16/20
8	LDW20-SC381	20F0295-08	Sediment	06/16/20
9	LDW20-IT330	20F0295-09	Sediment	06/16/20
10	LDW20-IT331	20F0295-10	Sediment	06/16/20
11	LDW20-IT388	20F0295-11	Sediment	06/16/20
12	LDW20-IT390	20F0295-12	Sediment	06/16/20
13	LDW20-IT389	20F0295-13	Sediment	06/16/20
14	LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
15	LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20
16				
17_				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u>/</u> of/
Reviewer:	a
2nd Reviewer:	1

METHOD: GC _ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? ___%D or ___%R

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
	45						
	/						
	7/2/20	5140056-50VI	10	BB	A.F	All (det3+ND)	VWX
	1/7/	and the second	•				772
L							
 							
<u> </u>							

LDC #: 4876436

VALIDATION FINDINGS WORKSHEET <u>Continuing Calibration</u>

Page:_	<u>/of/</u>
Reviewer:	9
2nd Reviewer:	1

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Were continuing calibration standards analyzed at the required frequencies?

Did the continuing calibration standards meet the %D validation criteria of <20.0%?

Level IV Only

Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	44/20	70070476007	2C	AA	2/.8	(1-6.14-15.MB	-1/// A
	7./	1 1 1		3	,	()	(dot3)	AND V
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LDC#:	165 ab
LDO 11	1

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	
Reviewer:	<u> </u>
2nd Reviewer:	9

METHOD: VGC HPLC

Level IV/P Only

Y N X/A/ Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

T	ii no, piease see iindings		The transfer of the second sec	
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
		2	41.1	- USB/A
				· · · · · · · · · · · · · · · · · · ·
	2	6	61.3	
	AA		42	
			44.9	
	2	T	54.5	
	Z	9	76.9	
	AA.		8.6	
	X			
	2	10	48.5	
	<u> </u>	13	41.5	V
L				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Metals

Validation Level:

Stage 2B & 4

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT331	20F0295-10	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20
LDW20-IT332DUP	20F0295-04DUP	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765G4a SDG #: 20F0295 Stage 2B/4

Laboratory: Analytical Resources, Inc.

Reviewer: 2nd Reviewer

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Sample receipt/Technical holding times	AA	
II.	ICP/MS Tune	A	
111.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	\mathcal{N}	
VII.	Matrix Spike/Matrix Spike Duplicates	A	
VIII.	Duplicate sample analysis	A_{i}	
IX.	Serial Dilution	\sim	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	$\mathcal{N}_{\mathcal{I}}$	
XII.	Internal Standard (ICP-MS)	\mathcal{N}_{-}	NH reviewed
XIII.	Sample Result Verification	A	Not reviewed for 6020A validation.
XIV	Overall Assessment of Data	LA_	

Note:

A = Acceptable N = Not provided/applicable ND = No compounds detected R = Rinsate FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank

OTHER:

SW = See worksheet Mercury underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT332	20F0295-04	Sediment	06/16/20
2	LDW20-SC368	20F0295-05	Sediment	06/16/20
3	LDW20-IT421	20F0295-06	Sediment	06/16/20
1	LDW20-IT409	20F0295-07	Sediment	06/16/20
5	LDW20-IT330	20F0295-09	Sediment	06/16/20
<u>3_</u> _	LDW20-IT331	20F0295-10	Sediment	06/16/20
7	LDW20-IT388	20F0295-11	Sediment	06/16/20
3	LDW20-IT390	20F0295-12	Sediment	06/16/20
9	LDW20-IT389	20F0295-13	Sediment	06/16/20
10	LDW20-IT332MS	20F0295-04MS	Sediment	06/16/20
11	LDW20-IT332MSD	20F0295-04MSD	Sediment	06/16/20
12_	LDW20-IT332DUP	20F0295-04DUP	Sediment	06/16/20
13_				
4_				

Notes:

METHOD: Trace Metals (EPA SW 846 Methods	6010/	6020,	/7000)	
Validation Area	Yes	No	NA	Comments
I. Technical holding times				
Were all technical holding times met?	Х			
Were all water samples preserved to a pH of				
<2.	İ	1	X	
II. ICP-MS Tune			<u> </u>	
Were mass resolutions within 0.1 amu for all				
isotopes in the tuning solution?		1	Х	
Were %RSDs of isoptoes in the tuning solution				
≤5%?		İ	х	
III. Calibration				
Were all instuments calibrated daily?	X			
Were the proper standards used?	Х			
Were all initial and continuing calibration				
verifications within the 90-110% (80-120% for	1			
mercury) QC limits?	х			
Were the low level standard checks within 70-				
130%?	}		x	
Were all initial calibration correlation				
coefficients within limits as specifed by the				
method?	Х			
IV. Blanks				
Was a method blank associated with every				
sample in this SDG?	х			
Was there contamination in the method				
blanks?		Х		
Was there contamination in the initial and				
continuing calibration blanks?		Х		
V. Interference Check Sample		_		
Were the interference check samples				
performed daily?	<u> </u>		Х	
Were the AB solution recoveries within 80-				
120%?			X	
VI. Matrix Spike/Matrix Spike Duplicates/Labo	ratory	Dup	licates	
Were MS/MSD recoveries with the QC limits?				
(If the sample concentration exceeded the				
spike concentration by a factor of 4, no action				
was taken.)		ļ	Х	
Were the MS/MSD or laboratory duplicate				
relative percent differences (RPDs) within the		1	1	
QC limits?		<u> </u>	X	<u></u>
VII. Laboratory Control Samples	T	Т		
Was a LCS analyzed for each batch in the SDG?	X	<u> </u>		
Were the LCS recoveries and RPDs (if				
applicable) within QC limits?	Х		1	

METHOD: Trace Metals (EPA SW 846 Methods	6010/	6020/	7000)	-
Validation Area	Yes	No	NA	Comments
VIII. Internal Standards				
Were all percent recoveries within the 30-120%	l	-	1	
(60-125% for EPA Method 200.8) QC limits?			х	
If the recoveries were outside the limits, was a				
reanalysis performed?	ł		x	
IX. Serial Dilution				
Were all percent differences <10%?			Х	
Was there evidence of negative interference?				
If yes, professional judgement will be used to				
qualify the data.			x	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect				
sample dilutions?	Х			
Were all soil samples dry weight corrected?	Х			
XI. Overall Assessment of Data				
Was the overall assessment of the data found				
to be acceptable?	Х			
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?		Х		
Were target analytes detected in the field				
blanks?			X	

ICP-MS

CVAA

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
2, 7	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
1, 3-6, 8, 9	As
QC: 11, 12	As, Cd, Cr, Cu, Pb, Ag, Zn
	Analysis Method
ICP	

As, Cd, Cr, Cu, Pb, Ag, Zn

Hg

Page 1 of 1 Reviewer:CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

An intial calibration verification (ICV), continuing calibration verification (CCV), low level calibration check (LLCC), and interference check sample (ICSAB) percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis

True = concentration of each analyte in the source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalcuated %R	Reported %R	Acceptable (Y/N)
ICV	CVAA	Hg	4.0515	4	101.3	101.3	Υ
CCV	CVAA	Hg	3.9381	4	98.5	98.5	Υ

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

 $%R = (Found/True) \times 100$

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

 $%D = (Absolute value (I - SDR)) \times 100 / (I)$

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

					Recalcuated	Reported	
Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	%R/RPD/%D	%R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Hg	0.499	0.5	99.8	99.8	Υ
	MS	Hg					
	Duplicate	Hg					

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Analytes were recalculated and verified using the following equation:

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

								Recalcuated	
					Final Volume	Percent	Reported	Result	Acceptable
Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight (g)	(mL)	solids (%)	Result (mg/Kg)	(mg/Kg)	(Y/N)
2	Hg	0.1766	1	0.282	50	75.98	0.0412	0.0412	Υ
7	Hg	0.1454	1	0.206	50	69.99	0.0504	0.0504	Υ

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Wet Chemistry

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Samula Identification	Laboratory Sample Identification	Matrix	Collection Date
Sample Identification			
LDW20-SC324	20F0295-01	Sediment	06/16/20
LDW20-SC327	20F0295-02	Sediment	06/16/20
LDW20-SC326	20F0295-03	Sediment	06/16/20
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-SC368	20F0295-05	Sediment	06/16/20
LDW20-IT421	20F0295-06	Sediment	06/16/20
LDW20-IT409	20F0295-07	Sediment	06/16/20
LDW20-SC381	20F0295-08	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT331	20F0295-10	Sediment	06/16/20
LDW20-IT388	20F0295-11	Sediment	06/16/20
LDW20-IT390	20F0295-12	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20
LDW20-SC324DUP	20F0295-01DUP	Sediment	06/16/20
LDW20-IT330MS	20F0295-09MS	Sediment	06/16/20
LDW20-IT330DUP	20F0295-09DUP	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0295

LDC #: 48765G6

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: \$\(\frac{17}{2}\)
Page: \(\begin{pmatrix} \text{of} \\ \\ \text{Reviewer:} \\ \text{2nd Reviewer:} \end{pmatrix}

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
1.	Sample receipt/Technical holding times	AIA	
11	Initial calibration	LA_	
111.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LES
IX.	Field duplicates	\mathcal{N}	
X.	Sample result verification	N	
ΧI	Overall assessment of data	12	

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 LDW20-SC324 20F0295-01 Sediment 06/16/20 LDW20-SC327 20F0295-02 Sediment 06/16/20 3 LDW20-SC326 20F0295-03 Sediment 06/16/20 LDW20-IT332 20F0295-04 Sediment 06/16/20 5 LDW20-SC368 20F0295-05 Sediment 06/16/20 20F0295-06 06/16/20 6 LDW20-IT421 Sediment LDW20-IT409 20F0295-07 Sediment 06/16/20 8 LDW20-SC381 20F0295-08 Sediment 06/16/20 LDW20-IT330 20F0295-09 Sediment 06/16/20 10 LDW20-IT331 20F0295-10 Sediment 06/16/20 11 LDW20-IT388 20F0295-11 Sediment 06/16/20 12 LDW20-IT390 20F0295-12 Sediment 06/16/20 13 LDW20-IT389 20F0295-13 Sediment 06/16/20 14 20F0295-01DUP Sediment 06/16/20 LDW20-SC324DUP 15 LDW20-IT330MS 20F0295-09MS Sediment 06/16/20 LDW20-IT330DUP 20F0295-09DUP 16 Sediment 06/16/20

Notes:

LDC #: 48765G6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 13	Total solids, TOC	
QC: 14	TS	
15, 16	тос	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0295

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT332	20F0295-04	Sediment	06/16/20
LDW20-IT330	20F0295-09	Sediment	06/16/20
LDW20-IT389	20F0295-13	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 8.2°C and 16.4°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0780-BLK1	06/29/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD	0.0726 ng/Kg 0.220 ng/Kg 0.477 ng/Kg 1.66 ng/Kg	All samples in SDG 20F0295

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-IT389	1,2,3,4,6,7,8-HpCDF	0.589 ng/Kg	0.589U ng/Kg
	OCDF	1.89 ng/Kg	1.89U ng/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0295	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	A
All samples in SDG 20F0295	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	А

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to compounds reported as EMPC, data were qualified as estimated in three samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0295

Sample	Compound	Flag	A or P	Reason
LDW20-IT332 LDW20-IT330 LDW20-IT389	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	Α	Compound quantitation (EMPC)
LDW20-IT332 LDW20-IT330 LDW20-IT389	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	Α	Compound quantitation (EMPC)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0295

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT389	1,2,3,4,6,7,8-HpCDF OCDF	0.589U ng/Kg 1.89U ng/Kg	Α

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0295

No Sample Data Qualified in this SDG

SDG i	#:48765G21VALIDATIO #:20F0295 atory: <u>Analytical Resources, Inc.</u>		LETEN Stage 4		VORKSHEET		Date: 🗷 👭 Page: of leviewer:
METH	HOD: HRGC/HRMS Polychlorinated Diox	ins/Dibenzo	ofurans (I	EPA M	ethod 1613B)	Zna R	eviewer: 🙏
	amples listed below were reviewed for ea tion findings worksheets.	nch of the fo	ollowing v	/alidatio	n areas. Validatio	on findings are r	noted in attached
	Validation Area				Comm	ents	
1.	Sample receipt/Technical holding times	4	Tang	> (W Z	2-16.40C.	- samo	for/
11.	HRGC/HRMS Instrument performance check	4	1				
III.	Initial calibration/ICV	AA	RSI	>≾-	0/3570.	1e/= 0	churts
IV.	Continuing calibration	A	CI	< 0	ac limits	<u> </u>	
V.	Laboratory Blanks	aw	•			<u>.</u>	
VI.	Field blanks	M					
VII.	Matrix spike/Matrix spike duplicates		05				
VIII.	Laboratory control samples	\triangleleft	20=	>			
IX.	Field duplicates	$ \mathcal{M} $					
X.	Labeled Compounds	A					
XI.	Compound quantitation RL/LOQ/LODs	W		·			
XII.	Target compound identification	A					
XIII.	System performance	A					
XIV.	Overall assessment of data	A					
lote:	N = Not provided/applicable $R = Rin$	o compounds sate eld blank	detected	7	D = Duplicate IB = Trip blank EB = Equipment blan	SB=Sourc OTHER: k	e blank
	Client ID			La	ab ID	Matrix	Date
1 1	LDW20-IT332			20	F0295-04	Sediment	06/16/20
2	LDW20-IT330			20	F0295-09	Sediment	06/16/20
3 1	LDW20-IT389			20	F0295-13	Sediment	06/16/20
4							
5							
6					···		
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VALIDATION FINDINGS CHECKLIST

Page:__/of_ Reviewer:___/5_ 2nd Reviewer:__/5_

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.				
Cooler temperature criteria was met.				
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?				
Were the retention time windows established for all homologues?				
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers \leq 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?				
Illa. Initial calibration			,	
Was the initial calibration performed at 5 concentration levels?				
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled compounds and \leq 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 \geq 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	14 (4.)			
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		1		,
Were the MS/MSD percent recoveries (%R) and the relative percent differences			1	



VALIDATION FINDINGS CHECKLIST

Page: -2of -2
Reviewer: -7
2nd Reviewer: -7

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 \pm 2 seconds (includes labeled standards)?				
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?	Ø	/		
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:

VALIDATION FINDINGS WOR/UHEET Blanks

Page: 1 of 1

Reviewer: PG

2nd Reviewer:

METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

Blank extraction date: 6/29/20 Blank analysis date: 7/2/20

Conc. units: ng/kg

Associated samples: All qual U

Conc. units. ng/i						1330Clated						
Compound	Blank ID		Sample Identification									
	BIF0780-BLK1	5X	3									
0	0.0726	0.363	0.589									
F	0.220	1.1			!							
Q	0.477	2.385	1.89			L						
G	1.66	8.3									 	
										<u> </u>		
			<u> </u>									
									!			
										<u></u>		
									<u> </u>		1	



VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported RLs

Page: _	<u></u>
Reviewer:	7
2nd Reviewer:	7

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

N	M	N/A
Y	<u>不</u>	N/A

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		41	All results flagged as EMPC > *		Jdets/A
			V < ₹∠		u/A
					/
			All results flagged "X" by the lab due to chlorinated		Jdets/A
			-diphenyl ether (CDPE) interference		

Comments:	See sample calculation verification worksheet for recalculations

VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page: <u>1</u> of <u>1</u>
Reviewer:PG
2nd Reviewer: 🛛

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

average RRF = sum of the RRFs/number of standards

%RSD = 100 * (S/X)

 A_{is} = Area of associated internal standard C_{is} = Concentration of internal standard

 A_x = Area of compound, C_x = Concentration of compound, S = Standard deviation of the RRFs,

X = Mean of the RRFs

				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Average RRF (initial)	RRF (10 std)	RRF (10 std)	%RSD	%RSD
1	ICAL	7/1/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.8223	0.8117684	0.8117	6.7	6.7
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2310	1.212577	1.2125	11.4	11.4
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9576	1.02541	1.0254	10.8	10.8
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1246	1.193104	1.1930	12.3	12.3
			OCDF (13C-OCDF)	1.392	1.3922	1.362751	1.3628	8.0	8.0
2			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)		<u> </u>				
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	l					
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
<u></u>			OCDF (13C-OCDF)						
3			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
			OCDF (13C-OCDF)						

Comments:	Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated
results.	

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

Page:_	_ <u>1_</u> of_1
Reviewer:	PG
2nd Reviewer:	CX
•	

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

Where: ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

 $RRF = (A_x)(C_{is})/(A_{is})(C_x)$

 A_{v} = Area of compound,

 $\hat{C_x}$ = Concentration of compound,

 A_{is} = Area of associated internal standard C_{is} = Concentration of internal standard

					Reported	Recalculated	Reported	Recalculated
#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Conc (CC)	Conc (CC)	%D	%D
1	20070202	7/2/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.7756249	0.7756	5.7	5.7
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2109160	1.2109	1.6	1.7
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9764576	0.9764	2.0	2.0
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1701800	1.1701	4.1	4.0
			OCDF (13C-OCDF)	1.392	1.3030900	1.3030	6.4	6.4
2	20070215	7/2/20	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.822	0.8055136	0.8055	2.0	2.0
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	1.231	1.2570670	1.2570	2.1	2.2
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	0.958	0.9913691	0.9913	3.5	3.5
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	1.125	1.1863840	1.1864	5.5	5.5
			OCDF (13C-OCDF)	1.392	1.2640570	1.2644	9.2	9.2
3			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)					
			OCDF (13C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

V:\Pei\Worksheets\8290\48765G21_CONCLC16_21_wnd

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample Results Verification

Page: <u>1</u> _	of_1
Reviewer: P	G
2nd Reviewer:	•
 t	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample dupli	cate (if applicable) were recalculated
for the compounds identified below using the following calculation:	, ,

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration

SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: BIF0780-BS1

Compound	Ac	oike Ided g/kg)	Spiked S Concen (ng/l	tration	L C	Recovery	I C:		I CS/I	
	ıcs	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	20.0	NA	19.97	NA	99.9	99.9				
1,2,3,7,8-PeCDD	100		101.79		102	102				
1,2,3,4,7,8-HxCDD	100		99.30		99.3	99.3				
1,2,3,4,7,8,9-HpCDF	100		105.44		105	105			}	
OCDF	200		182.39		91.2	91.2				
							,			
				-						
ļ	-				ļ					
		<u> </u>								
					 					
				}						

nments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of th	<u>e</u>
lculated results.	
	_

LDC # 48765

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page: /of/ Reviewer: 2nd reviewer: 2

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Percent solids, applicable to soil and solid matrices

	TY	N	N/A
- 1	V	N	N/A

%S

Were all reported results recalculated and verified for all level IV samples?

Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concenti		$\frac{(A_x)(I_s)(DF)}{(RRF)(V_o)(\%S)}$	Example:
A_{x}		Area of the characteristic ion (EICP) for the compound o be measured	Sample I.D
Ais		Area of the characteristic ion (EICP) for the specific nternal standard	
ls	= A	Amount of internal standard added in nanograms (ng)	conc. = (2.416e4 +12.06e4) (100)(20)(1) (5.56725+4.3678 = 16.9676877)(13.28)(13.28)(13.28)
V _o		olume or weight of sample extract in milliliters (ml) or large (g).	7.50 () 14.50 ° 0.19(76)7(10.19), 1
RRF		Relative Response Factor (average) from the initial alibration	= 9.32 NS/8
Df	= D	ilution Factor.	

#	Sample ID	Compound	Reported Concentration	Calculated Concentration ()	Qualification
	>	70	9.35	·	
		·			
			<u>-</u>		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for all samples in this SDG were reported between 6.5°C and 7.9°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r²) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0688-SRM1	Phenol Naphthalene Acenaphthylene Acenaphthene Anthracene	39.5 (42-158) 8.02 (33-167) 25.1 (52-148) 34.4 (51-149) 50.1 (57-143)	All samples in SDG 20F0300	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to SRM %R, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles - Data Qualification Summary - SDG 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS204 LDW20-SS210	Phenol Naphthalene Acenaphthylene Acenaphthene Anthracene	J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H2a VALIDATION COMPLETENESS WORKSHEET Date: SDG #: 20F0300 Stage 2B Page: Laboratory: Analytical Resources, Inc. 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.

2nd Reviewer:

	Validation Area		Comments
1.	Sample receipt/Technical holding times	A	Tues @ 65-7.9° c- same Ley
II.	GC/MS Instrument performance check	A	j 1
111.	Initial calibration/ICV	AA	RSO = 2070. Y2. 101 = 30/0
IV.	Continuing calibration	A	RSO = 20%. Y2. CX = 30%.
V.	Laboratory Blanks	\Diamond	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	Å	
IX.	Laboratory control samples	AKW	103
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	\triangleleft	

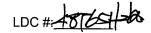
Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank N = Not provided/applicable R = Rinsate TB = Trip blank OTHER: SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A Bhanal	T. A Obligation William			
A. Phenol	T. 4-Chloroaniline	MM. 4-Chlorophenyl-phenyl ether	FFF. Di-n-octylphthalate	YYY. 2,3,5-Trimethylnaphthalene
B. Bis (2-chloroethyl) ether	U. Hexachlorobutadiene	NN. Fluorene	GGG. Benzo(b)fluoranthene	ZZZ. Perylene
C. 2-Chlorophenol	V. 4-Chloro-3-methylphenol	OO. 4-Nitroaniline	HHH. Benzo(k)fluoranthene	AAAA. Dibenzothiophene
D. 1,3-Dichlorobenzene	W. 2-Methylnaphthalene	PP. 4,6-Dinitro-2-methylphenol	III. Benzo(a)pyrene	BBBB. Benzo(a)fluoranthene
E. 1,4-Dichlorobenzene	X. Hexachlorocyclopentadiene	QQ. N-Nitrosodiphenylamine	JJJ. Indeno(1,2,3-cd)pyrene	CCCC. Benzo(b)fluorene
F. 1,2-Dichlorobenzene	Y. 2,4,6-Trichlorophenol	RR. 4-Bromophenyl-phenylether	KKK. Dibenz(a,h)anthracene	DDDD. cis/trans-Decalin
G. 2-Methylphenol	Z. 2,4,5-Trichlorophenol	SS. Hexachlorobenzene	LLL. Benzo(g,h,i)perylene	EEEE. Biphenyl
H. 2,2'-Oxybis(1-chloropropane)	AA. 2-Chloronaphthalene	TT. Pentachlorophenol	MMM. Bis(2-Chloroisopropyl)ether	FFFF. Retene
I. 4-Methylphenol	BB. 2-Nitroaniline	UU. Phenanthrene	NNN. Aniline	GGGG. C30-Hopane
J. N-Nitroso-di-n-propylamine	CC. Dimethylphthalate	VV. Anthracene	OOO. N-Nitrosodimethylamine	HHHH. 1-Methylphenanthrene
K. Hexachloroethane	DD. Acenaphthylene	WW. Carbazole	PPP. Benzoic Acid	IIII. 1,4-Dioxane
L. Nitrobenzene	EE. 2,6-Dinitrotoluene	XX. Di-n-butylphthalate	QQQ. Benzyl alcohol	JJJJ. Acetophenone
M. Isophorone	FF. 3-Nitroaniline	YY. Fluoranthene	RRR. Pyridine	KKKK, Atrazine
N. 2-Nitrophenol	GG. Acenaphthene	ZZ. Pyrene	SSS. Benzidine	LLLL. Benzaldehyde
O. 2,4-Dimethylphenol	HH. 2,4-Dinitrophenol	AAA. Butylbenzylphthalate	TTT. 1-Methylnaphthalene	MMMM. Caprolactam
P. Bis(2-chloroethoxy)methane	II. 4-Nitrophenol	BBB. 3,3'-Dichlorobenzidine	UUU.Benzo(b)thiophene	NNNN.
Q. 2,4-Dichlorophenol	JJ. Dibenzofuran	CCC. Benzo(a)anthracene	VVV.Benzonaphthothiophene	0000.
R. 1,2,4-Trichlorobenzene	KK. 2,4-Dinitrotoluene	DDD. Chrysene	WWW.Benzo(e)pyrene	PPPP.
S. Naphthalene	LL. Diethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	XXX. 2,6-Dimethylnaphthalene	QQQQ.



VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N N/A Was a LCS required?
Y N N/A Were the LCS/LCSD r

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LES A U %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BH70688 = 711	A	295 45-158	()	()	All (Lets+NO)	JALA
			4	8.02 43-16T) 25.1 (52-48) 34.4 (4-149) 50.1 (57-143)	()	()		1
			DD	25! (52-148)	()	()		
			44	34.4 (4-149)	()	()		
			DD TO VV	50.1 ST-H3)	()	()		\bigvee
				()	()	()		
				()	()	()		
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 6.5°C and 7.9°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
06/26/20	N-Nitrosodiphenylamine	65.7	All samples in SDG 20F0300	J (all detects) UJ (all non-detects)	А

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
07/07/20	Pentachlorophenol	25.9	All samples in SDG 20F0300	J (all detects) UJ (all non-detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
BIF0688-SRM2	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	6.95 (34-166) 5.23 (36-162) 19.2 (40-160) 13.9 (38-162)	All samples in SDG 20F0300	J (all detects) UJ (all non-detects)	Р

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, continuing calibration %D, and SRM %R, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS160 LDW20-SS204 LDW20-SS210	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	А	Initial calibration verification (%D)
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS204 LDW20-SS210	Pentachlorophenol	J (all detects) UJ (all non-detects)	Α	Continuing calibration (%D)
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS160 LDW20-SS160 LDW20-SS204 LDW20-SS210	1,4-Dichlorobenzene 1,2-Dichlorobenzene 2,4-Dimethylphenol 1,2,4-Trichlorobenzene	J (all detects) UJ (all non-detects)	Р	Standard reference materials (%R)

Duwamish AOC4

Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4

Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #:_	48765H2b	VALIDATION COMPLETENESS WORKSHEET
SDG #:	20F0300	Stage 2B

Stage 2B

Date:	94/2
Page:_	/of /
Reviewer:_	4
2nd Reviewer:_	M

Laboratory: Analytical Resources, Inc.

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	Temp (6.5 - 7.9° c - same day
II.	GC/MS Instrument performance check	A	· /
111.	Initial calibration/ICV	DIW	R50 ≤ 20%, Y2, KeV ≤ 30%
IV.	Continuing calibration	W	R50 ≤ 20/0, Y2, KeV ≤ 30/0
V.	Laboratory Blanks	\triangle	7
VI.	Field blanks	\bigvee	
VII.	Surrogate spikes	\triangleleft	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	* Fau	105
X.	Field duplicates	\n\	
XI.	Internal standards	\triangle	
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:

		T		
	Client ID	Lab ID	Matrix	Date
1	LDW20-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
i. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU,Benzo(b)thiophene	WWWW 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine



VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page: ___of___ Reviewer: ____ 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".

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

(N)N/A Were all %D within the validation criteria of ≤20 %
--

#	Date	Standard ID	Compound	Finding %D (Limit: <u><</u> 20.0%)	Associated Samples	Qualifications
	6/26/20	Standard ID SIF0395-5CVI	R	65.7	All (Sets +NO)	MN/A
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VALIDATION FINDINGS WORKSHEET Continuing Calibration

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

3 6 8 3 4 4 4 6	1.4.4	0/5) 000/ 1 1//	(
Y/N NI/A	Ware nercent differences	%D) ≤20 % and relative response factors	(RRE) within the method criteria?
Y/N N/A	Were percent unferences	70D/ 520 70 and relative response factors	(1313) Within the metrica criteria:

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit)		Qualifications
	7/7/20	NT14200707035	77	25.9		Associated Samples All (Lets+ND)	VM/A
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VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: __/of_/ Reviewer: _____ 2nd Reviewer: _____

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y/N N/A Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LG6 ★ L %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BIT0688-SAY>	<u> </u>	6.95 (34-166)	()	()	All Idets+ND	-VHA
		1	F	5-23 (26-KL)	()	()		
			0	19.2 40-160)	()	()		
			R	13.9 48-160	()	()		
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Hexachlorobenzene

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Hexachlorobenzene by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 6.5°C and 7.9°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Hexachlorobenzene - Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4 Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H3a VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0300

Stage 2B

Laboratory: Analytical Resources, Inc.

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	
l.	Sample receipt/Technical holding times	A	Toup @ 6.5-7.90c - some day
11.	GC Instrument Performance Check	4	7
III.	Initial calibration/ICV	A/A	\$50=20/0. ICV=20/0
IV.	Continuing calibration	\triangleleft	\$50=20/0. c ≤20/0 cc√=20/0
V.	Laboratory Blanks	A	l
VI.	Field blanks	N.	
VII.	Surrogate spikes / \$\$	A/4	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	$ \rightarrow $	100
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	1	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

FB = Field blank

R = Rinsate

D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6.	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14		10000		
15				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS204MS	20F0300-10MS	Sediment	06/16/20
LDW20-SS204MSD	20F0300-10MSD	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 6.5°C and 7.9°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0300	J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-SS340	Aroclor-1254 Aroclor-1260	45.5 46.8	J (all detects) J (all detects)	А
LDW20-SS353	Aroclor-1248 Aroclor-1254 Aroclor-1260	45.5 47.1 50.3	J (all detects) J (all detects) J (all detects)	А
LDW20-SS345	Aroclor-1260	43.8	J (all detects)	А
LDW20-SS342	Aroclor-1248 Aroclor-1254 Aroclor-1260	41.1 42.4 42.9	J (all detects) J (all detects)	A
LDW20-SS351	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.4 47.7 49.7	J (all detects) J (all detects) J (all detects)	А
LDW20-SS348	Aroclor-1248 Aroclor-1254 Aroclor-1260	42 48.1 49.5	J (all detects) J (all detects) J (all detects)	А
LDW20-SS349	Aroclor-1248 Aroclor-1254 Aroclor-1260	42 48.8 45.8	J (all detects) J (all detects) J (all detects)	A

Sample	Compound	RPD	Flag	A or P
LDW20-SS346	Aroclor-1248 Aroclor-1254 Aroclor-1260	42.2 46.4 56.2	J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and RPD between two columns, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS340 LDW20-SS353 LDW20-SS345 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346 LDW20-SS346 LDW20-SS160 LDW20-SS204 LDW20-SS204	Aroclor-1260	J (all detects)	A	Initial calibration verification (%D)
LDW20-SS340	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SS353 LDW20-SS342 LDW20-SS351 LDW20-SS348 LDW20-SS349 LDW20-SS346	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-SS345	Aroclor-1260	J (all detects)	A	Compound quantitation (RPD between two columns)

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H3b VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0300

Stage 2B

Laboratory: Analytical Resources, Inc.

Reviewer: 1

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Sample receipt/Technical holding times	A	Tourp @ 65-7.902 - SMO Ley \$50 = 20/0. KeV = 20/0 CCV = 20/0
II.	Initial calibration/ICV	A row	\$50 = 20/0. KeV = 20/0
III.	Continuing calibration	4	CCX ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	4	
VII.	Matrix spike/Matrix spike duplicates	\triangle	
VIII.	Laboratory control samples	AA	205
IX.	Field duplicates	<i>K</i>	
X.	Compound quantitation/RL/LOQ/LODs	/×	
XI.	Target compound identification	N	
XII	Overall assessment of data	A	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1_	LDW20-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS204MS	20F0300-10MS	Sediment	06/16/20
13	LDW20-SS204MSD	20F0300-10MSD	Sediment	06/16/20
14				
15				
16				
17				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachior	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

Notes:				

LDC #: 18765136

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	<u>/</u> of_/
Reviewer:_	9
2nd Reviewer:_	91

METHOD: √GC __ HPLO

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

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
	1/20	3140056-501	10	ÆB	4.8	All Uts)	VAVA
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LDC #: 18(651)36

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: ___of___ Reviewer: _____ 2nd Reviewer: ______

METHOD: $\sqrt{}$ GC $_$ HPLO

Level IV/D Only
Y N /N/A

Y N/N/A) Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors ≤40%?

If no, please see findings bellow.

If no, please see findings			
Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
A' A	1	45.5	Uto A
BB		46.8	
	2	455	
		<u> </u>	
83		50.2	
125	3	128	
<u> </u>	<u> </u>	400	
2	4	41.1	
		42.4	
BB		42.9	
	5		
		49.7	
		40.1 xa5	
	AA	AH BB Z AH BB Z AH BB Z AH BB Z AH BB Z AH BB Z AH BB	Compound Name Sample ID Limit (< 40%)

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	<u>ڪ</u> of_ <u>ځ</u>
Reviewer:	9
2nd Reviewer:	41

METHOD: GC __ HPLC

Level IV/D Only
Y N WA

Y N MA Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

N NA Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors <40%?

If no, please see findings bellow.

Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
7	42	Jets A
	488	17
	45.8	
8	42.2	
	46.4	/
	362	V
		Sample ID Limit (≤ 40%) 7 42 48.8 45.8

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Metals

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

	Laboratory Sample	Collection	
Sample Identification	Identification	Matrix	Date
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Cadmium, Chromium, Copper, Lead, Silver, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020A Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Silver	0.017 ug/L	All samples in SDG 20F0300

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS340	Silver	0.2 ug/L	0.2U ug/L
LDW20-SS353	Silver	0.25 ug/L	0.25U ug/L
LDW20-SS345	Silver	0.24 ug/L	0.24U ug/L
LDW20-SS342	Silver	0.23 ug/L	0.23U ug/L

Sample	Analyte	Reported Concentration	Modified Final Concentration
LDW20-SS351	Silver	0.27 ug/L	0.27U ug/L
LDW20-SS348	Silver	0.26 ug/L	0.26U ug/L
LDW20-SS349	Silver	0.25 ug/L	0.25U ug/L
LDW20-SS346	Silver	0.24 ug/L	0.24U ug/L
LDW20-SS160	Silver	0.1 ug/L	0.1U ug/L
LDW20-SS204	Silver	0.04 ug/L	0.04U ug/L
LDW20-SS210	Silver	0.08 ug/L	0.08U ug/L

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Metals - Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4 Metals - Laboratory Blank Data Qualification Summary - SDG 20F0300

Sample	Analyte	Modified Final Concentration	A or P
LDW20-SS340	Silver	0.2U ug/L	Α
LDW20-SS353	Silver	0.25U ug/L	Α
LDW20-SS345	Silver	0.24U ug/L	А
LDW20-SS342	Silver	0.23U ug/L	А
LDW20-SS351	Silver	0.27U ug/L	Α
LDW20-SS348	Silver	0.26U ug/L	Α
LDW20-SS349	Silver	0.25U ug/L	Α
LDW20-SS346	Silver	0.24U ug/L	Α
LDW20-SS160	Silver	0.1U ug/L	Α
LDW20-SS204	Silver	0.04U ug/L	Α
LDW20-SS210	Silver	0.08U ug/L	Α

Duwamish AOC4 Metals - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET LDC #: 48765H4a

SDG #: 20F0300

Stage 2B

Reviewer: 2nd Reviewer

Laboratory: Analytical Resources, Inc.

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
l.	Sample receipt/Technical holding times	A-A	
II.	ICP/MS Tune	A_	
111.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	S_{W}	
VI.	Field Blanks	\mathcal{N}_{\perp}	
VII.	Matrix Spike/Matrix Spike Duplicates	LA_	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	Λ	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	\mathcal{N}_{\leftarrow}	
XII.	Internal Standard (ICP-MS)	\mathcal{N}	not reviewed
XIII.	Sample Result Verification	, N	
XIV	Overall Assessment of Data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
-			Watrix	
1	LDW20-SS340	20F0300-01	Sediment	06/16/20
2	LDW20-SS353	20F0300-02	Sediment	06/16/20
3	LDW20-SS345	20F0300-03	Sediment	06/16/20
4	LDW20-SS342	20F0300-04	Sediment	06/16/20
5	LDW20-SS351	20F0300-05	Sediment	06/16/20
6	LDW20-SS348	20F0300-06	Sediment	06/16/20
7	LDW20-SS349	20F0300-07	Sediment	06/16/20
8	LDW20-SS346	20F0300-08	Sediment	06/16/20
9	LDW20-SS160	20F0300-09	Sediment	06/16/20
10	LDW20-SS204	20F0300-10	Sediment	06/16/20
11_	LDW20-SS210	20F0300-11	Sediment	06/16/20
12	LDW20-SS340MS	20F0300-01MS	Sediment	06/16/20
13	LDW20-SS340MSD	20F0300-01MSD	Sediment	06/16/20
14	LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20
15				

CVAA

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Hg

Sample ID	Target Analyte List
1 to 11	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg
QC: 12-14	Hg
	Analysis Method
ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn

Jane 1750 February 1951 Bakes 103 Reviewer:CR

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000) Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: mg/Kg Associated Samples: 1

					Sample Identification									
Analyte	PB (units)	Maximum ICB/CCB (ug/L)	Action Level	1	2	3	4	5	6	7	8	9	10	11
Ag		0.017		0.2	0.25	0.24	0.23	0.27	0.26	0.25	0.24	0.1	0.04	0.08
														l

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is established at 5X the highest ICB, CCB, or PB concentration.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Wet Chemistry

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	<u>Date</u>
LDW20-SS340	20F0300-01	Sediment	06/16/20
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS345	20F0300-03	Sediment	06/16/20
LDW20-SS342	20F0300-04	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS348	20F0300-06	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS346	20F0300-08	Sediment	06/16/20
LDW20-SS160	20F0300-09	Sediment	06/16/20
LDW20-SS204	20F0300-10	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20
LDW20-SS340DUP	20F0300-01DUP	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

LDC #: 48765H6 VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0300

Stage 2B

Laboratory: Analytical Resources, Inc.

Page: of Reviewer: 2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	AIA	
11	Initial calibration	A	
111.	Calibration verification	A	
IV	Laboratory Blanks	A _	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A_	CCS
IX.	Field duplicates	Δ	
X.	Sample result verification	N	
X	Overall assessment of data	L 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 LDW20-SS340 20F0300-01 Sediment 06/16/20 LDW20-SS353 20F0300-02 Sediment 06/16/20 3 LDW20-SS345 20F0300-03 Sediment 06/16/20 LDW20-SS342 20F0300-04 Sediment 06/16/20 5 LDW20-SS351 20F0300-05 Sediment 06/16/20 6 LDW20-SS348 20F0300-06 Sediment 06/16/20 LDW20-SS349 20F0300-07 Sediment 06/16/20 8 LDW20-SS346 20F0300-08 Sediment 06/16/20 LDW20-SS160 20F0300-09 Sediment 06/16/20 10 LDW20-SS204 20F0300-10 Sediment 06/16/20 LDW20-SS210 20F0300-11 Sediment 06/16/20 11 12 LDW20-SS340DUP 20F0300-01DUP Sediment 06/16/20 13 14

Notes:	 	 	

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 111	Total solids, TOC	
QC: 12	TS	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0300

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS353	20F0300-02	Sediment	06/16/20
LDW20-SS351	20F0300-05	Sediment	06/16/20
LDW20-SS349	20F0300-07	Sediment	06/16/20
LDW20-SS210	20F0300-11	Sediment	06/16/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG were reported between 6.5°C and 7.9°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0300

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
LDW20-SS210	1,2,3,4,7,8,9-HpCDF	0.654 ng/Kg	0.654U ng/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0300	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А
All samples in SDG 20F0300	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	А
All samples in SDG 20F0300	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to compounds reported as EMPC and CDPE interference, data were qualified as estimated in four samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0300

Sample	Compound	Flag	A or P	Reason
LDW20-SS353 LDW20-SS351 LDW20-SS349 LDW20-SS210	All compounds reported as estimated maximum possible concentration (EMPC) and greater than the reporting limit.	J (all detects)	А	Compound quantitation (EMPC)
LDW20-SS353 LDW20-SS351 LDW20-SS349 LDW20-SS210	All compounds reported as estimated maximum possible concentration (EMPC) and less than the reporting limit.	U (all non-detects)	А	Compound quantitation (EMPC)
LDW20-SS353 LDW20-SS351 LDW20-SS349 LDW20-SS210	All compounds flagged "X" due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А	Compound quantitation

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0300

Sample	Compound	Modified Final Concentration	A or P
LDW20-SS210	1,2,3,4,7,8,9-HpCDF	0.654U ng/Kg	А

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0300

No Sample Data Qualified in this SDG

SDG :	#:48765H21VALIDATIO #:20F0300 atory: Analytical Resources, Inc.		LETEN tage 28	IESS WORKSHEE		Date: 8/12/2 Page: _/of / Reviewer:
	HOD: HRGC/HRMS Polychlorinated Dioxi	ns/Dibenzo	ofurans (EPA Method 1613B)		Reviewer:
	amples listed below were reviewed for eation findings worksheets.	ch of the fo	ollowing	validation areas. Validat	ion findings are।	noted in attached
	Validation Area			Com	ments	
l.	Sample receipt/Technical holding times	A	Treo	D @ 65-7.90	- Sauc	las
Π.	HRGC/HRMS Instrument performance check	A	77			
III.	Initial calibration/ICV	AA	RSD	<20/3570.	1eV= RC	limits
IV.	Continuing calibration	\triangle	ecv	= Be limits		
V.	Laboratory Blanks	W				
VI.	Field blanks	N				
VII.	Matrix spike/Matrix spike duplicates	N	0	· · · · · · · · · · · · · · · · · · ·		
VIII.	Laboratory control samples / SKM	*	100	,		
IX.	Field duplicates	N				
Χ.	Labeled Compounds	√ (5)				
XI.	Compound quantitation RL/LOQ/LODs	ŹN .				
XII.	Target compound identification	N				
XIII.	System performance	N				
XIV.	Overall assessment of data	A				
lote:	A = Acceptable ND = No N = Not provided/applicable R = Rins	o compounds sate eld blank	detected	D = Duplicate TB = Trip blank EB = Equipment bla	SB=Sourd OTHER: ank	ce blank
	Client ID			Lab ID	Matrix	Date
1	LDW20-SS353			20F0300-02	Sediment	06/16/20
2	LDW20-SS351			20F0300-05	Sediment	06/16/20
3	LDW20-\$S349			20F0300-07	Sediment	06/16/20
4	LDW20-SS210			20F0300-11	Sediment	06/16/20
5						
6						
7						
8						
9						
10						
otes:						
						-

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:	 	

LDC #: 48765H21

VALIDATION FINDINGS WOR/UHEET Blanks

Page: 1 of 1

Reviewer: PG

2nd Reviewer: PG

METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

Blank extraction date: 7/6/20

Blank analysis date: 7/9/20

Conc. units: ng/kg Associated samples: All qual U

Compound	Blank ID	Sample Identification											
	BIF0803-BLK1	5X	4										
o	0.140	0.7											
Р	0.0330	0.165	0.654										
F	0.535	2.675											
Q	1.37	6.85											
G	6.33	31.65											
U	0.284	1.42									1:		
												F	



VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported RLs</u>

Page: _	
Reviewer:	<u>~</u>
2nd Reviewer:	A
•	$\overline{}$

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

Please see qualifications	below for all	questions answered "	'N". Not applicable	questions are	identified as "N/A".

Υ	N	MA
Y	N	N/A

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All results flagged as EMPC		Jdets/A
			V - PC		u/A
		All	All results flagged "X" by the lab due to chlorinated		Jdets/A
		,	diphenyl ether (CDPE) interference		

Comments:	See sample calculation verification worksheet for recalculations		
•			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT416	20F0337-01	Sediment	06/17/20
LDW20-IT416DL	20F0337-01DL	Sediment	06/17/20
LDW20-IT418	20F0337-02	Sediment	06/17/20
LDW20-IT423	20F0337-03	Sediment	06/17/20
LDW20-IT424	20F0337-04	Sediment	06/17/20
LDW20-IT426	20F0337-05	Sediment	06/17/20
LDW20-IT419	20F0337-06	Sediment	06/17/20
LDW20-IT416MS	20F0337-01MS	Sediment	06/17/20
LDW20-IT416MSD	20F0337-01MSD	Sediment	06/17/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 10.4°C and 12.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0337	J (all detects)	А

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW20-IT416MS/MSD (LDW20-IT416 LDW20-IT416DL)	Aroclor-1016	197 (56-120)	193 (56-120)	NA	-

Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-IT416	Aroclor-1254 Aroclor-1260	46.9 53.1	J (all detects) J (all detects)	А
LDW20-IT423	Aroclor-1248 Aroclor-1254 Aroclor-1260	55.3 43.2 51.7	J (all detects) J (all detects) J (all detects)	A
LDW20-IT426	Aroclor-1248 Aroclor-1254 Aroclor-1260	54.1 42.5 57.7	J (all detects) J (all detects) J (all detects)	А
LDW20-IT416DL	Aroclor-1254	47.1	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-IT416	Aroclor-1242	Results exceeded calibration range.	Not reportable	-
LDW20-IT416DL	All compounds except Aroclor-1242	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D and RPD between two columns, data were qualified as estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0337

Sample	Compound	Flag	A or P	Reason
LDW20-IT416 LDW20-IT418 LDW20-IT423 LDW20-IT424 LDW20-IT426 LDW20-IT419	Aroclor-1260	J (all detects)	А	Initial calibration verification (%D)
LDW20-IT416	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT423 LDW20-IT426	Aroclor-1248 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	Α	Compound quantitation (RPD between two columns)
LDW20-IT416DL	Aroclor-1254	J (all detects)	A	Compound quantitation (RPD between two columns)
LDW20-IT416	Aroclor-1242	Not reportable	-	Overall assessment of data
LDW20-IT416DL	All compounds except Aroclor-1242	Not reportable	-	Overall assessment of data

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

SDG Labor METI The s	#:48765l3bVALIDATION #:20F0337 ratory:_Analytical Resources, Inc. HOD: GC Polychlorinated Biphenyls (EP) amples listed below were reviewed for extion findings worksheets.	S A SW846 M	,	F 2nd F	Date: 2/12/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/
	Validation Area		Com	ments	
Ī.	Sample receipt/Technical holding times	A		°C - Save	Lass
11.	Initial calibration/ICV	A WIII	₽0 < =070 k	2162070	earl
111.	Continuing calibration	4	ers = 20%		
IV.	Laboratory Blanks	4		****	· · · · · · · · · · · · · · · · · · ·
V.	Field blanks	1/.			
VI.	Surrogate spikes /#S	XA			
VII.	Matrix spike/Matrix spike duplicates	W		,	
VIII.	Laboratory control samples	\overline{A}	Ledb		
IX.	Field duplicates	$\overline{}$			
X.	Compound quantitation/RL/LOQ/LODs	X			
XI.	Target compound identification	N /			
_ىنك	Overall assessment of data	$\perp M \mid$			
Note:	N = Not provided/applicable R = R	No compounds insate Field blank	detected D = Duplicate TB = Trip blank EB = Equipment bl	SB=Sour OTHER: ank	ce blank
	Client ID		Lab ID	Matrix	Date
l	LDW20-IT416		20F0337-01	Sediment	06/17/20
2	LDW20-IT416 PE D		20F0337-01F X € b 4	Sediment	06/17/20
3	LDW20-IT418		20F0337-02	Sediment	06/17/20
4	LDW20-IT423	20F0337-03	Sediment	06/17/20	
5	LDW20-IT424		20F0337-04	Sediment	06/17/20
6	LDW20-IT426		20F0337-05	Sediment	06/17/20
7	LDW20-IT419		20F0337-06	Sediment	06/17/20
8	LDW20-IT416MS		20F0337-01MS	Sediment	06/17/20
9	LDW20-IT416MSD		20F0337-01MSD	Sediment	06/17/20

3	LDVV20-11-TIONIOD			201 0007-0 TWOD	Ocument	00/11/20
10						
11						
12						
13		 				
Notes	:	·				

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

Notes:		

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page: <u>/</u> of <u>/</u>
Reviewer: 9
2nd Reviewer:
\

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

N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (DN/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
	1/20	5/4056501	K	BB	3/.8	All (dots)	VW/D
	/ /-	/					/ /
			·				
<u> </u>							
 							
						<u> </u>	
<u></u>						<u> </u>	

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

2nd Reviewer:

METHOD: // GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

M N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? Y/N/N/A

Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed? Y (N/N/A

Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#_	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	8/9	V	197 (56-120)	193 (56120)	()	1-2(NB)	Jets/1
	//		()	()	()		
			()	()	()		
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		L	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

LDC #: 48765/36

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	<u>/of /</u>
Reviewer:	9
2nd Reviewer:	7
	(

METHOD: \angle GC $_$ HPLC

Level IV/D Only
Y N (N/A) \

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors ≤40%?

If no, please see findings bellow.

$\overline{}$	If no, please see finding	s bellow.		
#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (<u><</u> 40%)	Qualifications
	AA	/	46.9	Jots/A
	<u>35</u>		53.	
	Z	<i></i>		
		4	55.3 43.2	
	AA		432	
	BB		51.7	
	Z	6	54.1	
	AA		42.5	
	BB		54.1 42.5 57.7	
			·	
	AA	ے	47./	
				· · · · · · · · · · · · · · · · · · ·

LDC #: 18765/36

VALIDATION FINDINGS WORKSHEET <u>Overall Assessment of Data</u>

Page: _	
Reviewer:	\(\)
2nd Reviewer:	A
	(

METHOD: ZGC _ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(<u>y</u>)_{N N/A}

Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	/	Finding /* > ealib unge All except & /		NR/A
				//
	<u> </u>	All except & Y		4
		/ /		
		<u> </u>		

Comments:		 			 	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT416	20F0337-01	Sediment	06/17/20
LDW20-IT418	20F0337-02	Sediment	06/17/20
LDW20-IT423	20F0337-03	Sediment	06/17/20
LDW20-IT424	20F0337-04	Sediment	06/17/20
LDW20-IT426	20F0337-05	Sediment	06/17/20
LDW20-IT419	20F0337-06	Sediment	06/17/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Standard Reference Materials

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Arsenic - Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4 Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4 Arsenic - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

LDC #:	48765I4a	VALIDATIC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Laboratory: Analytical Resources, Inc.

SDG #: 20F0337

METHOD: Arsenic- (EPA SW 846 Method 6020A)

Date 17/20
Page: c of 1
Reviewer: 2nd Reviewer: 2

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	AA	
11.	ICP/MS Tune	A	
JII.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N_{-}	CS
VIII.	Duplicate sample analysis	N,	cS
IX.	Serial Dilution	N	
X.	Laboratory control samples	A.	SRM
XI.	Field Duplicates	N_{i}	4
XII.	Internal Standard (ICP-MS)	<i>iV</i>	notheritud
XIII.	Sample Result Verification	N	
XIV	Overall Assessment of Data	A	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

SB=Source blank OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT416	20F0337-01	Sediment	06/17/20
2	LDW20-IT418	20F0337-02	Sediment	06/17/20
3	LDW20-IT423	20F0337-03	Sediment	06/17/20
4	LDW20-IT424	20F0337-04	Sediment	06/17/20
5	LDW20-IT426	20F0337-05	Sediment	06/17/20
6	LDW20-IT419	20F0337-06	Sediment	06/17/20
7				
8				
9				
10				
11				
12				
13				

Notes:			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Wet Chemistry

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

	Laboratory Sample		Collection
Sample Identification	Identification	Matrix	Date
LDW20-IT416	20F0337-01	Sediment	06/17/20
LDW20-IT418	20F0337-02	Sediment	06/17/20
LDW20-IT423	20F0337-03	Sediment	06/17/20
LDW20-IT424	20F0337-04	Sediment	06/17/20
LDW20-IT426	20F0337-05	Sediment	06/17/20
LDW20-IT419	20F0337-06	Sediment	06/17/20
LDW20-IT426MS	20F0337-05MS	Sediment	06/17/20
LDW20-IT426MSRE	20F0337-05MSRE	Sediment	06/17/20
LDW20-IT426DUP	20F0337-05DUP	Sediment	06/17/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

LDC #: 48765l6	VALIDATION COMPLETENESS WORKSHEET

SDG #: 20F0337 Laboratory: <u>Analytical Resources, Inc.</u> Stage 2B

	Date:	811°	<u> 1170</u>
	Page:	of	<u>\</u>
	Reviewer:	9	
2nd	Reviewer:	4	

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
l.	Sample receipt/Technical holding times	AA	
П	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	\mathcal{N}	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	À	
IX.	Field duplicates	\mathcal{N}	
X.	Sample result verification	N	
LXL	Overall assessment of data	LX	

Note:

A = Acceptable

SW = See worksheet

N = Not provided/applicable

le

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank
EB = Equipment blank

SB=Source blank

OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-IT416	20F0337-01	Sediment	06/17/20
2	LDW20-IT418	20F0337-02	Sediment	06/17/20
3	LDW20-IT423	20F0337-03	Sediment	06/17/20
4	LDW20-IT424	20F0337-04	Sediment	06/17/20
5	LDW20-IT426	20F0337-05	Sediment	06/17/20
6	LDW20-IT419	20F0337-06	Sediment	06/17/20
7	LDW20-IT426MS 多	20F0337-05MS 3	Sediment	06/17/20
8	LDW20-IT426MSQ & C E	20F0337-05MS Q & R E	Sediment	06/17/20
9	LDW20-IT426DUP	20F0337-05DUP	Sediment	06/17/20
10				
11				
12				
13				
14				
15				

Notes:		 	 		
				3.00	

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 6	Total solids, TOC
QC: 7,8	TOC
	9 TS, TOC

METHOD: Inorganics

MS analysis was performed by the laboratory. All MS percent recoveries (%R) were within the acceptable limits with the following exceptions.

MS ID	Matrix	Analyte	MS %R	%R Limit	Assocaited	Qualification	Det/ND
	7 s	тос	147	75-125	5	No qual (re-analyzed and within QC limits)	Det
							<u> </u>
		1					
		1					

Comments:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Polychlorinated Dioxins/Dibenzofurans

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0337

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT419	20F0337-06	Sediment	06/17/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 12.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0337

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration		
LDW20-IT419	1,2,3,4,7,8,9-HpCDF	0.099 ng/Kg	0.099U ng/Kg		
	OCDF	2.32 ng/Kg	2.32U ng/Kg		

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0337

Sample	Compound	Modified Final Concentration	A or P
LDW20-IT419	1,2,3,4,7,8,9-HpCDF OCDF	0.099U ng/Kg 2.32U ng/Kg	А

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0337

No Sample Data Qualified in this SDG

	#: 48765121 VALIDATIC #: 20F0337		PLETENES: Stage 2B	S WORKSHEET		Date 3/2/2
	ratory: <u>Analytical Resources, Inc.</u>		stage ZD		F	Page:of_/_ Reviewer:/
METH The s	HOD: HRGC/HRMS Polychlorinated Dioxamples listed below were reviewed for extion findings worksheets.			•	2nd F	Reviewer:/
	Validation Area			Comn	nents	
1.	Sample receipt/Technical holding times	4	Telep (e	12.800-	Some Law	1
11.	HRGC/HRMS Instrument performance check	1	/			
III.	Initial calibration/ICV	A/A	RSOSO	20/3570.	10V < 00	chaits
IV.	Continuing calibration	A	CCV =	ac limit	s	
V.	Laboratory Blanks	w,				
VI.	Field blanks	\mathcal{N}_{-}				· · · · · · · · · · · · · · · · · · ·
VII.	Matrix spike/Matrix spike duplicates	N	15		-	
VIII.	Laboratory control samples	\triangleleft	LCG			
IX.	Field duplicates	\mathcal{N}				
Χ.	Labeled Compounds	\triangle				
XI.	Compound quantitation RL/LOQ/LODs	N		1-1-1		· · · · · · · · · · · · · · · · · · ·
XII.	Target compound identification	N				
XIII.	System performance	N_				
XIV.	Overall assessment of data	<u> </u>				
Note:	N = Not provided/applicable R = Ri	No compounds nsate Field blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blar	SB=Sourd OTHER: nk	ce blank
	Client ID			Lab ID	Matrix	Date
1	LDW20-IT419			20F0337-06	Sediment	06/17/20
2						
3						
4						
5						
6						
7						
8						
0						

10 Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:			

LDC #: 48765I21

VALIDATION FINDINGS WOR/UHEET Blanks

Page:	<u>1</u> of <u>1</u>
Reviewer:	PG
2nd Reviewer:	*
	$\overline{}$

METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

Blank extraction date: 7/6/20 Blank analysis date: 7/9/20

Conc. units: ng/kg Associated samples: All qual U

76566ated Gampies. 741 gdai 6													
Compound_	Blank ID		Sample Identification										
	BIF0803-BLK1	5X	1							<u> </u>			
0	0.140	0.7											
Р	0.0330	0.165	0.099										
F	0.535	2.675									ļ		
Q	1.37	6.85	2.32										
G	6.33	31.65											
U	0.284	1.42	<u> </u>										

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Polychlorinated Biphenyls

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0361

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT319	20F0361-01	Sediment	06/19/20
LDW20-IT319DL	20F0361-01DL	Sediment	06/19/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 8.8°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0361	J (all detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
LDW20-IT319	Decachlorobiphenyl	146 (40-126)	All compounds	J (all detects)	Α

All internal standard areas and retention times were within QC limits with the following exceptions:

Sample	Internal Standards	Area (Limits)	Affected Compound	Flag	A or P
LDW20-IT319	Hexabromobiphenyl	38 (50-200)	Aroclor-1260	J (all detects)	Α

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed not reportable as follows:

Sample	Compound	Reason	Flag	A or P
LDW20-IT319DL	All compounds	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, surrogate %R, and internal standard area, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0361

Sample	Compound	Flag	A or P	Reason
LDW20-IT319	Aroclor-1260	J (all detects)	А	Initial calibration verification (%D)
LDW20-IT319	All compounds	J (all detects)	Α	Surrogates (%R)
LDW20-IT319	Aroclor-1260	J (all detects)	А	Internal standards (area)
LDW20-IT319DL	All compounds	Not reportable	-	Overall assessment of data

Duwamish AOC4

Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

				9 MOKVQUEE	1	Date: <u>8/17/</u>
	#: 20F0361	S	tage 2B		-	Page: / of /
₋abo	ratory: <u>Analytical Resources, Inc.</u>					Reviewer: // Reviewer: //
MET	HOD: GC Polychlorinated Biphenyls (EP	A SW846 M	ethod 8082A)	ZIId I	teviewer
	samples listed below were reviewed for e ation findings worksheets.	each of the fo	ollowing valida	ation areas. Validat	ion findings are	noted in attache
/allua	ation indings worksneets.					
	Validation Area			Com	ments	
ı.	Sample receipt/Technical holding times	T-A	Trees (0 8.80C	III GIII S	
II.	Initial calibration/ICV	A W	1	20.0		
III.	Continuing calibration	- A	ecv = :	207/		
IV.	Laboratory Blanks	A			,	
V.	Field blanks	N				
VI.	Surrogate spikes / 15	WD				
VII.	Matrix spike/Matrix spike duplicates	Ň.	c5			
VIII.	Laboratory control samples / SEM	AA	205			
łX.	Field duplicates	À				
X.	Compound quantitation/RL/LOQ/LODs	N				
XI.	Target compound identification	N /				
XII	Overall assessment of data	W				
lote:	N = Not provided/applicable R = R	No compounds insate Field _/ blank	detected	D = Duplicate TB = Trip blank EB = Equipment bla	SB=Sourc OTHER: ink	e blank
	Client ID			Lab ID	Matrix	Date
1	LDW20-IT319			20F0361-01	Sediment	06/19/20
2	LDW20-IT319RE			20F0361-01RE	Sediment	06/19/20
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VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chiordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

Notes:					

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	/of/_
Reviewer:_	9-
2nd Reviewer:	91

METHOD: GC HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? %D or %R

M N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (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
	1/20	SHOOS6-SCVI	10	BB	2/.8	All (Lats)	VUVA
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LDC #: 48/65/36

VALIDATION FINDINGS WORKSHEET Surrogate Recovery

Page:_	<u>/</u> of_/
Reviewer:	α
2nd Reviewer:	7

METHOD: _	GC HPLC
	required by the method? Yes or No
Please see qua	alifications below for all questions answered "N". Not applicable questions are identified as "N/A".
VY NV/A	Were surrogates spiked into all samples and blanks?
<u>Y N N/A</u> Y N N/A	Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Lim	its)	Qualifications
	1 1 dets-	N 10)	.0	0146	(40-126)	Set of A
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)	
		<u> </u>	L			

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
Α	Chlorobenzene (CBZ)	G	Octacosane	М	Benzo(e)Pyrene	s	1-Chloro-3-Nitrobenzene	Υ	Tetrachloro-m- xylene
В	4-Bromofluorobenzene (BFB)	Н	Ortho-Terphenyl	N	Terphenyl-D14	Т	3,4-Dinitrotoluene	z	1,2-Dinitrobenzene
С	a,a,a-Trifluorotoluene		Fluorobenzene (FBZ)	0	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	Р	1-methylnaphthalene	V	Tri-n-propyltin	<u> </u>	
Е	1,4-Dichlorobutane	к	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	w	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	Ĺ	Bromobenzene	R	4-Nitrophenol	Х	Triphenvl Phosphate		

.....

LDC#:4876577b

VALIDATION FINDINGS WORKSHEET <u>Internal Standards</u>

Page:_	<u>/_qf/_</u>
Reviewer:_	<i>'</i>
nd Reviewer	11

METHOD: LC/MS Perchlorate

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N/A Were all internal standard area counts within -50 to +100 of the associated calibration standard?

YN N/A Were the retention times of the internal standards within +/- 30 seconds of the retention times of the associated calibration standard?

#	Date	Sample ID	Internal Standard	Area (Limits)	RT (Limits)	Qualifications
		1 (kets)	HAB	Area (Limits) 38 (50 - 200)		VA (BB)
		/				/ / /
 						
						-

<u> </u>						

HBB= Hoxabromob; phony/

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page: _	
Reviewer:	4
2nd Reviewer:	7

LDC#:48//sisb

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y/N N/A

Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	2	Ar (diluted)		NR/A

Comments:	 		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Arsenic

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0361

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT319	20F0361-01	Sediment	06/19/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Arsenic - Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4 Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

				WORKSHEET		Date:
	#: <u>20F0361</u>	,	Stage 2B		-	Page:of_\
abor	atory: Analytical Resources, Inc.					Reviewer: A
IETH	IOD: Arsenic 75a (EPA SW 846 Method	6020A)				
.	amples listed below were reviewed for ea	ab of the	following volidat	ion orogo Volidatio	on findings are	noted in attach
	ampies listed below were reviewed for ea tion findings worksheets.	ich of the	iollowing validat	ion areas. Validati	on illidings are	noted in attach
		T				
	Validation Area			Comm	nents	
l.	Sample receipt/Technical holding times	AA_				
II.	ICP/MS Tune	A			 	
III.	Instrument Calibration	I A				
IV.	ICP Interference Check Sample (ICS) Analysis	A				
V.	Laboratory Blanks	A				
VI.	Field Blanks	<i>N</i>				
VII.	Matrix Spike/Matrix Spike Duplicates	N	CS			
VIII.	-Đưplicate sample analysis	N_	CS			
IX.	Serial Dilution	\mathcal{N}				
Χ.	Laboratory control samples	A				
XI.	Field Duplicates	$\mathcal{N}_{\mathcal{I}}$		4		
XII.	Internal Standard (ICP-MS)	\mathcal{N}	note	reved		
XIII.	Sample Result Verification	N				
XIV	Overall Assessment of Data	A				
te:	N = Not provided/applicable R = Rin	o compound sate eld blank	ds detected	D = Duplicate TB = Trip blank EB = Equipment blar	SB=Sour OTHER: k	ce blank
	Client ID			Lab ID	Matrix	Date
l	_DW20-IT319			20F0361-01	Sediment	06/19/20
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Notes:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0361

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT319	20F0361-01	Sediment	06/19/20
LDW20-IT319DUP	20F0361-01DUP	Sediment	06/19/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20F0361

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0361

No Sample Data Qualified in this SDG

						,
LDC#	: 48765J6 VALIDAT I			S WORKSHEET	Γ	Date: 817
	:	S	Stage 2B		_	Page: <u> </u> of_
Labora	atory: Analytical Resources, Inc.				F 2nd F	Page: _of_ Reviewer: Reviewer:
					ZIIG I	CONCOVER
METH	OD: (Analyte) TOC (EPA SW846 Met	thod 9060A).	, Total Solids	(SM 2540G)		
The sa	amples listed below were reviewed for	each of the f	ollowing valid	ation areas. Validat	ion findings are	noted in attach
	ion findings worksheets.					
	Validation Area			Com	monto.	
I.	Sample receipt/Technical holding times	Λ / Λ		Com	<u>nents</u>	
11	Initial calibration	Δ				
III.	Calibration verification	A			-	
IV	Laboratory Blanks	SW				
V	Field blanks					
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS			
VII.	Duplicate sample analysis	A				
VIII.	Laboratory control samples	A	LCS			
IX.	Field duplicates	\mathcal{N}				
X.	Sample result verification	N				
ΧI	Overall assessment of data					,
lote:	N = Not provided/applicable $R = F$	No compound Rinsate Field blank	s detected	D = Duplicate TB = Trip blank EB = Equipment bla	SB=Sour OTHER: nk	ce blank
c	lient ID			Lab ID	Matrix	Date
1 L	DW20-IT319			20F0361-01	Sediment	06/19/20
2 L	DW20-IT319DUP			20F0361-01DUP	Sediment	06/19/20
3						
4						
5						
6						
7						
8			- Control of the cont			
9						
10						
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12			·			
13						

Notes:

LDC #: 48765J6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
	1 Total solids, TOC
QC: 2	TS

LDC #: 48765J6

VALIDATION FINDINGS WORKSHEET <u>Laboratory Blank Contamination (PB/ICB/CCB)</u>

Page 1 of 1 Reviewer:CR

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: %

Associated Samples: All

						Samı	ole Identific	ation		
Analyte	PB (units)	Maximum ICB/CCB (%)	Action Level	No qualifier	·s					
TOC		0.02	0.2							

Comments: The listed analyte concentration is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establised at 52

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 14, 2020

Parameters:

Semivolatiles

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT383MS	20F0405-01MS	Sediment	06/23/20
LDW20-IT383MSD	20F0405-01MSD	Sediment	06/23/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270E in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to nonconformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 7.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Semivolatiles – Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4 Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4 Semivolatiles - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

SDG #	: 48765K2b VALIDATIO b: 20F0405 atory: Analytical Resources, Inc.		LETENES: tage 2B	S WORKSHEET		Date: 2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/
ИЕТН	OD: GC/MS Polynuclear Aromatic Hydro	ocarbons (E	EPA SW 846	Method 8270E-SIM)	ZIIU F	keviewei
	amples listed below were reviewed for ea ion findings worksheets.	ch of the fo	ollowing valida	ation areas. Validation	n findings are ı	noted in attached
	Validation Area			Comme	ents	
1.	Sample receipt/Technical holding times	A	Texp(0 7.30C-Sa	ne day	
II.	GC/MS Instrument performance check	X			7	
III.	Initial calibration/ICV	AIA	R50===	0%. ICY:	≤30P0	
IV.	Continuing calibration	A	COVE	30/0 20/0	ι -	
V.	Laboratory Blanks	A		/		
VI.	Field blanks	N				
VII.	Surrogate spikes	\bigcirc				
VIII.	Matrix spike/Matrix spike duplicates	A,				
IX.	Laboratory control samples /SRM	D /A	100	***************************************		
X.	Field duplicates	/N				
XI.	Internal standards	*				
XII.	Compound quantitation RL/LOQ/LODs	N				
XIII.	Target compound identification	N				
XIV.	System performance	N				
XV.	Overall assessment of data	₹				
ote:	N = Not provided/applicable R = Rins	o compounds sate eld blank	detected	D = Duplicate TB = Trip blank EB = Equipment blank	SB=Sourc OTHER:	ce blank
c	lient ID			Lab ID	Matrix	Date
L	DW20-IT383			20F0405-01	Sediment	06/23/20
2 L	DW20-IT383MS			20F0405-01MS	Sediment	06/23/20
3 L	DW20-IT383MSD			20F0405-01MSD	Sediment	06/23/20
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<u>, </u>						
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otes:						

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 14, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT313DL	20F0405-02DL	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT304DL	20F0405-03DL	Sediment	06/23/20
LDW20-IT415	20F0405-04	Sediment	06/23/20
LDW20-IT415DL	20F0405-04DL	Sediment	06/23/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for samples in this SDG were reported between 6.4°C and 7.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/02/20	SIG0056-SCV1	1C	Aroclor-1260	21.8	All samples in SDG 20F0405	J (all detects)	Α

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits with the following exceptions:

Sample	Internal Standards	Area (Limits)	Affected Compound	Flag	A or P
LDW20-IT383	Hexabromobiphenyl	48 (50-200)	Aroclor-1260	J (all detects)	Р

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LDW20-IT383	Aroclor-1248	58.2	J (all detects)	А
LDW20-IT415	Aroclor-1254 Aroclor-1260	56.8 40.4	J (all detects) J (all detects)	А

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-JT313	Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT313DL	All compounds except Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-
LDW20-IT304	Aroclor-1248 Aroclor-1254 Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW20-IT304DL	All compounds except Aroclor-1248 Aroclor-1254 Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-
LDW20-IT415	Aroclor-1248 Aroclor-1254	Results exceeded calibration range.	Not reportable	-
LDW20-IT415DL	All compounds except Aroclor-1248 Aroclor-1254	Results from undiluted analyses were more usable.	Not reportable	-

Due to ICV %D, internal standard area, and RPD between two columns, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Biphenyls - Data Qualification Summary - SDG 20F0405

Sample	Compound	Flag	A or P	Reason
LDW20-IT383 LDW20-IT313 LDW20-IT304DL LDW20-IT415	Aroclor-1260	J (all detects)	А	Initial calibration verification (%D)
LDW20-IT383	Aroclor-1260	J (all detects)	Р	Internal standards (area)
LDW20-IT383	Aroclor-1248	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-IT415	Aroclor-1260	J (all detects)	А	Compound quantitation (RPD between two columns)
LDW20-IT313	Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT313DL	All compounds except Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT304	Aroclor-1248 Aroclor-1254 Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-IT304DL	All compounds except Aroclor-1248 Aroclor-1254 Aroclor-1260	Not reportable	-	Overall assessment of data
LDW20-IT415	Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data
LDW20-IT415DL	All compounds except Aroclor-1248 Aroclor-1254	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

				S WURKSHEET		Date: <u>79/29/2</u>
	#: <u>20F0405</u> atory: <u>Analytical Resources, Inc.</u>	3	tage 2B		F	Page: // of/ Reviewer:
Labore	atory. Anarytical Nesources, me.					Reviewer: 0
METH	IOD: GC Polychlorinated Biphenyls (EPA	A SW846 M	ethod 8082A	4)		
The sa	amples listed below were reviewed for ea	ach of the fo	ollowing valid	lation areas. Validation	findings are	noted in attached
	tion findings worksheets.					
	T	T				
	Validation Area			Comme		
<u>I.</u>	Sample receipt/Technical holding times	1 X	Text	06.4-7.20.	= Same a	day
II.	Initial calibration/ICV	A M	RSB	20/0 /eV-	520/0	\bigcup
III.	Continuing calibration	★	Cel/ <	520/0		
IV.	Laboratory Blanks	*				
V.	Field blanks	1 1/				
VI.	Surrogate spikes	1				
VII.	Matrix spike/Matrix spike duplicates	N	<i>es</i>			
VIII.	Laboratory control samples /SRM	A/A	109			
IX.	Field duplicates	<u> </u>				
X.	Compound quantitation/RL/LOQ/LODs	₹W				
XI.	Target compound identification	N				
XII	Overall assessment of data	14H				
Note:	ote: 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 L	_DW20-IT383		**	20F0405-01	Sediment	06/23/20
2 L	_DW20-IT313			20F0405-02	Sediment	06/23/20
3 L	DW20-IT313RE D			20F0405-02RED	Sediment	06/23/20
4 L	_DW20-IT304			20F0405-03	Sediment	06/23/20
5 L	DW20-IT304RE			20F0405-03RE DL	Sediment	06/23/20
6 L	DW20-IT415			20F0405-04	Sediment	06/23/20
7 L	DW20-IT415RE			20F0405-04RE	Sediment	06/23/20
8						
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VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	

Notes:		

LDC #: 18/16/36

VALIDATION FINDINGS WORKSHEET Initial Calibration Verification

Page:_	
Reviewer:_	9
2nd Reviewer:	

METHOD: √GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

What type of initial calibration verification calculation was performed? ___%D or ___%R

Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	7/20	51400565CV	1e	BB	2/8	All (dats)	VIII/A
	7-7-5	7-7					777
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LDC #: 48765 1230

VALIDATION FINDINGS WORKSHEET Internal Standards

Page:_	<u>/ of /</u>	
Reviewer:_	4	
nd Reviewer:	4_	•

METHOD: LC/MS Perchlorate

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y/N/A Were all internal standard area counts within -50 to +100 of the associated calibration standard?

Were the retention times of the internal standards within +/- 30 seconds of the retention times of the associated calibration standard?

#	Date	Sample ID	Internal Standard	Area (Limite)		
#	Date			Area (Limits)	RT (Limits)	Qualifications
		/ Cloty)	#BB	48 (50-200)		Valt (BB)
		1/				
		·				
)				

			######################################			
		,				<u> </u>

HBB= Hexabromabithony/

LDC #48765K-

VALIDATION FINDINGS WORKSHEET <u>Compound Quantitation and Reported CRQLs</u>

Page: _	
Reviewer:	7
2nd Reviewer:	- A

METHOD: <u>GC</u> HPLC

Level IV/D Only

Y N M/A) Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Y N Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

Did the relative percent differences of detected compounds between two columns/detectors ≤40%?

If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	2	/	58.2	Joet of
	AA BB	6	56.8	
	BB		40.4	W

LDC #: 48765836

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page: _	of
Reviewer:	9
2nd Reviewer:	ap
•	

METHOD: ___GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

YN N/A

Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding AA > caleb lunge	Associated Samples	Qualifications
	2	AA > caleb lange		WR/K
	3	All except AA		
		/		
	4	Z. AA. BB > calib rang	2	
	<u>'</u>			
	5	Allexcept Z. AA, BB		
		′		
	X \$6	## Z. AA * > coleb	un e	
	7	All except Z. AA		
	<u>'</u>	/		

Comments:		 	 ·	 	 	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Arsenic

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT415	20F0405-04	Sediment	06/23/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic by Environmental Protection Agency (EPA) SW 846 Method 6020A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Arsenic - Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4 Arsenic - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4 Arsenic - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

SDG : Labor	#: 20F0405 atory: <u>Analytical Resources, Inc.</u>	(PLETENES Stage 2B	S WORKSHEET		Date: \$\frac{17}{2}\$ Page: of \frac{1}{2}\$ Reviewer: \frac{1}{2}\$
METH	HOD: Arsenic-75a (EPA SW 846 Method	6020A)				-
	amples listed below were reviewed for ea tion findings worksheets.	ch of the t	following valida	ation areas. Validation	findings are	noted in attached
	Validation Area			Comme	nts	
1.	Sample receipt/Technical holding times	AA				
II.	ICP/MS Tune	A				
111.	Instrument Calibration	A				
IV.	ICP Interference Check Sample (ICS) Analysis	A				
V.	Laboratory Blanks	A				
VI.	Field Blanks	\mathcal{N}_{\perp}				
VII.	Matrix Spike/Matrix Spike Duplicates	N	<u>CS</u>			
VIII.	Duplicate sample analysis	N	CS_			
IX.	Serial Dilution	\mathcal{N}				
X.	Laboratory control samples	A	LCS			
XI.	Field Duplicates	N			· · · · · ·	
XII.	Internal Standard (ICP-MS)	\mathcal{N}_{-}	notiev	rend		
XIII.	Sample Result Verification	N				
XIV	Overall Assessment of Data			***************************************		
Note:	N = Not provided/applicable R = Rin	o compound sate eld blank	s detected	D = Duplicate TB = Trip blank EB = Equipment blank	SB=Source OTHER:	ce blank
	Client ID			Lab ID	Matrix	Date
1 1	LDW20-IT383			20F0405-01	Sediment	06/23/20
2	LDW20-IT313			20F0405-02	Sediment	06/23/20
3 1	LDW20-IT304			20F0405-03	Sediment	06/23/20
4 1	LDW20-IT415			20F0405-04	Sediment	06/23/20
5						
6						

Client ID	Lab ID	Matrix	Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT415	20F0405-04	Sediment	06/23/20
	LDW20-IT383 LDW20-IT313 LDW20-IT304	LDW20-IT383 20F0405-01 LDW20-IT313 20F0405-02 LDW20-IT304 20F0405-03	LDW20-IT383 20F0405-01 Sediment LDW20-IT313 20F0405-02 Sediment LDW20-IT304 20F0405-03 Sediment

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: August 17, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT383	20F0405-01	Sediment	06/23/20
LDW20-IT313	20F0405-02	Sediment	06/23/20
LDW20-IT304	20F0405-03	Sediment	06/23/20
LDW20-IT415	20F0405-04	Sediment	06/23/20
LDW20-IT304MS	20F0405-03MS	Sediment	06/23/20
LDW20-IT304DUP	20F0405-03DUP	Sediment	06/23/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4 Wet Chemistry - Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

			PLETENESS WORKSHEET		Date:
	: <u>20F0405</u>	S	tage 2B	-	Page: \of_ Reviewer:
Labora	atory: Analytical Resources, Inc.				Reviewer:
METH	OD: (Analyte) TOC (EPA SW846 M	<u>lethod 9060A),</u>	Total Solids (SM 2540G)		
The sa	amples listed below were reviewed fo	or each of the f	ollowing validation areas. Validation	on findings are	noted in attache
validat	ion findings worksheets.				
ſ <u></u>			_		
	Validation Area	1 4 1	<u>Comn</u>	nents	
I.	Sample receipt/Technical holding times	A14			
	Initial calibration	<u> </u>			
III.	Calibration verification	A			
IV	Laboratory Blanks	A			
V	Field blanks	N N			
VI.	Matrix Spike/Matrix Spike Duplicates	<u> </u>			
VII.	Duplicate sample analysis	A			
VIII.	Laboratory control samples		LCS, SRM		
IX.	Field duplicates				
X.	Sample result verification	N			
ΧI	Overall assessment of data	<u> </u>			
Note:	N = Not provided/applicable R:	O = No compound = Rinsate B = Field blank	D = Duplicate TB = Trip blank EB = Equipment blan	SB=Sour OTHER: nk	ce blank
	Client ID		Lab ID	Matrix	Date
1 L	DW20-IT383		20F0405-01	Sediment	06/23/20
	DW20-IT313		20F0405-02	Sediment	06/23/20
	DW20-IT304		20F0405-03	Sediment	06/23/20
4 L	DW20-IT415		20F0405-04	Sediment	06/23/20
5 L	DW20-IT304MS		20F0405-03MS	Sediment	06/23/20
	DW20-IT304DUP		20F0405-03DUP	Sediment	06/23/20
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Notes:				
				
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 LDC #: 48765K6

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page 1 of 1 Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List	
1 to 4	Total solids, TOC	
QC: 5, 6	ТОС	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Duwamish AOC4

LDC Report Date:

August 17, 2020

Parameters:

Polychlorinated Dioxins/Dibenzofurans

Validation Level:

Stage 2B

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): 20F0405

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-IT304	20F0405-03	Sediment	06/23/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperature for samples in this SDG was reported at 7.2°C upon receipt by the laboratory. Since the samples were received the same day that they were collected, time did not allow for sufficient cooling of the samples, therefore no data were qualified.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
BIF0803-BLK1	07/06/20	1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD	0.140 ng/Kg 0.0330 ng/Kg 0.535 ng/Kg 1.37 ng/Kg 6.33 ng/Kg 0.284 ng/Kg	All samples in SDG 20F0405

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 20F0405	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А

Sample	Finding	Flag	A or P
All samples in SDG 20F0405	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	А

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to compounds reported as EMPC and CDPE interference, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4 Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 20F0405

Sample	Compound	Flag	A or P	Reason
LDW20-IT304	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	А	Compound quantitation (EMPC)
LDW20-IT304	All results flagged "X" by the laboratory due to chlorinated diphenyl ether (CDPE) interference.	J (all detects)	A	Compound quantitation (CDPE interference)

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

Duwamish AOC4

Polychlorinated Dioxins/Dibenzofurans - Field Blank Data Qualification Summary - SDG 20F0405

No Sample Data Qualified in this SDG

_DC#	t: 48765K21 VALIDATIO	N COMF	PLETENES	SS WORKSHEE	T	Date: 8/13/2
	#: <u>20F0405</u>					
_abora	atory: Analytical Resources, Inc.					Reviewer:
METU	IOD: UPGC/UPMS Polychlarinated Diay	ins/Dibonz	ofurana (ED	A Mothod 1613D)	2nd l	Reviewer: 7
VIE I I	IOD: HRGC/HRMS Polychlorinated Diox	IIIS/DIDENZ	oluraris (EP	A Welliou 1013b)		
The sa	amples listed below were reviewed for ea	ach of the f	ollowing vali	dation areas. Valida	tion findings are	noted in attached
	tion findings worksheets.				_	
	I					
	Validation Area	1 ,,			ments	
<u>l.</u>	Sample receipt/Technical holding times	A	7.2	· °C		
II.	HRGC/HRMS Instrument performance check	A				
III.	Initial calibration/ICV	AA	RSD-	20/35/0.	Ret ICV	eclinits
IV.	Continuing calibration	A.	COV:	< RCLimit	5	
V.	Laboratory Blanks	W			_	
VI.	Field blanks	\				
VII.	Matrix spike/Matrix spike duplicates	1/				
VIII.	Laboratory control samples	A	100			
IX.	Field duplicates	1/				
X.	Labeled Compounds / FM	À				
XI.	Compound quantitation RL/LOQ/LODs	5W				
XII.	Target compound identification	N				
XIII.	System performance	N				
XIV.	Overall assessment of data	1				
		X_	1			
ote:	A = Acceptable $ND = NN = Not provided/applicable$ $R = Rin$	lo compound: isate	s detected	D = Duplicate TB = Trip blank	SB=Sou OTHER:	ce blank
		ield blank		EB = Equipment bla	ank	
T	Client ID			Labin	Matrice	D-4-
				Lab ID	Matrix	Date
	.DW20-IT304			20F0405-03	Sediment	06/23/20
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VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:		 		

LDC #: 48765K21

VALIDATION FINDINGS WOR/UHEET Blanks

Page:	<u>1_of_1_</u>
Reviewer:_	PG
2nd Reviewer:_	4

METHOD: HRGC/HRMS Dioxins (EPA Method 1613B)

Blank extraction date: 7/6/20 Blank analysis date: 7/9/20

Conc. units: ng/kg Associated samples: All qual U

Compound	Blank ID		Sample Identification							
	BIF0803-BLK1	5X								
0	0.140	0.7								
Р	0.0330	0.165								
F	0.535	2.675								
Q	1.37	6.85							 	
G	6.33	31.65								
U	0.284	1.42					 	 	 	

LDC #: 48765

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported RLs

Page: _	
Reviewer:	<u> </u>
2nd Reviewer:	47

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B/SGS AXYS Method MLA-017)

Please see qualifications below for a	ll questions answered "l	N". Not applicable questions	are identified as "N/A".
---------------------------------------	--------------------------	------------------------------	--------------------------

Y N N/A Y N N/A

Were the correct labeled compound, quantitation ions and relative response factors (RRF) used to quantitate the compound? Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		\$ 1/	All results flagged as EMPC		Jdets/A
 					
ļ		All	All results flagged "X" by the lab due to chlorinated		Jdets/A
			diphenyl ether (CDPE) interference		
ļ					

Comments:	See sample calculation verification worksheet for recalculations
_	