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

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

November 4, 2021

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 September 13, 2021. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #52054_RV1:

SDG #	Fraction
21F0418, 21F0430, 21F0441, 21F0442 21G0001, 21G0028, 21G0030, 21G0050 21G0051, 21G0064, 21G0079, 21G0082 21G0089, 21G0094, 21G0108, 21G0111 21G0112, 21G0114, 21G0126, 21G0127 21G0138, 21G0140, 21G0141, 21G0145 21G0156, 21G076	Semivolatiles, PAHs, Hexachlorobenzene, PCBs, Metals

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020)
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review (January 2017)
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (January 2017)
- 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
Project Manager/Senior Chemist
pgeng@lab-data.com

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

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

October 6, 2021

SUBJECT: Duwamish AOC4 - Data Validation

Dear Ms. Vandervort,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on September 13, 2021. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #52054:

SDG #	Fraction
21F0418, 21F0430, 21F0441, 21F0442 21G0001, 21G0028, 21G0030, 21G0050 21G0051, 21G0064, 21G0079, 21G0082 21G0089, 21G0094, 21G0108, 21G0111 21G0112, 21G0114, 21G0126, 21G0127 21G0138, 21G0140, 21G0141, 21G0145 21G0156, 21G076	Semivolatiles, PAHs, Hexachlorobenzene, PCBs, Metals

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020)
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review (January 2017)
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (January 2017)
- 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
Project Manager/Senior Chemist
pgeng@lab-data.com

223 pages-ADV

Attachment 1

2B/4 (client Select) EDD

LDC# 52054 (Windward Environmental, LLC - Seattle, WA / Duwamish AOC4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	SVOA (8270E)		(2) SVOA (8270E)		(1) SVOA (8270E)		PAHs (8270E -SIM)		(1) PAHs (8270E -SIM)		(1) Pest (8081B)		PCBs (8082A)		(3) Metals (6020B)		(1) Metals (6020B)		4 Metals (6020B-UCT-KED)		2 Metals (6020B-UCT-KED)		1 Metals (6020B-UCT-KED)		Hg (7471B)							
Matrix:	Water/Sediment			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	21F0418	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	10	-	-	-	-	-	-	-	-	-	-	-	-						
B	21F0430	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	13	0	4	-	-	0	4	-	-	-	-	0	4						
C	21F0441	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	11	-	-	-	-	-	-	-	-	-	-	-	-						
D	21F0442	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	9	-	-	-	-	-	-	-	-	-	-	-	-						
E	21G0001	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	17	-	-	-	-	-	-	-	-	-	-	-	-						
F	21G0028	09/13/21	10/04/21	-	-	-	-	-	-	0	5	-	-	-	-	0	15	-	-	-	-	-	-	-	-	-	-	0	5						
G	21G0030	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	4	-	-	-	-	-	-	-	-	-	-	-	-						
H	21G0050	09/13/21	10/04/21	-	-	-	-	0	5	-	-	-	-	-	-	0	26	-	-	-	-	-	-	-	-	-	-	-	-						
I	21G0051	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	4	-	-	-	-	-	-	-	-	-	-	-	-						
J	21G0064	09/13/21	10/04/21	-	-	-	-	0	1	0	1	-	-	-	-	0	10	-	-	-	-	-	-	-	-	0	6	-	-						
K	21G0079	09/13/21	10/04/21	-	-	-	-	-	-	0	2	-	-	-	-	0	17	-	-	-	-	-	-	-	-	0	6	-	-						
L	21G0082	09/13/21	10/04/21	-	-	0	2	0	2	0	2	-	-	-	-	0	21	-	-	-	-	-	-	0	3	0	5	-	-						
M	21G0089	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	8	-	-	-	-	-	-	-	-	0	6	-	-						
N	21G0094	09/13/21	10/04/21	-	-	-	-	0	2	-	-	-	-	-	-	0	17	-	-	0	1	-	-	-	-	0	3	0	1						
O	21G0108	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	12	-	-	0	1	-	-	-	-	-	-	-	-						
P	21G0111	09/13/21	10/04/21	0	2	-	-	0	5	0	4	-	-	0	2	0	13	0	2	-	-	0	2	0	1	0	3	0	2						
Q	21G0112	09/13/21	10/04/21	-	-	-	-	0	3	0	8	-	-	-	-	0	17	-	-	-	-	-	-	-	-	0	8	-	-						
R	21G0114	09/13/21	10/04/21	-	-	-	-	0	2	-	-	-	-	-	-	0	2	-	-	-	-	-	-	-	-	0	2	-	-						
S	21G0126	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	8	-	-	-	-	-	-	-	-	-	-	-	-						
T	21G0127	09/13/21	10/04/21	0	2	0	1	0	7	0	4	-	-	0	2	0	20	-	-	0	6	0	2	-	-	0	6	0	8						
U	21G0138	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	15	-	-	-	-	-	-	-	-	-	-	-	-						
V	21G0140	09/13/21	10/04/21	-	-	-	-	0	3	-	-	-	-	-	-	0	8	-	-	-	-	-	-	0	3	-	-	-	-						
W	21G0141	09/13/21	10/04/21	0	1	-	-	-	-	0	2	0	1	0	1	0	5	-	-	0	1	0	1	-	-	-	-	0	1						
X	21G0145	09/13/21	10/04/21	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Y	21G0156	09/13/21	10/04/21	0	2	-	-	-	-	0	3	0	2	-	-	0	21	-	-	-	-	-	-	-	-	0	6	-	-						
Z	21G0176	09/13/21	10/04/21	-	-	-	-	-	-	-	-	-	-	-	-	0	1	-	-	-	-	-	-	-	-	-	-	-	-						
Total	T/PG			0	8	0	3	0	30	0	31	0	3	0	5	0	304	0	6	0	9	0	9	0	7	0	51	0	21	0	0	0	0	0	487

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

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Attachment 1

2B/4 (client Select) EDD **LDC# 52054 (Windward Environmental, LLC - Seattle, WA / Duwamish AOC4)**

LDC	SDG#	DATE REC'D	(3) DATE DUE	NH_3-N (4500 -NH 3)		Part. Size (D6913)		S= (4500 -S2 D)		S= (PSEP)		TOC (9060A)		Total Solids (2540G)		TS, S= (PSEP)																			
Matrix:	Water/Sediment			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	21F0418	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	10	0	10	-	-																	
B	21F0430	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	15	0	15	-	-																	
C	21F0441	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	11	0	11	-	-																	
D	21F0442	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	8	0	8	-	-																	
E	21G0001	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	17	0	17	-	-																	
F	21G0028	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	15	0	15	-	-																	
G	21G0030	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	4	0	4	-	-																	
H	21G0050	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	26	0	26	-	-																	
I	21G0051	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	4	0	4	-	-																	
J	21G0064	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	10	0	10	-	-																	
K	21G0079	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	17	0	17	-	-																	
L	21G0082	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	21	0	21	-	-																	
M	21G0089	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	8	0	8	-	-																	
N	21G0094	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	17	0	17	-	-																	
O	21G0108	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	12	0	12	-	-																	
P	21G0111	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	13	0	13	-	-																	
Q	21G0112	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	17	0	17	-	-																	
R	21G0114	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	2	0	2	-	-																	
S	21G0126	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	8	0	14	-	-																	
T	21G0127	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	20	0	20	-	-																	
U	21G0138	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	15	0	15	-	-																	
V	21G0140	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	8	0	8	-	-																	
W	21G0141	09/13/21	10/04/21	0	3	0	3	0	3	0	3	0	7	0	7	0	2																	
X	21G0145	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	1	0	1	-	-																	
Y	21G0156	09/13/21	10/04/21	0	2	-	-	0	2	0	2	0	22	0	22	0	2																	
Z	21G0176	09/13/21	10/04/21	-	-	-	-	-	-	-	-	0	1	0	1	-	-																	
Total	T/PG			0	5	0	3	0	5	0	5	0	309	0	315	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	646

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

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0418

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS696	21F0418-01	Sediment	06/28/21
LDW21-SS695	21F0418-02	Sediment	06/28/21
LDW21-IT696	21F0418-03	Sediment	06/28/21
LDW21-IT695	21F0418-04	Sediment	06/28/21
LDW21-SS693	21F0418-05	Sediment	06/28/21
LDW21-IT693	21F0418-06	Sediment	06/28/21
LDW21-SS691	21F0418-07	Sediment	06/28/21
LDW21-IT691	21F0418-08	Sediment	06/28/21
LDW21-SS692	21F0418-09	Sediment	06/28/21
LDW21-IT692	21F0418-10	Sediment	06/28/21
LDW21-SS691MS	21F0418-07MS	Sediment	06/28/21
LDW21-SS691MSD	21F0418-07MSD	Sediment	06/28/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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.

The chain-of-custodies were reviewed for documentation of cooler temperatures. Cooler temperatures for all samples were reported at 19.5°C upon receipt by the laboratory. The samples were received the same day they were collected and did not have sufficient time to cool down. No data was qualified based on the cooler temperature.

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 analytes.

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent 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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21F0418

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21F0418

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21F0418

No Sample Data Qualified in this SDG

LDC #: 52054A3b
SDG #: 21F0418
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/23/21
Page: 1 of 1
Reviewer: R
2nd Reviewer: R

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	Temp @ 19.5 – same day
II.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / ~~DS~~	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / ~~SRM~~	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SS696	21F0418-01	Sediment	06/28/21
2	LDW21-SS695	21F0418-02	Sediment	06/28/21
3	LDW21-IT696	21F0418-03	Sediment	06/28/21
4	LDW21-IT695	21F0418-04	Sediment	06/28/21
5	LDW21-SS~~396~~693	21F0418-05	Sediment	06/28/21
6	LDW21-IT693	21F0418-06	Sediment	06/28/21
7	LDW21-SS691	21F0418-07	Sediment	06/28/21
8	LDW21-IT691	21F0418-08	Sediment	06/28/21
9	LDW21-SS692	21F0418-09	Sediment	06/28/21
10	LDW21-IT692	21F0418-10	Sediment	06/28/21
11	LDW21-SS691MS	21F0418-07MS	Sediment	06/28/21
12	LDW21-SS691MSD	21F0418-07MSD	Sediment	06/28/21
13				
14				

Notes:

LDC Report# 52054A6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0418

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS696	21F0418-01	Sediment	06/28/21
LDW21-SS695	21F0418-02	Sediment	06/28/21
LDW21-IT696	21F0418-03	Sediment	06/28/21
LDW21-IT695	21F0418-04	Sediment	06/28/21
LDW21-SS396	21F0418-05	Sediment	06/28/21
LDW21-IT693	21F0418-06	Sediment	06/28/21
LDW21-SS691	21F0418-07	Sediment	06/28/21
LDW21-IT691	21F0418-08	Sediment	06/28/21
LDW21-SS692	21F0418-09	Sediment	06/28/21
LDW21-IT692	21F0418-10	Sediment	06/28/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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
PB (prep blank)	Total organic carbon	0.02%	All samples in SDG 21F0418

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

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

VIII. Laboratory Control Samples

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. Target Analyte Quantitation

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 21F0418

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21F0418

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21F0418

No Sample Data Qualified in this SDG

LDC #: 52054A6
SDG #: 21F0418
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: EOR
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS, SRM
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS696	21F0418-01	Sediment	06/28/21
2	LDW21-SS695	21F0418-02	Sediment	06/28/21
3	LDW21-IT696	21F0418-03	Sediment	06/28/21
4	LDW21-IT695	21F0418-04	Sediment	06/28/21
5	LDW21-SS396	21F0418-05	Sediment	06/28/21
6	LDW21-IT693	21F0418-06	Sediment	06/28/21
7	LDW21-SS691	21F0418-07	Sediment	06/28/21
8	LDW21-IT691	21F0418-08	Sediment	06/28/21
9	LDW21-SS692	21F0418-09	Sediment	06/28/21
10	LDW21-IT692	21F0418-10	Sediment	06/28/21
11				
12				
13				
14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0430

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS128	21F0430-01	Sediment	06/25/20
LDW20-SC128	21F0430-02	Sediment	06/24/20
LDW20-SC163A	21F0430-03	Sediment	06/26/20
LDW20-SC163B	21F0430-04	Sediment	06/26/20
LDW20-SC231A	21F0430-05	Sediment	06/19/20
LDW20-SC231B	21F0430-06	Sediment	06/19/20
LDW20-SC231Z	21F0430-07	Sediment	06/19/20
LDW20-SS249	21F0430-08	Sediment	06/30/20
LDW20-SC249A	21F0430-09	Sediment	06/18/20
LDW20-SC249B	21F0430-10	Sediment	06/18/20
LDW20-SC249Z	21F0430-11	Sediment	06/18/20
LDW20-SC254A	21F0430-12	Sediment	06/18/20
LDW20-SC254B	21F0430-13	Sediment	06/18/20
LDW20-SC128MS	21F0430-02MS	Sediment	06/24/20
LDW20-SC128MSD	21F0430-02MSD	Sediment	06/24/20

Introduction

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

The analyses were performed by the following method:

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

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

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

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

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

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

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 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 with the following exceptions:

Sample	Analyte	Total Days From Sample Collection Until Extraction	Recommended Holding Time (in Days) From Sample Collection Until Extraction
LDW20-SS128	All analytes	379	365
LDW20-SC128	All analytes	380	365
LDW20-SC163A LDW20-SC163B	All analytes	378	365
LDW20-SC231A LDW20-SC231B LDW20-SC231Z	All analytes	385	365
LDW20-SS249	All analytes	374	365
LDW20-SC249A LDW20-SC249B LDW20-SC249Z LDW20-SC254A LDW20-SC254B	All analytes	386	365

Although the recommended holding time was exceeded, using professional judgment, no data were qualified. PCBs are known to be environmentally stable and are not expected to degrade significantly during transport or storage.

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 analytes.

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent 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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

LDC #: 52054B3b

SDG #: 21F0430

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer:

2nd Reviewer: A

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/N	
II.	Initial calibration/ICV	A/A	RSD≤20% ICV≤20%
III.	Continuing calibration	A	CCV≤20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples /SRM	A	SRM
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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-SS128	21F0430-01	Sediment	06/25/20
2	LDW20-SC128	21F0430-02	Sediment	06/24/20
3	LDW20-SC163A	21F0430-03	Sediment	06/26/20
4	LDW20-SC163B	21F0430-04	Sediment	06/26/20
5	LDW20-SC231A	21F0430-05	Sediment	06/19/20
6	LDW20-SC231B	21F0430-06	Sediment	06/19/20
7	LDW20-SC231Z	21F0430-07	Sediment	06/19/20
8	LDW20-SS249	21F0430-08	Sediment	06/30/20
9	LDW20-SC249A	21F0430-09	Sediment	06/18/20
10	LDW20-SC249B	21F0430-10	Sediment	06/18/20
11	LDW20-SC249Z	21F0430-11	Sediment	06/18/20
12	LDW20-SC254A	21F0430-12	Sediment	06/18/20
13	LDW20-SC254B	21F0430-13	Sediment	06/18/20
14	LDW20-SC128MS	21F0430-02MS	Sediment	06/24/20
15	LDW20-SC128MSD	21F0430-02MSD	Sediment	06/24/20
16				
17				

LDC #: 52054B36

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Page: 1 of 1
Reviewer: 1

All circled dates have exceeded the technical holding times.
(Y) N N/A Were all cooler temperatures within validation criteria?

METHOD: __GC__ HPLC

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days (HT=14)	Qualifier
2	S		6-24-21	7-9-21		15	J/UN/P
1	S		6-25-20	7-9-21		379	Text
2, 14-15	↓		6-24-20	↓		380	↓
3-4	↓		6-26-20	↓		378	↓
5-7	↓		6-19-20	↓		385	↓
8	↓		6-30-20	↓		374	↓
9-13	↓		6-18-20	↓		386	↓
(dets+ND)							

TECHNICAL HOLDING TIME CRITERIA

VOLATILES:
- Water unpreserved: Aromatic within 7 days, non-aromatic within 14 days of sample collection.
- Water preserved: Both within 14 days of sample collection.
- Soils: Both within 14 days of sample collection.

EXTRACTABLES:
- Water: Extracted within 7 days, analyzed within 40 days.
- Soil: Extracted within 14 days, analyzed within 40 days.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: November 3, 2021

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0430

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS249	21F0430-08	Sediment	06/30/20
LDW20-SC249A	21F0430-09	Sediment	06/18/20
LDW20-SC249B	21F0430-10	Sediment	06/18/20
LDW20-SC249Z	21F0430-11	Sediment	06/18/20
LDW20-SS321	21F0430-14	Sediment	06/29/20
LDW20-IT321	21F0430-15	Sediment	06/23/20
LDW20-SS249MS	21F0430-08MS	Sediment	06/30/20
LDW20-SS249DUP	21F0430-08DUP	Sediment	06/30/20

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 6020B
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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 with the following exceptions:

Sample	Analyte	Total Days From Sample Collection Until Analysis	Required Holding Time (in Days) From Sample Collection Until Analysis	Flag	A or P
LDW20-SS249 LDW20-SS249DUP	Mercury	380 days	28 days	J (all detects)	P
LDW20-SC249A LDW20-SC249B LDW20-SC249Z	Mercury	392 days	28 days	J (all detects)	P
LDW20-SS249 LDW20-SS249DUP	Arsenic Cadmium Copper Lead Silver	384 days	365 days	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P
LDW20-SC249A LDW20-SC249B LDW20-SC249Z	Arsenic Cadmium Copper Lead Silver	396 days	365 days	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P
LDW20-SS249 LDW20-SS249DUP	Chromium	385 days	365 days	J (all detects)	P
LDW20-SC249A LDW20-SC249B LDW20-SC249Z	Chromium	397 days	365 days	J (all detects)	P
LDW20-SS249 LDW20-SS249DUP	Zinc	387 days	365 days	J (all detects)	P
LDW20-SC249A LDW20-SC249B LDW20-SC249Z	Zinc	399 days	365 days	J (all detects)	P
LDW20-SS321	Arsenic	388 days	365 days	J (all detects)	P
LDW20-IT321	Arsenic	391 days	365 days	J (all detects)	P

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) 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	%R (Limits)	Flag	A or P
LDW20-SS249MS (All samples in SDG 21F0430)	Silver	41.4 (75-125)	J (all detects)	A

VIII. Duplicate Sample Analysis

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

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

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. Target Analyte Quantitation

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 technical holding time and MS %R, data were qualified as estimated in seven samples.

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

Duwamish AOC4
Metals - Data Qualification Summary - SDG 21F0430

Sample	Analyte	Flag	A or P	Reason
LDW20-SS249 LDW20-SS249DUP LDW20-SC249A LDW20-SC249B LDW20-SC249Z	Arsenic Cadmium Chromium Copper Mercury Lead Silver Zinc	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P	Technical holding times
LDW20-SS321 LDW20-IT321	Arsenic	J (all detects)	P	Technical holding times
LDW20-SS249 LDW20-SC249A LDW20-SC249B LDW20-SC249Z LDW20-SS249DUP	Silver	J (all detects)	A	Matrix spike (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

LDC #: 52054B4a

SDG #: 21F0430

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/28/21

Page: 1 of 1

Reviewer: CG

2nd Reviewer: CG

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/SW	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Target Analyte Quantitation	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-SS249	21F0430-08	Sediment	06/30/20
2	LDW20-SC249A	21F0430-09	Sediment	06/18/20
3	LDW20-SC249B	21F0430-10	Sediment	06/18/20
4	LDW20-SC249Z	21F0430-11	Sediment	06/18/20
5	LDW20-SS249MS	21F0430-08MS	Sediment	06/30/20
6	LDW20-SS249DUP	21F0430-08DUP	Sediment	06/30/20
7	LDW20-SS321	21F0430-14	"	6/29/20
8	LDW20-SSIT321	" -15	"	6/23/20
9				
10				
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 4	As, Cd, Cu, Cr, Pb, Ag, Zn, Hg
7, 8	As
QC: 5, 6	As, Cd, Cu, Cr, Pb, Ag, Zn, Hg

Analysis Method

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

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
All samples were properly preserved (water samples to a pH of <2) and analyzed within the required holding time with the following exceptions.

Method:		Mercury by 7471B, HT = 28 days			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (Days)	Qualifier	Det/ND
1, 5, 6	6/30/2020	7/15/2021	380	J/R/P	Det
2, 3, 4	6/18/2020	7/15/2021	392	J/R/P	Det

Method:		As, Cd, Cu, Pb, Ag, HT = 1 year (Frozen)			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (Days)	Qualifier	Det/ND
1, 5, 6	6/30/2020	7/19/2021	384	J/UJ/P	Det
2, 3, 4	6/18/2020	7/19/2021	396	J/UJ/P	Det

Method:		Cr, HT = 1 year (Frozen)			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (Days)	Qualifier	Det/ND
1, 5, 6	6/30/2020	7/20/2021	385	J/UJ/P	Det
2, 3, 4	6/18/2020	7/20/2021	397	J/UJ/P	Det

Method:		Zn, HT = 1 year (Frozen)			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (Days)	Qualifier	Det/ND
1, 5, 6	6/30/2020	7/22/2021	387	J/UJ/P	Det
2, 3, 4	6/18/2020	7/22/2021	399	J/UJ/P	Det

Holding Time

Method:		As HT = 1 year (Frozen)			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (Days)	Qualifier	Det/ND
7	6/29/2020	7/22/2021	388	J/UJ/P	Det
8	6/23/2020	7/19/2021	391	J/UJ/P	Det

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

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	Associated Samples	Qualification	Det/ND
5	s	Ag	41.4	75-125	All	J/UJ/A	Det

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0430

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS128	21F0430-01	Sediment	06/25/20
LDW20-SC128	21F0430-02	Sediment	06/24/20
LDW20-SC163A	21F0430-03	Sediment	06/26/20
LDW20-SC163B	21F0430-04	Sediment	06/26/20
LDW20-SC231A	21F0430-05	Sediment	06/19/20
LDW20-SC231B	21F0430-06	Sediment	06/19/20
LDW20-SC231Z	21F0430-07	Sediment	06/19/20
LDW20-SS249	21F0430-08	Sediment	06/30/20
LDW20-SC249A	21F0430-09	Sediment	06/18/20
LDW20-SC249B	21F0430-10	Sediment	06/18/20
LDW20-SC249Z	21F0430-11	Sediment	06/18/20
LDW20-SC254A	21F0430-12	Sediment	06/18/20
LDW20-SC254B	21F0430-13	Sediment	06/18/20
LDW20-SS321	21F0430-14	Sediment	06/29/20
LDW20-IT321	21F0430-15	Sediment	06/23/20
LDW20-SS128MS	21F0430-01FMS	Sediment	06/25/20
LDW20-SS128DUP1	21F0430-01DUP1	Sediment	06/25/20
LDW20-SS128DUP2	21F0430-01DUP2	Sediment	06/25/20

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

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

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

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 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 with the following exceptions:

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
LDW20-SS128 LDW20-SS128DUP1 LDW20-SS128DUP2	Total solids	414	180	J (all detects)	P
LDW20-SC128	Total solids	415	180	J (all detects)	P
LDW20-SC163A LDW20-SC163B	Total solids	413	180	J (all detects)	P
LDW20-SC231A LDW20-SC231B LDW20-SC231Z	Total solids	420	180	J (all detects)	P
LDW20-SS249	Total solids	409	180	J (all detects)	P
LDW20-SC249A LDW20-SC249B LDW20-SC249Z LDW20-SC254A LDW20-SC254B	Total solids	421	180	J (all detects)	P
LDW20-SS321	Total solids	410	180	J (all detects)	P
LDW20-IT321	Total solids	416	180	J (all detects)	P
LDW20-SS128 LDW20-SS128DUP1	Total organic carbon	420	365	J (all detects)	P
LDW20-SC128	Total organic carbon	421	365	J (all detects)	P
LDW20-SC163A LDW20-SC163B	Total organic carbon	419	365	J (all detects)	P
LDW20-SC231A LDW20-SC231B LDW20-SC231Z	Total organic carbon	426	365	J (all detects)	P
LDW20-SS249	Total organic carbon	415	365	J (all detects)	P
LDW20-SC249A LDW20-SC249B LDW20-SC249Z LDW20-SC254A LDW20-SC254B	Total organic carbon	427	365	J (all detects)	P

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
LDW20-SS321	Total organic carbon	416	365	J (all detects)	P
LDW20-IT321	Total organic carbon	422	365	J (all detects)	P

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. Target Analyte Quantitation

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.

Due to technical holding time, data were qualified as estimated in seventeen samples.

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

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 21F0430

Sample	Analyte	Flag	A or P	Reason
LDW20-SS128 LDW20-SS128DUP1 LDW20-SS128DUP2	Total solids	J (all detects)	P	Technical holding times
LDW20-SS128 LDW20-SS128DUP1	Total organic carbon	J (all detects)	P	Technical holding times
LDW20-SC128 LDW20-SC163A LDW20-SC163B LDW20-SC231A LDW20-SC231B LDW20-SC231Z LDW20-SS249 LDW20-SC249A LDW20-SC249B LDW20-SC249Z LDW20-SC254A LDW20-SC254B LDW20-SS321 LDW20-IT321	Total solids Total organic carbon	J (all detects) J (all detects)	P	Technical holding times

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21F0430

No Sample Data Qualified in this SDG

LDC #: 52054B6
SDG #: 21F0430
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/28/21
Page: 1 of 2
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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 SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS128	21F0430-01	Sediment	06/25/20
2	LDW20-SC128	21F0430-02	Sediment	06/24/20
3	LDW20-SC163A	21F0430-03	Sediment	06/26/20
4	LDW20-SC163B	21F0430-04	Sediment	06/26/20
5	LDW20-SC231A	21F0430-05	Sediment	06/19/20
6	LDW20-SC231B	21F0430-06	Sediment	06/19/20
7	LDW20-SC231Z	21F0430-07	Sediment	06/19/20
8	LDW20-SS249	21F0430-08	Sediment	06/30/20
9	LDW20-SC249A	21F0430-09	Sediment	06/18/20
10	LDW20-SC249B	21F0430-10	Sediment	06/18/20
11	LDW20-SC249Z	21F0430-11	Sediment	06/18/20
12	LDW20-SC254A	21F0430-12	Sediment	06/18/20
13	LDW20-SC254B	21F0430-13	Sediment	06/18/20
14	LDW20-SS321	21F0430-14	Sediment	06/29/20
15	LDW20-IT321	21F0430-15	Sediment	06/23/20
16	LDW20-SS128MS	21F0430-01FMS	Sediment	06/25/20
17	LDW20-SS128DUP	21F0430-01DUP	Sediment	06/25/20

LDC #: 52054B6
SDG #: 21F0430
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/28/21
Page: 2 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW20-SS128~~TRP~~ DUP	21F0430-01~~TRP~~ DUP	Sediment	06/25/20
19				
20				
21				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
16	TOC
17	TOC, TS
18	TS

VALIDATION FINDINGS WORKSHEETS
Holding Time

METHOD: Inorganics

All samples were properly preserved and within the requried holding time with the following exceptions.

		Method: SM2540G Analyte: Total solids Holding Time:180 days			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (days)	Qualifier	Det/ND
1, 17, 18	6/25/2020	8/13/2021	414	J/R/P	Det
2	6/24/2020	8/13/2021	415	J/R/P	Det
3, 4	6/26/2020	8/13/2021	413	J/R/P	Det
5, 6, 7	6/19/2020	8/13/2021	420	J/R/P	Det
8	6/30/2020	8/13/2021	409	J/R/P	Det
9 to 13	6/18/2020	8/13/2021	421	J/R/P	Det
14	6/29/2020	8/13/2021	410	J/R/P	Det
15	6/23/2020	8/13/2021	416	J/R/P	Det

		Method: 9060A Analyte: TOC Holding Time: 1 year (Frozen)			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (days)	Qualifier	Det/ND
1, 16, 17	6/25/2020	8/19/2021	420	J/UJ/P	Det
2	6/24/2020	8/19/2021	421	J/UJ/P	Det
3, 4	6/26/2020	8/19/2021	419	J/UJ/P	Det
5, 6, 7	6/19/2020	8/19/2021	426	J/UJ/P	Det
8	6/30/2020	8/19/2021	415	J/UJ/P	Det
9 to 13	6/18/2020	8/19/2021	427	J/UJ/P	Det
14	6/29/2020	8/19/2021	416	J/UJ/P	Det
15	6/23/2020	8/19/2021	422	J/UJ/P	Det

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0441

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC560B	21F0441-01	Sediment	06/29/21
LDW21-SC560C	21F0441-02	Sediment	06/29/21
LDW21-SC560E	21F0441-03	Sediment	06/29/21
LDW21-SC558A	21F0441-04	Sediment	06/29/21
LDW21-SC558B	21F0441-05	Sediment	06/29/21
LDW21-SC558C	21F0441-06	Sediment	06/29/21
LDW21-SC558D	21F0441-07	Sediment	06/29/21
LDW21-SC558E	21F0441-08	Sediment	06/29/21
LDW21-SC558G	21F0441-09	Sediment	06/29/21
LDW21-SC558I	21F0441-10	Sediment	06/29/21
LDW21-SC558K	21F0441-11	Sediment	06/29/21
LDW21-SC558IMS	21F0441-10MS	Sediment	06/29/21
LDW21-SC558IMSD	21F0441-10MSD	Sediment	06/29/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Analyte	%D	Associated Samples	Flag	A or P
07/19/21	07192103	Col. 2	Aroclor-1260	28.1	LDW21-SC560B LDW21-SC560C LDW21-SC560E LDW21-SC558C LDW21-SC558D LDW21-SC558E LDW21-SC558G	J (all detects)	A
07/20/21	07202107	Col. 2	Aroclor-1260	29.4	LDW21-SC558I LDW21-SC558K	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/Internal Standards

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample LDW21-SC558C. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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 not within the QC limits for LDW21-SC558IMS/MSD. No data were qualified for MS/MSD samples analyzed greater than or equal to a 5X dilution. 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. Target Analyte Quantitation

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

Sample	Analyte	RPD	Flag	A or P
LDW21-SC558K	Aroclor-1254	49.5	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 continuing calibration %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 21F0441

Sample	Analyte	Flag	A or P	Reason
LDW21-SC560B LDW21-SC560C LDW21-SC560E LDW21-SC558C LDW21-SC558D LDW21-SC558E LDW21-SC558G LDW21-SC558I LDW21-SC558K	Aroclor-1260	J (all detects)	A	Continuing calibration (%D)
LDW21-SC558K	Aroclor-1254	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21F0441

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21F0441

No Sample Data Qualified in this SDG

LDC #: 52054C3b
SDG #: 21F0441
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: O
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	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /DS	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	12/13 = 70R out ≥5x OF
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC560B	21F0441-01	Sediment	06/29/21
2	LDW21-SC560C	21F0441-02	Sediment	06/29/21
3	LDW21-SC560E	21F0441-03	Sediment	06/29/21
4	LDW21-SC558A	21F0441-04	Sediment	06/29/21
5	LDW21-SC558B	21F0441-05	Sediment	06/29/21
6	LDW21-SC558C	21F0441-06	Sediment	06/29/21
7	LDW21-SC558D	21F0441-07	Sediment	06/29/21
8	LDW21-SC558E	21F0441-08	Sediment	06/29/21
9	LDW21-SC558G	21F0441-09	Sediment	06/29/21
10	LDW21-SC558I	21F0441-10	Sediment	06/29/21
11	LDW21-SC558K	21F0441-11	Sediment	06/29/21
12	LDW21-SC558IMS	21F0441-10MS	Sediment	06/29/21
13	LDW21-SC558IMSD	21F0441-10MSD	Sediment	06/29/21
14				

Notes:

LDC #: 52054C3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: q

METHOD: ✓ GC __ HPLC

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

[✓ Y] N N/A Were continuing calibration standards analyzed at the required frequencies?
Y [✓ N] N/A Did the continuing calibration standards meet the %D validation criteria of ≤20.0%?

Level ~~IV~~ Only

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

#	Date	Standard ID	~~Detector/~~ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/19/21	07192103	2	~~28.1~~	28.1	( )	1-3, 6-9 (dets)	J/UJ/A
				Aroclor1260		( )		
						( )		
	7/20/21	07202107	2	Aroclor 1260	29.4	( )	10-11 ~~(ND)~~ (dets)	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
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LDC #: 52054C36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: 9

METHOD: __/__ GC __ HPLC

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	~~Detector/~~ Column	Surrogate Compound	%R (Limits)	Qualifications
	6	2	O	128 (40-126)	No qual (OF ≥ 5x)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

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

LDC #: 52054Cab

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: Q

METHOD: ✓ GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1254	11	49.5	Hots/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0441

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC560B	21F0441-01	Sediment	06/29/21
LDW21-SC560C	21F0441-02	Sediment	06/29/21
LDW21-SC560E	21F0441-03	Sediment	06/29/21
LDW21-SC558A	21F0441-04	Sediment	06/29/21
LDW21-SC558B	21F0441-05	Sediment	06/29/21
LDW21-SC558C	21F0441-06	Sediment	06/29/21
LDW21-SC558D	21F0441-07	Sediment	06/29/21
LDW21-SC558E	21F0441-08	Sediment	06/29/21
LDW21-SC558G	21F0441-09	Sediment	06/29/21
LDW21-SC558I	21F0441-10	Sediment	06/29/21
LDW21-SC558K	21F0441-11	Sediment	06/29/21
LDW21-SC560BDUP1	21F0441-01DUP1	Sediment	06/29/21
LDW21-SC560BDUP2	21F0441-01DUP2	Sediment	06/29/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21F0441

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. Target Analyte Quantitation

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 21F0441

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21F0441

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21F0441

No Sample Data Qualified in this SDG

LDC #: 52054C6
SDG #: 21F0441
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/28/24
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC560B	21F0441-01	Sediment	06/29/21
2	LDW21-SC560C	21F0441-02	Sediment	06/29/21
3	LDW21-SC560E	21F0441-03	Sediment	06/29/21
4	LDW21-SC558A	21F0441-04	Sediment	06/29/21
5	LDW21-SC558B	21F0441-05	Sediment	06/29/21
6	LDW21-SC558C	21F0441-06	Sediment	06/29/21
7	LDW21-SC558D	21F0441-07	Sediment	06/29/21
8	LDW21-SC558E	21F0441-08	Sediment	06/29/21
9	LDW21-SC558G	21F0441-09	Sediment	06/29/21
10	LDW21-SC558I	21F0441-10	Sediment	06/29/21
11	LDW21-SC558K	21F0441-11	Sediment	06/29/21
12	LDW21-SC560BDUP	21F0441-01DUP	Sediment	06/29/21
13	LDW21-SC560B~~TRP~~ DUP	21F0441-01~~TRP~~ DUP	Sediment	06/29/21
14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
12, 13	TS

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

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

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

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

LDC Report# 52054D3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0442

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC564A	21F0442-01	Sediment	06/29/21
LDW21-SC564B	21F0442-02	Sediment	06/29/21
LDW21-SC564BDL	21F0442-02DL	Sediment	06/29/21
LDW21-SC564C	21F0442-03	Sediment	06/29/21
LDW21-SC564D	21F0442-04	Sediment	06/29/21
LDW21-SC564E	21F0442-05	Sediment	06/29/21
LDW21-SC564G	21F0442-06	Sediment	06/29/21
LDW21-SC564I	21F0442-07	Sediment	06/29/21
LDW21-SC564K	21F0442-08	Sediment	06/29/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Analyte	%D	Associated Samples	Flag	A or P
07/20/21	07202107	Col. 2	Aroclor-1260	29.4	LDW21-SC564K	J (all detects)	A
07/19/21	07192116	Col. 2	Aroclor-1260	34.6	LDW21-SC564B LDW21-SC564G	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/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 Analyte	Flag	A or P
LDW21-SC564B	Col. 1 Col. 2	Decachlorobiphenyl Decachlorobiphenyl	288 (40-126) 304 (40-126)	All analytes	J (all detects)	A

All internal standard percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standards	%R (Limits)	Affected Analyte	Flag	A or P
LDW21-SC564B	Hexabromobiphenyl	20 (50-200)	Aroclor-1260	J (all detects)	A

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

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

Sample	Analyte	RPD	Flag	A or P
LDW21-SC564BDL	Aroclor-1248	46.5	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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	Analyte	Reason	Flag	A or P
LDW21-SC564BDL	All analytes	Results from undiluted analyses were more usable.	Not reportable	-

Due to continuing calibration %D, surrogate %R, and internal standard %R, 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 Biphenyls - Data Qualification Summary - SDG 21F0442

Sample	Analyte	Flag	A or P	Reason
LDW21-SC564K LDW21-SC564B LDW21-SC564G	Aroclor-1260	J (all detects)	A	Continuing calibration (%D)
LDW21-SC564B	All analytes	J (all detects)	A	Surrogates (%R)
LDW21-SC564B	Aroclor-1260	J (all detects)	A	Internal standards (%R)
LDW21-SC564BDL	All analytes	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21F0442

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21F0442

No Sample Data Qualified in this SDG

LDC #: 52054D3b
SDG #: 21F0442
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: Q
2nd Reviewer: A

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	SW/SW	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC564A	21F0442-01	Sediment	06/29/21
2	LDW21-SC564B	21F0442-02	Sediment	06/29/21
3	LDW21-SC564BDL	21F0442-02DL	Sediment	06/29/21
4	LDW21-SC564C	21F0442-03	Sediment	06/29/21
5	LDW21-SC564D	21F0442-04	Sediment	06/29/21
6	LDW21-SC564E	21F0442-05	Sediment	06/29/21
7	LDW21-SC564G	21F0442-06	Sediment	06/29/21
8	LDW21-SC564I	21F0442-07	Sediment	06/29/21
9	LDW21-SC564K	21F0442-08	Sediment	06/29/21
10				
11				
12				
13				

Notes:

LDC #: 52054D36

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: Q

METHOD: ✓ GC __ HPLC

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

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

~~Level IV~~ Only

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

#	Date	Standard ID	~~Detector/~~ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/20/21	07202107	2	Aroclor ~~1254~~	29.4	( )	9 (dets)	J/UJ/A
				1260		( )		
						( )		
	7/19/21	07192116	2	Aroclor 1260	34.6	( )	2.7 (dets)	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
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						( )		

LDC #: 52054036

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

METHOD: __/GC __ HPLC

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	~~Detector/~~ Column	Surrogate Compound	%R (Limits)	Qualifications
	2 (dbs)	1	O	288 (40-126)	dbs/PR
		2	O	304 (↓)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

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

LDC #: 52054D3b

VALIDATION FINDINGS WORKSHEET
Internal Standards

Reviewer: Q

METHOD: GC

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

Y (N) N/A — Were all internal standard area counts within -50 to +100% of the ICAL midpoint standard?

(Y) N N/A — Were the retention times of the internal standards within +/- 0.05 min seconds of the retention times of the ICAL midpoint standard?

#	Date	Sample ID	Internal Standard	Area (Limits)	RT (Limits)	Qualifications
		2 (dets)	Hexabromobiphenyl	20 (50-200)		J/UJ/A (BB)

LDC #: 52054D3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: Q

METHOD: ✓ GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1248	3	46.5	det3/A

LDC #: 52054036

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

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

METHOD: 1 **GC** __ **HPLC**

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

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

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

#	Compound Name	Finding	Associated Samples	Qualifications
	3	All (diluted)		NR/J

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21F0442

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC564A	21F0442-01	Sediment	06/29/21
LDW21-SC564B	21F0442-02	Sediment	06/29/21
LDW21-SC564C	21F0442-03	Sediment	06/29/21
LDW21-SC564D	21F0442-04	Sediment	06/29/21
LDW21-SC564E	21F0442-05	Sediment	06/29/21
LDW21-SC564G	21F0442-06	Sediment	06/29/21
LDW21-SC564I	21F0442-07	Sediment	06/29/21
LDW21-SC564K	21F0442-08	Sediment	06/29/21
LDW21-SC564BMS	21F0442-02MS	Sediment	06/29/21
LDW21-SC564BDUP	21F0442-02DUP	Sediment	06/29/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21F0442

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. Target Analyte Quantitation

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 21F0442

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21F0442

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21F0442

No Sample Data Qualified in this SDG

LDC #: 52054D6
SDG #: 21F0442
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/28/21
Page: 1 of 1
Reviewer: CF
2nd Reviewer: CF

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC564A	21F0442-01	Sediment	06/29/21
2	LDW21-SC564B	21F0442-02	Sediment	06/29/21
3	LDW21-SC564C	21F0442-03	Sediment	06/29/21
4	LDW21-SC564D	21F0442-04	Sediment	06/29/21
5	LDW21-SC564E	21F0442-05	Sediment	06/29/21
6	LDW21-SC564G	21F0442-06	Sediment	06/29/21
7	LDW21-SC564I	21F0442-07	Sediment	06/29/21
8	LDW21-SC564K	21F0442-08	Sediment	06/29/21
9	LDW21-SC564BMS	21F0442-02MS	Sediment	06/29/21
10	LDW21-SC564BDUP	21F0442-02DUP	Sediment	06/29/21
11				
12				
13				
14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
9, 10	TOC

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0001

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC565A	21G0001-01	Sediment	06/30/21
LDW21-SC565B	21G0001-02	Sediment	06/30/21
LDW21-SC565C	21G0001-03	Sediment	06/30/21
LDW21-SC629A	21G0001-04	Sediment	06/30/21
LDW21-SC629B	21G0001-05	Sediment	06/30/21
LDW21-SC629C	21G0001-06	Sediment	06/30/21
LDW21-SC629D	21G0001-07	Sediment	06/30/21
LDW21-SC629F	21G0001-08	Sediment	06/30/21
LDW21-SC629H	21G0001-09	Sediment	06/30/21
LDW21-SC629J	21G0001-10	Sediment	06/30/21
LDW21-SS559	21G0001-11	Sediment	06/30/21
LDW21-SC572A	21G0001-12	Sediment	06/30/21
LDW21-SC572B	21G0001-13	Sediment	06/30/21
LDW21-SC572C	21G0001-14	Sediment	06/30/21
LDW21-SC572D	21G0001-15	Sediment	06/30/21
LDW21-SC572E	21G0001-16	Sediment	06/30/21
LDW21-SC576A	21G0001-17	Sediment	06/30/21
LDW21-SC565CMS	21G0001-03MS	Sediment	06/30/21
LDW21-SC565CMSD	21G0001-03MSD	Sediment	06/30/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Analyte	%D	Associated Samples	Flag	A or P
07/21/21	07202140	Col. 2	Aroclor-1260	21.6	LDW21-SS559 LDW21-SC576A	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/Internal Standards

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

All internal standard percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standards	%R (Limits)	Affected Analyte	Flag	A or P
LDW21-SC629C	Hexabromobiphenyl	46 (50-200)	Aroclor-1260	J (all detects)	A
LDW21-SC629D	Hexabromobiphenyl	46 (50-200)	Aroclor-1260	J (all detects)	A
LDW21-SC629F	Hexabromobiphenyl	41 (50-200)	Aroclor-1260	J (all detects)	A
LDW21-SC629H	Hexabromobiphenyl	42 (50-200)	Aroclor-1260	J (all detects)	A
LDW21-SC572A	Hexabromobiphenyl	49 (50-200)	Aroclor-1260	J (all detects)	A
LDW21-SC572B	Hexabromobiphenyl	43 (50-200)	Aroclor-1260	J (all detects)	A
LDW21-SC572C	Hexabromobiphenyl	40 (50-200)	Aroclor-1260	J (all detects)	A

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 continuing calibration %D and internal standard %R, 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 21G0001

Sample	Analyte	Flag	A or P	Reason
LDW21-SS559 LDW21-SC576A	Aroclor-1260	J (all detects)	A	Continuing calibration (%D)
LDW21-SC629C LDW21-SC629D LDW21-SC629F LDW21-SC629H LDW21-SC572A LDW21-SC572B LDW21-SC572C	Aroclor-1260	J (all detects)	A	Internal standards (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0001

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0001

No Sample Data Qualified in this SDG

LDC #: 52054E3b
SDG #: 21G0001
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 2
Reviewer: CL
2nd Reviewer: RC

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	
II.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A/SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / ±S	A/SW	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC565A	21G0001-01	Sediment	06/30/21
2	LDW21-SC565B	21G0001-02	Sediment	06/30/21
3	LDW21-SC565C	21G0001-03	Sediment	06/30/21
4	LDW21-SC629A	21G0001-04	Sediment	06/30/21
5	LDW21-SC629B	21G0001-05	Sediment	06/30/21
6	LDW21-SC629C	21G0001-06	Sediment	06/30/21
7	LDW21-SC629D	21G0001-07	Sediment	06/30/21
8	LDW21-SC629F	21G0001-08	Sediment	06/30/21
9	LDW21-SC629H	21G0001-09	Sediment	06/30/21
10	LDW21-SC629J	21G0001-10	Sediment	06/30/21
11	LDW21-SS559	21G0001-11	Sediment	06/30/21
12	LDW21-SC572A	21G0001-12	Sediment	06/30/21
13	LDW21-SC572B	21G0001-13	Sediment	06/30/21
14	LDW21-SC572C	21G0001-14	Sediment	06/30/21
15	LDW21-SC572D	21G0001-15	Sediment	06/30/21
16	LDW21-SC572E	21G0001-16	Sediment	06/30/21
17	LDW21-SC576A	21G0001-17	Sediment	06/30/21

LDC #: 52054E3b

SDG #: 21G0001

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Reviewer: Q

2nd Reviewer: Q

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

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC565CMS	21G0001-03MS	Sediment	06/30/21
19	LDW21-SC565CMSD	21G0001-03MSD	Sediment	06/30/21
20				
21				
22				

Notes:

LDC #: 52054E36

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Page: 1 of 1
Reviewer: Q

METHOD: ✓ **GC** __ **HPLC**

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

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

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

Level ~~IV~~ Only

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

#	Date	Standard ID	~~Detector~~/ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/21/21	07202140	2	Aroclor 1260	21.6	( )	11, 17 (dets)	J/UJ/A
						( )		
						( )		
						( )		
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LDC #: 52054Z36

VALIDATION FINDINGS WORKSHEET
Internal Standards

Reviewer: 4

METHOD: GC

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

Y (N) N/A Were all internal standard area counts within -50 to +100% of the ICAL midpoint standard?

Y (N) N/A Were the retention times of the internal standards within +/- 0.05 min seconds of the retention times of the ICAL midpoint standard?

#	Date	Sample ID	Internal Standard	Area (Limits)	RT (Limits)	Qualifications
		6	Hexabromobiphenyl	46 (50-200)		√ (N/A (BB)
		7		46		
		8		41		
		9		42		
		12		49		
		13		43		
		14	√	40		√
		(Reps)				

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0001

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC565A	21G0001-01	Sediment	06/30/21
LDW21-SC565B	21G0001-02	Sediment	06/30/21
LDW21-SC565C	21G0001-03	Sediment	06/30/21
LDW21-SC629A	21G0001-04	Sediment	06/30/21
LDW21-SC629B	21G0001-05	Sediment	06/30/21
LDW21-SC629C	21G0001-06	Sediment	06/30/21
LDW21-SC629D	21G0001-07	Sediment	06/30/21
LDW21-SC629F	21G0001-08	Sediment	06/30/21
LDW21-SC629H	21G0001-09	Sediment	06/30/21
LDW21-SC629J	21G0001-10	Sediment	06/30/21
LDW21-SS559	21G0001-11	Sediment	06/30/21
LDW21-SC572A	21G0001-12	Sediment	06/30/21
LDW21-SC572B	21G0001-13	Sediment	06/30/21
LDW21-SC572C	21G0001-14	Sediment	06/30/21
LDW21-SC572D	21G0001-15	Sediment	06/30/21
LDW21-SC572E	21G0001-16	Sediment	06/30/21
LDW21-SC576A	21G0001-17	Sediment	06/30/21
LDW21-SC565ADUP1	21G0001-01DUP1	Sediment	06/30/21
LDW21-SC565ADUP2	21G0001-01DUP2	Sediment	06/30/21
LDW21-SC572CMS	21G0001-14MS	Sediment	06/30/21
LDW21-SC572CDUP	21G0001-14DUP	Sediment	06/30/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0001

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) for total organic carbon were outside of QC limits, however, no data were qualified due to the sample being re-analyzed 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. Target Analyte Quantitation

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 21G0001

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0001

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0001

No Sample Data Qualified in this SDG

LDC #: 52054E6
SDG #: 21G0001
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/28/21
Page: 1 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC565A	21G0001-01	Sediment	06/30/21
2	LDW21-SC565B	21G0001-02	Sediment	06/30/21
3	LDW21-SC565C	21G0001-03	Sediment	06/30/21
4	LDW21-SC629A	21G0001-04	Sediment	06/30/21
5	LDW21-SC629B	21G0001-05	Sediment	06/30/21
6	LDW21-SC629C	21G0001-06	Sediment	06/30/21
7	LDW21-SC629D	21G0001-07	Sediment	06/30/21
8	LDW21-SC629F	21G0001-08	Sediment	06/30/21
9	LDW21-SC629H	21G0001-09	Sediment	06/30/21
10	LDW21-SC629J	21G0001-10	Sediment	06/30/21
11	LDW21-SS559	21G0001-11	Sediment	06/30/21
12	LDW21-SC572A	21G0001-12	Sediment	06/30/21
13	LDW21-SC572B	21G0001-13	Sediment	06/30/21
14	LDW21-SC572C	21G0001-14	Sediment	06/30/21
15	LDW21-SC572D	21G0001-15	Sediment	06/30/21
16	LDW21-SC572E	21G0001-16	Sediment	06/30/21
17	LDW21-SC576A	21G0001-17	Sediment	06/30/21

LDC #: 52054E6

SDG #: 21G0001

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/28/21

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC565ADUP	21G0001-01DUP	Sediment	06/30/21
19	LDW21-SC565A~~TRP~~DUP	21G0001-01~~TRP~~DUP	Sediment	06/30/21
20	LDW21-SC572CMS	21G0001-14MS	Sediment	06/30/21
~~21~~	~~LDW21-SC572CMSD~~	~~21G0001-14MSD~~	~~Sediment~~	~~06/30/21~~
22	LDW21-SC572CDUP	21G0001-14DUP	Sediment	06/30/21
23				
24				
25				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
18, 19	TS
20, 22	TOC

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

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

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

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

VALIDATION FINDINGS WORKSHEETS
Matrix Spikes

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 Samples	Qualification	Det/ND
20	s	TOC	127	75-125		Sample re-analyzed and within QC limits	

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0028

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC549A	21G0028-01	Sediment	07/01/21
LDW21-SC549B	21G0028-02	Sediment	07/01/21
LDW21-SC549C	21G0028-03	Sediment	07/01/21
LDW21-SC549E	21G0028-04	Sediment	07/01/21
LDW21-SC549G	21G0028-05	Sediment	07/01/21
LDW21-SC549AMS	21G0028-01MS	Sediment	07/01/21
LDW21-SC549AMSD	21G0028-01MSD	Sediment	07/01/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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	Analyte	Concentration	Associated Samples
BJG0290-BLK1	07/14/21	Fluorene Phenanthrene Fluoranthene Pyrene	0.83 ug/Kg 1.59 ug/Kg 1.57 ug/Kg 1.10 ug/Kg	All samples in SDG 21G0028

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	Analyte	Reported Concentration	Modified Final Concentration
LDW21-SC549A	Fluorene	4.32 ug/Kg	4.32U 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. Surrogate recoveries (%R) were not within QC limits for samples LDW21-SC549B, LDW21-SC549C, and LDW21-SC549E. Using professional judgment, no data were qualified when one base or one acid surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

VIII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-SC549AMS/MSD (LDW21-SC549A)	Fluoranthene	150 (46-120)	150 (46-120)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

LCS ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
BJG0290-BS1	Indeno(1,2,3-cd)pyrene	65.1 (67-132)	All samples in SDG 21G0028	J (all detects)	P

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 MS/MSD %R and LCS %R, data were qualified as estimated in five 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 21G0028

Sample	Analyte	Flag	A or P	Reason
LDW21-SC549A	Fluoranthene	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW21-SC549A LDW21-SC549B LDW21-SC549C LDW21-SC549E LDW21-SC549G	Indeno(1,2,3-cd)pyrene	J (all detects)	P	Laboratory control samples (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0028

Sample	Analyte	Modified Final Concentration	A or P
LDW21-SC549A	Fluorene	4.32U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

LDC #: 52054F2b

SDG #: 21G0028

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer:

2nd Reviewer: JA

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%, r^2 ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples LCSRM	SW/A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC549A	21G0028-01	Sediment	07/01/21
2	LDW21-SC549B	21G0028-02	Sediment	07/01/21
3	LDW21-SC549C	21G0028-03	Sediment	07/01/21
4	LDW21-SC549E	21G0028-04	Sediment	07/01/21
5	LDW21-SC549G	21G0028-05	Sediment	07/01/21
6	LDW21-SC549AMS	21G0028-01MS	Sediment	07/01/21
7	LDW21-SC549AMSD	21G0028-01MSD	Sediment	07/01/21
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52054F36

VALIDATION FINDINGS WORKSHEET
Blanks

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

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

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

(Y) N N/A Was a method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
(Y) N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 7/14/21 **Blank analysis date:** 7/20/21
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID	Sample Identification								
BJ50390-BLK1		1								
~~Bis(2-ethylhexyl)phthalate~~ NN	0.83		4.32/4							
UU	1.59									
YY	1.57									
ZZ	1.10									

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

Compound	Blank ID	Sample Identification								

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

LDC #: 52054F3b

VALIDATION FINDINGS WORKSHEET

Surrogate Recovery

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

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

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

Y [✓ N] N/A Were percent recoveries (%R) for surrogates within QC limits?
Y N [✓ N/A] If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y N [✓ N/A] If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		2	YY-d10	266 (36-134)	No Qual
				( )	
		3	↓	167 (↓)	↓
				( )	
		4	↓	172 (↓)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

Base/Neutral Surrogates:
(NBZ) = Nitrobenzene-d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl-d14
(DCB) = 1,2-Dichlorobenzene-d4

Acid Surrogates:
(PHL) = Phenol-d5
(2FP)= 2-Fluorophenol
(TBP) = 2,4,6-Tribromophenol
(2CP) = 2-Chlorophenol-d4

LDC #: 52054F2b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: Q

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

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

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

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

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

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		6/7	YY	150 (46-120)	150 (46-120)	( )	1 (dets)	J dets/A
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		

LDC #: 52054F2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:

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

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

[✓ Y] N N/A Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BJF0290-BS1	VVV	65. (67-132)	( )	( )	All (dets)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0028

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC549A	21G0028-01	Sediment	07/01/21
LDW21-SC549B	21G0028-02	Sediment	07/01/21
LDW21-SC549C	21G0028-03	Sediment	07/01/21
LDW21-SC549E	21G0028-04	Sediment	07/01/21
LDW21-SC549G	21G0028-05	Sediment	07/01/21
LDW21-SC509B	21G0028-06	Sediment	07/01/21
LDW21-SC509C	21G0028-07	Sediment	07/01/21
LDW21-SC509E	21G0028-08	Sediment	07/01/21
LDW21-SC509G	21G0028-09	Sediment	07/01/21
LDW21-SC513A	21G0028-10	Sediment	07/01/21
LDW21-SC514A	21G0028-11	Sediment	07/01/21
LDW21-SC514B	21G0028-12	Sediment	07/01/21
LDW21-SC514C	21G0028-13	Sediment	07/01/21
LDW21-SC514E	21G0028-14	Sediment	07/01/21
LDW21-SC514G	21G0028-15	Sediment	07/01/21
LDW21-SC549AMS	21G0028-01MS	Sediment	07/01/21
LDW21-SC549AMSD	21G0028-01MSD	Sediment	07/01/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standards	%R (Limits)	Affected Analyte	Flag	A or P
LDW21-SC509C	Hexabromobiphenyl	47 (50-200)	Aroclor-1260	J (all detects)	P

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

SRM ID	Column	Analyte	%R (Limits)	Associated Samples	Flag	A or P
BJG0288-SRM1	Col. 1	Aroclor-1260	282 (38-167)	LDW21-SC549A LDW21-SC549B LDW21-SC549C LDW21-SC549E LDW21-SC549G LDW21-SC509B LDW21-SC509C LDW21-SC513A LDW21-SC514A LDW21-SC514B LDW21-SC514C	J (all detects)	P
BJG0288-SRM1	Col. 1	Aroclor-1260	282 (38-167)	LDW21-SC509E LDW21-SC509G LDW21-SC514E LDW21-SC514G	NA	-
BJG0288-SRM1	Col. 2	Aroclor-1260	258 (38-167)	LDW21-SC549A LDW21-SC549B LDW21-SC549C LDW21-SC549E LDW21-SC549G LDW21-SC509B LDW21-SC509C LDW21-SC513A LDW21-SC514A LDW21-SC514B LDW21-SC514C	J (all detects)	P
BJG0288-SRM1	Col. 2	Aroclor-1260	258 (38-167)	LDW21-SC509E LDW21-SC509G LDW21-SC514E LDW21-SC514G	NA	-

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 internal standard %R 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
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0028

Sample	Analyte	Flag	A or P	Reason
LDW21-SC509C	Aroclor-1260	J (all detects)	P	Internal standards (%R)
LDW21-SC549A LDW21-SC549B LDW21-SC549C LDW21-SC549E LDW21-SC549G LDW21-SC509B LDW21-SC509C LDW21-SC513A LDW21-SC514A LDW21-SC514B LDW21-SC514C	Aroclor-1260	J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

LDC #: 52054F3b
SDG #: 21G0028
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer:
2nd Reviewer: M

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / FS	A/SW	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A/SW	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC549A	21G0028-01	Sediment	07/01/21
2	LDW21-SC549B	21G0028-02	Sediment	07/01/21
3	LDW21-SC549C	21G0028-03	Sediment	07/01/21
4	LDW21-SC549E	21G0028-04	Sediment	07/01/21
5	LDW21-SC549G	21G0028-05	Sediment	07/01/21
6	LDW21-SC509B	21G0028-06	Sediment	07/01/21
7	LDW21-SC509C	21G0028-07	Sediment	07/01/21
8	LDW21-SC509E	21G0028-08	Sediment	07/01/21
9	LDW21-SC509G	21G0028-09	Sediment	07/01/21
10	LDW21-SC513A	21G0028-10	Sediment	07/01/21
11	LDW21-SC514A	21G0028-11	Sediment	07/01/21
12	LDW21-SC514B	21G0028-12	Sediment	07/01/21
13	LDW21-SC514C	21G0028-13	Sediment	07/01/21
14	LDW21-SC514E	21G0028-14	Sediment	07/01/21
15	LDW21-SC514G	21G0028-15	Sediment	07/01/21
16	LDW21-SC549AMS	21G0028-01MS	Sediment	07/01/21
17	LDW21-SC549AMSD	21G0028-01MSD	Sediment	07/01/21

LDC #: 5205AF3b

VALIDATION FINDINGS WORKSHEET
Internal Standards

Page: 1 of 1
Reviewer: Q

METHOD: GC

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

Y N N/A — Were all internal standard area counts within -50 to +100% of the ICAL midpoint standard?
Y N N/A — Were the retention times of the internal standards within +/- 0.05 min seconds of the retention times of the ICAL midpoint standard?

#	Date	Sample ID	Internal Standard	Area (Limits)	RT (Limits)	Qualifications
		7(dt)	Hexabromobiphenyl	47 (50-1200)		J/UJ/P (BB)

LDC #: 52054F3b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: Q

METHOD: ✓ **GC** ___ **HPLC**

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

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

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

Level IV/D Only

Y N (N/A) Was an LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIG0288-SRM1	Aroclor 1260 (1)	282 (38-167)	( )	( )	All (dets=1-7,10-13)	J dets/A
		↓ (2)	258 (↓)	( )	( )		↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0028

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC549A	21G0028-01	Sediment	07/01/21
LDW21-SC549B	21G0028-02	Sediment	07/01/21
LDW21-SC549C	21G0028-03	Sediment	07/01/21
LDW21-SC549E	21G0028-04	Sediment	07/01/21
LDW21-SC549G	21G0028-05	Sediment	07/01/21
LDW21-SC549AMS	21G0028-01MS	Sediment	07/01/21
LDW21-SC549AMSD	21G0028-01MSD	Sediment	07/01/21
LDW21-SC549ADUP	21G0028-01DUP	Sediment	07/01/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Mercury by Environmental Protection Agency (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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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. 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.

III. 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	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.00595 mg/Kg	All samples in SDG 21G0028

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.

IV. Field Blanks

No field blanks were identified in this SDG.

V. 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
LDW21-SC549AMS/MSD (All samples in SDG 21G0028)	Mercury	4.31 (75-125)	-	J (all detects)	A

For LDW21-SC549AMS/MSD, although the percent recoveries were severely low for mercury, the associated sample results were qualified as estimated (J/UJ) since the post spike recoveries were within the QC limits for this analyte.

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

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW21-SC549AMS/MSD (All samples in SDG 21G0028)	Mercury	129 (≤20)	J (all detects)	A

VI. Duplicate Sample Analysis

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

VII. Laboratory Control Samples

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

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

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

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

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

Duwamish AOC4
Mercury - Data Qualification Summary - SDG 21G0028

Sample	Analyte	Flag	A or P	Reason
LDW21-SC549A LDW21-SC549B LDW21-SC549C LDW21-SC549E LDW21-SC549G LDW21-SC549ADUP	Mercury	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW21-SC549A LDW21-SC549B LDW21-SC549C LDW21-SC549E LDW21-SC549G LDW21-SC549ADUP	Mercury	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4
Mercury - Laboratory Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

Duwamish AOC4
Mercury - Field Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

LDC #: 52054F4c

SDG #: 21G0028

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage ~~4~~ 2B

Date: 9/28/21

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: Mercury (EPA SW 846 Method 7471B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	SW	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	SW	
VI.	Duplicate sample analysis	A	
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Target Analyte Quantitation	N	
X.	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	LDW21-SC549A	21G0028-01	Sediment	07/01/21
2	LDW21-SC549B	21G0028-02	Sediment	07/01/21
3	LDW21-SC549C	21G0028-03	Sediment	07/01/21
4	LDW21-SC549E	21G0028-04	Sediment	07/01/21
5	LDW21-SC549G	21G0028-05	Sediment	07/01/21
6	LDW21-SC549AMS	21G0028-01MS	Sediment	07/01/21
7	LDW21-SC549AMSD	21G0028-01MSD	Sediment	07/01/21
8	LDW21-SC549ADUP	21G0028-01DUP	Sediment	07/01/21
9				
10				
11				
12				
13				
14				
15				
16				
17				

Notes:

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

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

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

				Sample Identification								
Analyte	**PB (mg/Kg)**	**Maximum ICB/CCB (units)**	**Action Level**	No qual (>RL)								
Hg	0.00595											

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

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

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

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND	Post spike
6, 7	s	Hg	4.31		75-125			All	J/UJ/A	Det	112
		Hg				129	20	All	J/UJ/A	Det	

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0028

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC549A	21G0028-01	Sediment	07/01/21
LDW21-SC549B	21G0028-02	Sediment	07/01/21
LDW21-SC549C	21G0028-03	Sediment	07/01/21
LDW21-SC549E	21G0028-04	Sediment	07/01/21
LDW21-SC549G	21G0028-05	Sediment	07/01/21
LDW21-SC509B	21G0028-06	Sediment	07/01/21
LDW21-SC509C	21G0028-07	Sediment	07/01/21
LDW21-SC509E	21G0028-08	Sediment	07/01/21
LDW21-SC509G	21G0028-09	Sediment	07/01/21
LDW21-SC513A	21G0028-10	Sediment	07/01/21
LDW21-SC514A	21G0028-11	Sediment	07/01/21
LDW21-SC514B	21G0028-12	Sediment	07/01/21
LDW21-SC514C	21G0028-13	Sediment	07/01/21
LDW21-SC514E	21G0028-14	Sediment	07/01/21
LDW21-SC514G	21G0028-15	Sediment	07/01/21
LDW21-SC549ADUP1	21G0028-01DUP1	Sediment	07/01/21
LDW21-SC549ADUP2	21G0028-01DUP2	Sediment	07/01/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0028

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. Target Analyte Quantitation

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 21G0028

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0028

No Sample Data Qualified in this SDG

LDC #: 52054F6
SDG #: 21G0028
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/28/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC549A	21G0028-01	Sediment	07/01/21
2	LDW21-SC549B	21G0028-02	Sediment	07/01/21
3	LDW21-SC549C	21G0028-03	Sediment	07/01/21
4	LDW21-SC549E	21G0028-04	Sediment	07/01/21
5	LDW21-SC549G	21G0028-05	Sediment	07/01/21
6	LDW21-SC509B	21G0028-06	Sediment	07/01/21
7	LDW21-SC509C	21G0028-07	Sediment	07/01/21
8	LDW21-SC509E	21G0028-08	Sediment	07/01/21
9	LDW21-SC509G	21G0028-09	Sediment	07/01/21
10	LDW21-SC513A	21G0028-10	Sediment	07/01/21
11	LDW21-SC514A	21G0028-11	Sediment	07/01/21
12	LDW21-SC514B	21G0028-12	Sediment	07/01/21
13	LDW21-SC514C	21G0028-13	Sediment	07/01/21
14	LDW21-SC514E	21G0028-14	Sediment	07/01/21
15	LDW21-SC514G	21G0028-15	Sediment	07/01/21
16	LDW21-SC549ADUP \	21G0028-01DUP \	Sediment	07/01/21
17	LDW21-SC549A~~TRP~~ DUP	21G0028-01~~TRP~~ DUP	Sediment	07/01/21

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
16, 17	TS

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0030

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC517B	21G0030-01	Sediment	07/01/21
LDW21-SC517C	21G0030-02	Sediment	07/01/21
LDW21-SC517E	21G0030-03	Sediment	07/01/21
LDW21-SC517G	21G0030-04	Sediment	07/01/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent recoveries (%R) 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 with the following exceptions:

SRM ID	Column	Analyte	%R (Limits)	Associated Samples	Flag	A or P
BJG0288-SRM1	Col. 1	Aroclor-1260	282 (38-167)	LDW21-SC517B LDW21-SC517C	J (all detects)	P
BJG0288-SRM1	Col. 1	Aroclor-1260	282 (38-167)	LDW21-SC517E LDW21-SC517G	NA	-
BJG0288-SRM1	Col. 2	Aroclor-1260	258 (38-167)	LDW21-SC517B LDW21-SC517C	J (all detects)	P
BJG0288-SRM1	Col. 2	Aroclor-1260	258 (38-167)	LDW21-SC517E LDW21-SC517G	NA	-

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 SRM %R, data were qualified as estimated in two samples.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0030

Sample	Analyte	Flag	A or P	Reason
LDW21-SC517B LDW21-SC517C	Aroclor-1260	J (all detects)	P	Standard reference materials (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0030

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0030

No Sample Data Qualified in this SDG

LDC #: 52054G3b
SDG #: 21G0030
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/3/21
Page: 1 of 1
Reviewer: CJ
2nd Reviewer: KC

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	
II.	Initial calibration/ICV	A/A	RSD≤20% ICV≤20%
III.	Continuing calibration	A	CCV≤20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /FS	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples /SRM	A/SW	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC517B	231G0030-01	Sediment	07/01/21
2	LDW21-SC517C	231G0030-02	Sediment	07/01/21
3	LDW21-SC517E	231G0030-03	Sediment	07/01/21
4	LDW21-SC517G	231G0030-04	Sediment	07/01/21
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

LDC #: 52054F36

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: Q

METHOD: ✓ **GC** ___ **HPLC**

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

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

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

Level IV/D Only

Y N (N/A) Was an LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BJF0288-SRM1	Aroclor 1260 (1)	282 (38-167)	( )	( )	All (dets=1-2)	J/dets/A
	↓	↓ (2)	258 (↓)	( )	( )		↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0030

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC517B	21G0030-01	Sediment	07/01/21
LDW21-SC517C	21G0030-02	Sediment	07/01/21
LDW21-SC517E	21G0030-03	Sediment	07/01/21
LDW21-SC517G	21G0030-04	Sediment	07/01/21
LDW21-SC517BMS	21G0030-01MS	Sediment	07/01/21
LDW21-SC517BDUP	21G0030-01DUP	Sediment	07/01/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0030

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. Target Analyte Quantitation

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 21G0030

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0030

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0030

No Sample Data Qualified in this SDG

LDC #: 52054G6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/28/21
SDG #: 21G0030 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC517B	231G0030-01	Sediment	07/01/21
2	LDW21-SC517C	231G0030-02	Sediment	07/01/21
3	LDW21-SC517E	231G0030-03	Sediment	07/01/21
4	LDW21-SC517G	231G0030-04	Sediment	07/01/21
5	LDW21-SC517BMS	231G0030-01MS	Sediment	07/01/21
6	LDW21-SC517BDUP	231G0030-01DUP	Sediment	07/01/21
7				
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11				
12				
13				
14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
5, 6	TOC

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Butylbenzylphthalate

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0050

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC531B	21G0050-18	Sediment	07/02/21
LDW21-SC531B-FD	21G0050-19	Sediment	07/02/21
LDW21-SC531C	21G0050-20	Sediment	07/02/21
LDW21-SC531E	21G0050-21	Sediment	07/02/21
LDW21-SC531G	21G0050-22	Sediment	07/02/21
LDW21-SC531BMS	21G0050-18MS	Sediment	07/02/21
LDW21-SC531BMSD	21G0050-18MSD	Sediment	07/02/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Butylbenzylphthalate 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

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

X. Field Duplicates

Samples LDW21-SC531B and LDW21-SC531B-FD were identified as field duplicates. No results were detected in any of the samples.

XI. Internal Standards

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

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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
Butylbenzylphthalate - Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Laboratory Blank Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Field Blank Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

LDC #: 52054H2a
SDG #: 21G0050
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer: 9
2nd Reviewer: AC

METHOD: GC/MS Butylbenzylphthalate (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD≤20%. ICV≤30%
IV.	Continuing calibration	A	CCV≤20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	1+2
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC531B	21G0050-18	Sediment	07/02/21
2	LDW21-SC531B-FD	21G0050-19	Sediment	07/02/21
3	LDW21-SC531C	21G0050-20	Sediment	07/02/21
4	LDW21-SC531E	21G0050-21	Sediment	07/02/21
5	LDW21-SC531G	21G0050-22	Sediment	07/02/21
6	LDW21-SC531BMS	21G0050-18MS	Sediment	07/02/21
7	LDW21-SC531BMSD	21G0050-18MSD	Sediment	07/02/21
8				
9				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0050

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC520B	21G0050-01	Sediment	07/02/21
LDW21-SC520C	21G0050-02	Sediment	07/02/21
LDW21-SC520E	21G0050-03	Sediment	07/02/21
LDW21-SC520G	21G0050-04	Sediment	07/02/21
LDW21-SC521B	21G0050-05	Sediment	07/02/21
LDW21-SC521C	21G0050-06	Sediment	07/02/21
LDW21-SC521E	21G0050-07	Sediment	07/02/21
LDW21-SC521G	21G0050-08	Sediment	07/02/21
LDW21-SC521I	21G0050-09	Sediment	07/02/21
LDW21-SC527B	21G0050-10	Sediment	07/02/21
LDW21-SC527C	21G0050-11	Sediment	07/02/21
LDW21-SC527E	21G0050-12	Sediment	07/02/21
LDW21-SC527G	21G0050-13	Sediment	07/02/21
LDW21-SC533B	21G0050-14	Sediment	07/02/21
LDW21-SC533C	21G0050-15	Sediment	07/02/21
LDW21-SC533E	21G0050-16	Sediment	07/02/21
LDW21-SC533G	21G0050-17	Sediment	07/02/21
LDW21-SC531B	21G0050-18	Sediment	07/02/21
LDW21-SC531B-FD	21G0050-19	Sediment	07/02/21
LDW21-SC531C	21G0050-20	Sediment	07/02/21
LDW21-SC531E	21G0050-21	Sediment	07/02/21
LDW21-SC531G	21G0050-22	Sediment	07/02/21
LDW21-SC532B	21G0050-23	Sediment	07/02/21
LDW21-SC532C	21G0050-24	Sediment	07/02/21
LDW21-SC532E	21G0050-25	Sediment	07/02/21
LDW21-SC532G	21G0050-26	Sediment	07/02/21

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC520BMS	21G0050-01MS	Sediment	07/02/21
LDW21-SC520BMSD	21G0050-01MSD	Sediment	07/02/21
LDW21-SC533BMS	21G0050-14MS	Sediment	07/02/21
LDW21-SC533BMSD	21G0050-14MSD	Sediment	07/02/21

Introduction

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

The analyses were performed by the following method:

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

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

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

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

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-SC533BMS/MSD (LDW21-SC533B)	Aroclor-1016	122 (56-120)	129 (56-120)	NA	-
LDW21-SC533BMS/MSD (LDW21-SC533B)	Aroclor-1260	179 (58-120)	130 (58-120)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

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

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

IX. Field Duplicates

Samples LDW21-SC531B and LDW21-SC531B-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC531B	LDW21-SC531B-FD	
Aroclor-1248	184	209	13
Aroclor-1254	362	408	12
Aroclor-1260	191	197	3

X. Target Analyte Quantitation

All target analyte quantitations met validation criteria.

XI. Target Analyte Identification

All target analyte identifications met validation criteria.

XII. Overall Assessment of Data

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

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

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0050

Sample	Analyte	Flag	A or P	Reason
LDW21-SC533B	Aroclor-1260	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

LDC #: 52054H3b

SDG #: 21G0050

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 9/27/21

Page: 1 of 2

Reviewer: Q

2nd Reviewer: A

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A A	RSD ≤ 20%. RF ≥ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A	
VII.	Matrix spike/Matrix spike duplicates	MN	
VIII.	Laboratory control samples / LCSD	A	LCS
IX.	Field duplicates	FW	D = 18+19
X.	Target analyte quantitation	A	
XI.	Target analyte identification	A	
XII	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC520B	21G0050-01	Sediment	07/02/21
2	LDW21-SC520C	21G0050-02	Sediment	07/02/21
3	LDW21-SC520E	21G0050-03	Sediment	07/02/21
4	LDW21-SC520G	21G0050-04	Sediment	07/02/21
5	LDW21-SC521B	21G0050-05	Sediment	07/02/21
6	LDW21-SC521C	21G0050-06	Sediment	07/02/21
7	LDW21-SC521E	21G0050-07	Sediment	07/02/21
8	LDW21-SC521G	21G0050-08	Sediment	07/02/21
9	LDW21-SC521I	21G0050-09	Sediment	07/02/21
10	LDW21-SC527B	21G0050-10	Sediment	07/02/21
11	LDW21-SC527C	21G0050-11	Sediment	07/02/21
12	LDW21-SC527E	21G0050-12	Sediment	07/02/21
13	LDW21-SC527G	21G0050-13	Sediment	07/02/21
14	LDW21-SC533B	21G0050-14	Sediment	07/02/21
15	LDW21-SC533C	21G0050-15	Sediment	07/02/21
16	LDW21-SC533E	21G0050-16	Sediment	07/02/21
17	LDW21-SC533G	21G0050-17	Sediment	07/02/21

LDC #: 52054H3b
SDG #: 21G0050
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 9/22/21

Reviewer: 9
2nd Reviewer: A

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

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC531B	21G0050-18	Sediment	07/02/21
19	LDW21-SC531B-FD	21G0050-19	Sediment	07/02/21
20	LDW21-SC531C	21G0050-20	Sediment	07/02/21
21	LDW21-SC531E	21G0050-21	Sediment	07/02/21
22	LDW21-SC531G	21G0050-22	Sediment	07/02/21
23	LDW21-SC532B	21G0050-23	Sediment	07/02/21
24	LDW21-SC532C	21G0050-24	Sediment	07/02/21
25	LDW21-SC532E	21G0050-25	Sediment	07/02/21
26	LDW21-SC532G	21G0050-26	Sediment	07/02/21
27	LDW21-SC520BMS	21G0050-01MS	Sediment	07/02/21
28	LDW21-SC520BMSD	21G0050-01MSD	Sediment	07/02/21
29	LDW21-SC533BMS	21G0050-14MS	Sediment	07/02/21
30	LDW21-SC533BMSD	21G0050-14MSD	Sediment	07/02/21
31				
32				
33				

Notes:

	BJF0295 1-13						
	BJF0305 14-26						

LDC #: 52054#36

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: Q

Method: ✓ GC __ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?			✓	
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?	✓			IS
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
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?		✓		
VIII. Laboratory control samples				
Was an LCS analyzed per analytical or extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: 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	XX. Hexachlorobutadiene

Notes:_____

LDC #: 52054H3b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: q

METHOD: ✓ GC __ HPLC

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

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

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

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

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	29/30	Arochlor 1016	122 (56-120)	129 (56-120)	( )	14 (ND)	J dets/A
		↓ 1260	179 (58-120)	130 (58-120)	( )	(dets)	
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#:52054H3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	18	19	
Aroclor 1248	184	209	13
Aroclor 1254	362	408	12
Aroclor 1260	191	197	3

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054H3b_Windward.wpd

LDC #: 52054#26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: 9

METHOD: GC ✓ HPLC _____

The calibration factors (CF) and relative standard deviation (%RSD) were recalculated using the following calculations:

CF = A/C
Average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where: A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (250 std)	Recalculated CF (250 std)	Reported Ave CF (initial)	Recalculated Ave CF (intial)	Reported %RSD	Recalculated %RSD
1	ICAL	5/22/21	BB-1 (1)	0.0302432	0.0302432	0.0293254	0.0293254	2.5	2.5
	2		BB-1 (2)	0.0510927	0.0510927	0.0498903	0.0498903	3.5	3.5
2									
3									
4									

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 #: 52054#36

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: 9

METHOD: ___ GC_HPLC

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

% Difference = 100 * (ave. CF -CF)/ave.CF

Where: ave. CF = initial calibration average CF
CF = continuing calibration CF
A = Area of compound
C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(Ical)/ CCV Conc.	Reported	Recalculated	Reported	Recalculated
					CF/ Conc. CCV	CF/ Conc. CCV	%D	%D
1	07220107E	7/22/21	BB-1 (1)	0.0293254	0.0302148	0.0302148	3.2	3.0
			BB-1 (2)	0.0498903	0.0544731	0.0544731	9.2	9.2
2	07220121E	7/23/21	↓	0.0293254	0.0314367	0.0314367	7.2	7.2
			↓	0.0498903	0.0553744	0.0553744	10.8	11.0
3	07220133E	7/23/21	↓	0.0293254	0.0316653	0.0316653	8.0	8.0
			↓	0.0498903	0.0570055	0.0570054	14.4	14.3
4	07220150E	7/23/21	↓	0.0293254	0.0312764	0.0312764	6.8	6.7
			↓	0.0498903	0.0559901	0.0559901	12.0	12.2

LDC #: 52054H26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: 9

METHOD: ✓ GC_HPLC

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

% Difference = 100 * (ave. CF -CF)/ave.CF

Where: ave. CF = initial calibration average CF
CF = continuing calibration CF
A = Area of compound
C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(Ical)/ CCV Conc.	Reported CF/ Conc. CCV	Recalculated CF/ Conc. CCV	Reported %D	Recalculated %D
1	07221626	7/23/21	BB-1 (1)	0.0293254	0.0309508	0.0309508	5.6	5.6
			BB-1 (2)	0.0498903	0.0559059	0.0559059	12.0	12.1
2	07232102	7/23/21	↓	0.0293254	0.0287918	0.0287918	2.0	1.8
			↓	0.0498903	0.0507282	0.0507282	1.6	1.7
3	07232115E	7/24/21	↓	0.0293254	0.0287135	0.0287135	2.0	2.1
			↓	0.0498903	0.0506771	0.0506771	1.6	1.6
4	~~07232104E~~ 07232167E	7/24/21	↓	0.0293254	0.0304441	0.0304441	4.0	4.0
			↓	0.0498903	0.0550701	0.0550701	10.4	10.4
5								

LDC #: 52054H36

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: [illegible]

METHOD: ✓ GC ___ HPLC

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
DCB	1	40.0	34.1	85.2	85.2	
TCMX	1	1	30.5	76.1	76.2	

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

LDC #: 52054#36

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1
Reviewer: 9

METHOD: ✓ GC __ HPLC

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

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

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100 MS = Matrix spike MSD = Matrix spike duplicate

MS/MSD samples: 29/30

Compound	Spike Added (ug/kg)		Sample Conc. (ug/kg)	Spike Sample Concentration (ug/kg)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)											
Benzene (8021B)											
Methane (RSK-175)											
2,4-D (8151)											
Dinoseb (8151)											
Naphthalene (8310)											
Anthracene (8310)											
HMX (8330)											
2,4,6-Trinitrotoluene (8330)											
BB	101	101	176	357	307	179	179	130	130	15	15

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

LDC #: 52054#26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: Q

METHOD: ✓ GC __HPLC

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

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

Where SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: BJ60295-BS1

Compound	Spike Added (ug/kg)		Spike Sample Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
BD	101	NA	101	NA	100	100				

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

LDC #: 52054#36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: 9

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

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 within 10% of the reported results?

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

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 1 Compound Name BB-1

Concentration = $\frac{(76888)(80)}{(301398)(0.02932254)} = 695.9$

$conc = \frac{(695.9 + 581.0 + 648.4 + 715.6 + 707.4)(2.5)(1)}{(5)(19.8)(0.6319)} = 133.8$ ug/kg

#	Sample ID	Compound	Reported Concentrations (ug/kg)	Recalculated Results Concentrations ( )	Qualifications
	1	BB	134		

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0050

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC520B	21G0050-01	Sediment	07/02/21
LDW21-SC520C	21G0050-02	Sediment	07/02/21
LDW21-SC520E	21G0050-03	Sediment	07/02/21
LDW21-SC520G	21G0050-04	Sediment	07/02/21
LDW21-SC521B	21G0050-05	Sediment	07/02/21
LDW21-SC521C	21G0050-06	Sediment	07/02/21
LDW21-SC521E	21G0050-07	Sediment	07/02/21
LDW21-SC521G	21G0050-08	Sediment	07/02/21
LDW21-SC521I	21G0050-09	Sediment	07/02/21
LDW21-SC527B	21G0050-10	Sediment	07/02/21
LDW21-SC527C	21G0050-11	Sediment	07/02/21
LDW21-SC527E	21G0050-12	Sediment	07/02/21
LDW21-SC527G	21G0050-13	Sediment	07/02/21
LDW21-SC533B	21G0050-14	Sediment	07/02/21
LDW21-SC533C	21G0050-15	Sediment	07/02/21
LDW21-SC533E	21G0050-16	Sediment	07/02/21
LDW21-SC533G	21G0050-17	Sediment	07/02/21
LDW21-SC531B	21G0050-18	Sediment	07/02/21
LDW21-SC531B-FD	21G0050-19	Sediment	07/02/21
LDW21-SC531C	21G0050-20	Sediment	07/02/21
LDW21-SC531E	21G0050-21	Sediment	07/02/21
LDW21-SC531G	21G0050-22	Sediment	07/02/21
LDW21-SC532B	21G0050-23	Sediment	07/02/21
LDW21-SC532C	21G0050-24	Sediment	07/02/21
LDW21-SC532E	21G0050-25	Sediment	07/02/21
LDW21-SC532G	21G0050-26	Sediment	07/02/21

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC520BDUP1	21G0050-01DUP1	Sediment	07/02/21
LDW21-SC520BDUP2	21G0050-01DUP2	Sediment	07/02/21
LDW21-SC533GMS	21G0050-17MS	Sediment	07/02/21
LDW21-SC533GDUP	21G0050-17DUP	Sediment	07/02/21
LDW21-SC531EDUP1	21G0050-21DUP1	Sediment	07/02/21
LDW21-SC531EDUP2	21G0050-21DUP2	Sediment	07/02/21

Introduction

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

The analyses were performed by the following methods:

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

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

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

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

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

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

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 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 21G0050

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 LDW21-SC531B and LDW21-SC531B-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	LDW21-SC531B	LDW21-SC531B-FD	
Total organic carbon	1.65	2.15	26
Total solids	63.04	65.45	4

X. Target Analyte Quantitation

All target analyte quantitations were acceptable.

XI. Overall Assessment of Data

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

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

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0050

No Sample Data Qualified in this SDG

LDC #: 52054H6
SDG #: 21G0050
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 9/29/21
Page: 1 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	
IX.	Field duplicates	SW	(1&6, A)
X.	Target Analyte Quantitation	A	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC520B	21G0050-01	Sediment	07/02/21
2	LDW21-SC520C	21G0050-02	Sediment	07/02/21
3	LDW21-SC520E	21G0050-03	Sediment	07/02/21
4	LDW21-SC520G	21G0050-04	Sediment	07/02/21
5	LDW21-SC521B	21G0050-05	Sediment	07/02/21
6	LDW21-SC521C	21G0050-06	Sediment	07/02/21
7	LDW21-SC521E	21G0050-07	Sediment	07/02/21
8	LDW21-SC521G	21G0050-08	Sediment	07/02/21
9	LDW21-SC521I	21G0050-09	Sediment	07/02/21
10	LDW21-SC527B	21G0050-10	Sediment	07/02/21
11	LDW21-SC527C	21G0050-11	Sediment	07/02/21
12	LDW21-SC527E	21G0050-12	Sediment	07/02/21
13	LDW21-SC527G	21G0050-13	Sediment	07/02/21
14	LDW21-SC533B	21G0050-14	Sediment	07/02/21
15	LDW21-SC533C	21G0050-15	Sediment	07/02/21
16	LDW21-SC533E	21G0050-16	Sediment	07/02/21
17	LDW21-SC533G	21G0050-17	Sediment	07/02/21

LDC #: 52054H6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0050 Stage 4 Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC531B	21G0050-18	Sediment	07/02/21
19	LDW21-SC531B-FD	21G0050-19	Sediment	07/02/21
20	LDW21-SC531C	21G0050-20	Sediment	07/02/21
21	LDW21-SC531E	21G0050-21	Sediment	07/02/21
22	LDW21-SC531G	21G0050-22	Sediment	07/02/21
23	LDW21-SC532B	21G0050-23	Sediment	07/02/21
24	LDW21-SC532C	21G0050-24	Sediment	07/02/21
25	LDW21-SC532E	21G0050-25	Sediment	07/02/21
26	LDW21-SC532G	21G0050-26	Sediment	07/02/21
27	LDW21-SC520BDUP |	21G0050-01DUP |	Sediment	07/02/21
28	LDW21-SC520B~~TRP~~ DUP2	21G0050-01~~TRP~~ DUP2	Sediment	07/02/21
29	LDW21-SC533GMS	21G0050-17MS	Sediment	07/02/21
30	LDW21-SC533GDUP	21G0050-17DUP	Sediment	07/02/21
31	LDW21-SC531E~~DUP~~ DUP |	21G0050-21DUP |	Sediment	07/02/21
32	LDW21-SC531E~~TRP~~ DUP2	21G0050-21~~TRP~~ DUP2	Sediment	07/02/21
33				
34				
35				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
27, 28	TS
29	TOC
30	TOC
31, 32	TS

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times were met?	X			
II. Calibration				
Were all instuments calibrated at the requried frequency?	X			
Were the proper number of standards used?	X			
Were all initial and continuing calibration verifications within the QC limits?	X			
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
Were balance checks performed as required?	X			
III. Blanks				
Was a method blank assoicated with every sample in this SDG?	X			
Was there contamination in the method blanks?		X		
Was there contamination in the initial and continuing calibration blanks?	X			
IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)	X			
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?	X			
V. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			
X. Sample Result Verification				
Were all reproting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
XII. Field Duplicates				
Were field duplicates identified in this SDG?	X			
Were target analytes detected in the field duplicates?	X			
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			X	

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

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

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

				Sample Identification								
Analyte	**PB (units)**	**Maximum ICB/CCB (%)**	**Action Level**									
TOC		0.02	0.02									

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

METHOD: Inorganics

Analyte	Concentration (mg/L)		RPD
	18	19	
TOC	1.65	2.15	26
Total solids	63.04	65.45	4

LDC #: 52054H6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Reviewer: CR

Method: Inorganics

The correlation coefficient (r) for the calibration of TOC was recalculated.Calibration date: 7/14/21

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

$$\%R = \frac{\text{Found} \times 100}{\text{True}}$$

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

True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (mg/l)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Calibration verification	TOC	ICV	44.446	44.87	101	96	Y
Calibration verification	TOC	CCV	44.446	43.672	98	98	Y
Calibration verification	TOC	CCV	44.446	43.95	99	99	Y

Comments:

METHOD: Inorganics

Percent recoveries (%R) for the laboratory control sample (LCS) and matrix spike (MS) were recalcuated using the following formula.
%R = (Found/True) x 100
Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)
True = concentraiton of each analyte in the source
The sample and duplciate relative percent difference (RPD) was recalcuated using the following formula.
RPD = (Absolute value(S-D)x 200) / (S+D)
S = Original sample concentraiton
D = Duplciate sample concentration

Sample ID	Type of Analysis	Element	Found/S	True/D	Recalcuated %R/RPD	Reported %R/RPD	Acceptable (Y/N)
LCS	LCS	TOC	44.9	44.4	101	101	Y
29	MS	TOC	1.55	1.52	102	102	Y
27	Duplicate	TS	61.61	61.67	0.097	0.096	Y

METHOD: Inorganics

Sample ID	Analyte	Raw Data (%)	Percent solids (%)	Reported Result (%)	Recalcuated Result (%)	Acceptable (Y/N)
1	TOC	0.808	61.61	1.31	1.31	Y
2	TOC	1.015	62.46	1.63	1.63	Y
3	TOC	0.847	61.46	1.38	1.38	Y
4	TOC	0.714	68.58	1.04	1.04	Y
5	TOC	0.987	63.94	1.54	1.54	Y
6	TOC	0.838	66.66	1.26	1.26	Y
7	TOC	0.632	70.38	0.9	0.90	Y
8	TOC	0.907	68.03	1.33	1.33	Y
9	TOC	1.818	65.2	2.79	2.79	Y
10	TOC	0.894	57.11	1.57	1.57	Y
11	TOC	0.759	61.59	1.23	1.23	Y
12	TOC	1.027	71.61	1.43	1.43	Y
13	TOC	0.466	73.13	0.64	0.64	Y

Sample ID	Analyte	Dry Weight (g)	Wet Weight (g)	Tare Weight (g)	Reported Result (%)	Recalcuated Result (%)	Acceptable (Y/N)
14	TS	4.1187	5.9443	0.7842	64.62	64.62	Y
15	TS	4.2803	5.6963	0.7919	71.13	71.13	Y
16	TS	4.883	6.997	0.8024	65.87	65.87	Y
17	TS	4.4675	6.1124	0.7908	69.09	69.09	Y
18	TS	4.4651	6.1415	0.794	63.04	68.65	Y
19	TS	4.2193	6.0244	0.7994	65.45	65.45	Y
20	TS	3.8689	5.771	0.8007	61.73	61.73	Y
21	TS	5.2461	6.8278	0.7929	73.79	73.79	Y
22	TS	4.6172	6.4708	0.7989	67.32	67.32	Y
23	TS	4.7134	6.9444	0.8016	63.68	63.68	Y
24	TS	5.1856	7.0422	0.7949	70.28	70.28	Y
25	TS	5.5023	7.8478	0.7994	66.72	66.72	Y
26	TS	5.2451	7.2679	0.7991	68.73	68.73	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0051

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC534B	21G0051-01	Sediment	07/02/21
LDW21-SC534C	21G0051-02	Sediment	07/02/21
LDW21-SC534E	21G0051-03	Sediment	07/02/21
LDW21-SC534G	21G0051-04	Sediment	07/02/21
LDW21-SC534EMS	21G0051-03MS	Sediment	07/02/21
LDW21-SC534EMSD	21G0051-03MSD	Sediment	07/02/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Analyte	%D	Associated Samples	Flag	A or P
07/20/21	07202107	Col. 2	Aroclor-1260	29.4	LDW21-SC534C LDW21-SC534E LDW21-SC534G	J (all detects) UJ (all non-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/Internal Standards

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

All internal standard percent 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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 continuing calibration %D, 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 Biphenyls - Data Qualification Summary - SDG 21G0051

Sample	Analyte	Flag	A or P	Reason
LDW21-SC534C LDW21-SC534E LDW21-SC534G	Aroclor-1260	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0051

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0051

No Sample Data Qualified in this SDG

LDC #: 52054I3b
SDG #: 21G0051
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/27/21
Page: 1 of 1
Reviewer: 9
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	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	M	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SPM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC534B	21G0051-01	Sediment	07/02/21
2	LDW21-SC534C	21G0051-02	Sediment	07/02/21
3	LDW21-SC534E	21G0051-03	Sediment	07/02/21
4	LDW21-SC534G	21G0051-04	Sediment	07/02/21
5	LDW21-SC534EMS	21G0051-03MS	Sediment	07/02/21
6	LDW21-SC534EMSD	21G0051-03MSD	Sediment	07/02/21
7				
8				
9				
10				
11				
12				
13				

Notes:

LDC #: 52054I3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: Q

METHOD: ✓ GC __ HPLC

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

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

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

Level IV Only

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

#	Date	Standard ID	~~Detector/~~ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/20/21	07202107	2	Aroclor 1260	29.4	( )	2-4.5-6. (dets+ND)	J/UJ/A
						( )		
						( )		
	7/21/21	07202152	2	✓	29.9	( )	1.MB (dets)	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0051

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC534B	21G0051-01	Sediment	07/02/21
LDW21-SC534C	21G0051-02	Sediment	07/02/21
LDW21-SC534E	21G0051-03	Sediment	07/02/21
LDW21-SC534G	21G0051-04	Sediment	07/02/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0051

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

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

VIII. Laboratory Control Samples

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. Target Analyte Quantitation

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 21G0051

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0051

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0051

No Sample Data Qualified in this SDG

LDC #: 52054I6
SDG #: 21G0051
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC534B	21G0051-01	Sediment	07/02/21
2	LDW21-SC534C	21G0051-02	Sediment	07/02/21
3	LDW21-SC534E	21G0051-03	Sediment	07/02/21
4	LDW21-SC534G	21G0051-04	Sediment	07/02/21
5				
6				
7				
8				
9				
10				
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12				
13				
14				
15				
16				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Butylbenzylphthalate

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0064

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC580	21G0064-01	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Butylbenzylphthalate 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

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. Internal Standards

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

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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
Butylbenzylphthalate - Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Laboratory Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Field Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

LDC #: 52054J2a

SDG #: 21G0064

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/23/21

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Butylbenzylphthalate (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV = 70%
IV.	Continuing calibration	A	CCV = 70%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	MS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC580	21G0064-01	Sediment	07/06/21
2				
3				
4				
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52654A29

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Reviewer: 9

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

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

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

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	7/23/21	NT10210723302	AAA	22.3		MB	J/UJ/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0064

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT507	21G0064-10	Sediment	07/06/21
LDW21-IT507MS	21G0064-10MS	Sediment	07/06/21
LDW21-IT507MSD	21G0064-10MSD	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	All samples in SDG 21G0064	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-IT507MS/MSD (LDW21-IT507)	Chrysene	41.0 (48-120)	-	J (all detects)	A
	Benzo(b)fluoranthene	41.3 (52-137)	50.4 (52-137)	J (all detects)	
	Indeno(1,2,3-cd)pyrene	46.0 (67-132)	52.3 (67-132)	J (all detects)	
	Dibenzo(a,h)anthracene	52.9 (66-139)	57.3 (66-139)	J (all detects)	

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 with the following exceptions:

LCS ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
BJG0328-BS1	Indeno(1,2,3-cd)pyrene	55.3 (67-132)	All samples in SDG 21G0064	J (all detects)	P
	Dibenzo(a,h)anthracene	60.1 (66-139)		J (all detects)	

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration r^2, MS/MSD %R, and LCS %R, data were qualified as estimated in one sample.

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

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 21G0064

Sample	Analyte	Flag	A or P	Reason
LDW21-IT507	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW21-IT507	Chrysene Benzo(b)fluoranthene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW21-IT507	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene	J (all detects) J (all detects)	P	Laboratory control samples (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

LDC #: 52054J2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/28/21

SDG #: 21G0064

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: 9

2nd Reviewer: D

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	TW/A	RSD ≤ 20% . r^2 ≥ 0.990 %D ≤ 30%
IV.	Continuing calibration	A	%D ≤ 30%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	TW	
IX.	Laboratory control samples / SRM	TW/A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-IT507	21G0064-10	Sediment	07/06/21
2	LDW21-IT507MS	21G0064-10MS	Sediment	07/06/21
3	LDW21-IT507MSD	21G0064-10MSD	Sediment	07/06/21
4				
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52054126

VALIDATION FINDINGS WORKSHEET
Initial Calibration

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

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

Y N N/A Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?

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

Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?_____

Y N N/A Did the initial calibration meet the acceptance criteria?

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

#	Date	Standard ID	Compound	Finding %RSD (Limit: <20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	7/5/21	ICAL2	KK	r^2=0.9891		All (dets)	J/UN/A

INICAL.2SD

LDC #: 52054A1b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: [illegible]

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

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

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

(Y) N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

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

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		2/3	DDD	41.0 (48-120)	( )	( )	1 (dets)	J/UJ/A
			~~GGG~~	41.3 (52-137)	50.4 (52-137)	( )		↓
			JJJ	46.0 (67-132)	52.3 (67-132)	( )		↓
			KKK	52.9 (66-139)	57.3 (66-139)	( )		↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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LDC #: 52054I2b

Page: 1 of 1
Reviewer: 9

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
[✓ Y] N N/A Was a LCS required?
Y [✓ N] N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BJ40328-BS1	WW	55.3 (67-132)	( )	( )	All (dets)	J/UJ/P
			KKK	60.1 (66-139	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0064

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC580	21G0064-01	Sediment	07/06/21
LDW21-IT578	21G0064-02	Sediment	07/06/21
LDW21-IT578FD	21G0064-03	Sediment	07/06/21
LDW21-SC581B	21G0064-04	Sediment	07/06/21
LDW21-SC581C	21G0064-05	Sediment	07/06/21
LDW21-SC581E	21G0064-06	Sediment	07/06/21
LDW21-IT542	21G0064-07	Sediment	07/06/21
LDW21-IT518	21G0064-08	Sediment	07/06/21
LDW21-IT518FD	21G0064-09	Sediment	07/06/21
LDW21-IT507	21G0064-10	Sediment	07/06/21
LDW21-SC581BMS	21G0064-04MS	Sediment	07/06/21
LDW21-SC581BMSD	21G0064-04MSD	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent 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

Samples LDW21-IT578 and LDW21-IT578FD and samples and LDW21-IT518 and LDW21-IT518FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT578	LDW21-IT578FD	
Aroclor-1248	18.8	19.7	5
Aroclor-1254	61.9	62.6	1
Aroclor-1260	122	92.3	28

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT518	LDW21-IT518FD	
Aroclor-1248	39.9	43.5	9
Aroclor-1254	106	104	2
Aroclor-1260	64.4	63.6	1

X. Target Analyte Quantitation

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

Sample	Analyte	RPD	Flag	A or P
LDW21-SC581B	Aroclor-1260	58.8	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, 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 21G0064

Sample	Analyte	Flag	A or P	Reason
LDW21-SC581B	Aroclor-1260	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

LDC #: 52054J3b
SDG #: 21G0064
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	SW	D=2+3 · 8+9
X.	Target analyte quantitation	A/N	
XI.	Target analyte 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	LDW21-SC580	21G0064-01	Sediment	07/06/21
2	LDW21-IT578	21G0064-02	Sediment	07/06/21
3	LDW21-IT578FD	21G0064-03	Sediment	07/06/21
4	LDW21-SC581B	21G0064-04	Sediment	07/06/21
5	LDW21-SC581C	21G0064-05	Sediment	07/06/21
6	LDW21-SC581E	21G0064-06	Sediment	07/06/21
7	LDW21-IT542	21G0064-07	Sediment	07/06/21
8	LDW21-IT518	21G0064-08	Sediment	07/06/21
9	LDW21-IT518FD	21G0064-09	Sediment	07/06/21
10	LDW21-IT507	21G0064-10	Sediment	07/06/21
11	LDW21-SC581BMS	21G0064-04MS	Sediment	07/06/21
12	LDW21-SC581BMSD	21G0064-04MSD	Sediment	07/06/21
13				

Notes:

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	2	3	
Aroclor 1248	18.8	19.7	5
Aroclor 1254	61.9	62.6	1
Aroclor 1260	122	92.3	28

Compound	Concentration (ug/kg)		RPD
	8	9	
Aroclor 1248	39.9	43.5	9
Aroclor 1254	106	104	2
Aroclor 1260	64.4	63.6	1

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054J3b_Windward.wpd

LDC #: 52054136

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

METHOD: ✓ GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1260	4	58.8	J+ (all) / A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0064

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC580	21G0064-01	Sediment	07/06/21
LDW21-IT578	21G0064-02	Sediment	07/06/21
LDW21-IT578FD	21G0064-03	Sediment	07/06/21
LDW21-IT518	21G0064-08	Sediment	07/06/21
LDW21-IT518FD	21G0064-09	Sediment	07/06/21
LDW21-IT507	21G0064-10	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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

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

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

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 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 method. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples LDW21-IT578 and LDW21-IT578FD and samples LDW21-IT518 and LDW21-IT518FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW21-IT578	LDW21-IT578FD	
Arsenic	15.2	16.7	9

Analyte	Concentration (mg/Kg)		RPD
	LDW21-IT518	LDW21-IT518FD	
Arsenic	5.85	6.40	9

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Target Analyte Quantitation

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 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

LDC #: 52054J4a

SDG #: 21G0064

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer: CT

2nd Reviewer: CT

METHOD: Arsenic (EPA SW 846 Method 6020A)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	SW	(2,3) (4,5)
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Target Analyte Quantitation	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	LDW21-SC580	21G0064-01	Sediment	07/06/21
2	LDW21-IT578	21G0064-02	Sediment	07/06/21
3	LDW21-IT578FD	21G0064-03	Sediment	07/06/21
4	LDW21-IT518	21G0064-08	Sediment	07/06/21
5	LDW21-IT518FD	21G0064-09	Sediment	07/06/21
6	LDW21-IT507	21G0064-10	Sediment	07/06/21
7				
8				
9				
10				
11				
12				
13				

Notes:

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	2	3	
Arsenic	15.2	16.7	9

Analyte	Concentration (mg/Kg)		RPD
	4	5	
Arsenic	5.85	6.40	9

LDC Report# 52054J6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0064

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC580	21G0064-01	Sediment	07/06/21
LDW21-IT578	21G0064-02	Sediment	07/06/21
LDW21-IT578FD	21G0064-03	Sediment	07/06/21
LDW21-SC581B	21G0064-04	Sediment	07/06/21
LDW21-SC581C	21G0064-05	Sediment	07/06/21
LDW21-SC581E	21G0064-06	Sediment	07/06/21
LDW21-IT542	21G0064-07	Sediment	07/06/21
LDW21-IT518	21G0064-08	Sediment	07/06/21
LDW21-IT518FD	21G0064-09	Sediment	07/06/21
LDW21-IT507	21G0064-10	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0064

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

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

Samples LDW21-IT578 and LDW21-IT578FD and samples LDW21-IT518 and LDW21-IT518FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-IT578	LDW21-IT578FD	
Total organic carbon	0.82	0.76	8
Total solids	63.74	66.87	5

Analyte	Concentration (%)		RPD
	LDW21-IT518	LDW21-IT518FD	
Total organic carbon	0.88	0.90	2
Total solids	61.95	63.38	2

X. Target Analyte Quantitation

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 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0064

No Sample Data Qualified in this SDG

LDC #: 52054J6
SDG #: 21G0064
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A,A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(2,3) (8,9)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC580	21G0064-01	Sediment	07/06/21
2	LDW21-IT578	21G0064-02	Sediment	07/06/21
3	LDW21-IT578FD	21G0064-03	Sediment	07/06/21
4	LDW21-SC581B	21G0064-04	Sediment	07/06/21
5	LDW21-SC581C	21G0064-05	Sediment	07/06/21
6	LDW21-SC581E	21G0064-06	Sediment	07/06/21
7	LDW21-IT542	21G0064-07	Sediment	07/06/21
8	LDW21-IT518	21G0064-08	Sediment	07/06/21
9	LDW21-IT518FD	21G0064-09	Sediment	07/06/21
10	LDW21-IT507	21G0064-10	Sediment	07/06/21
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC

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

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

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

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

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	2	3	
TOC	0.82	0.76	8
Total solids	63.74	66.87	5

Analyte	Concentration (%)		RPD
	8	9	
TOC	0.88	0.90	2
Total solids	61.95	63.38	2

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0079

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT592A	21G0079-01	Sediment	07/06/21
LDW21-IT592A-FD	21G0079-02	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	All samples in SDG 21G0079	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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 with the following exceptions:

LCS ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
BJG0328-BS1	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene	55.3 (67-132) 60.1 (66-139)	All samples in SDG 21G0079	J (all detects) J (all detects)	P

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

X. Field Duplicates

Samples LDW21-IT592A and LDW21-IT592A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT592A	LDW21-IT592A-FD	
Benzo(a)anthracene	86.9	85.0	2
Chrysene	71.4	89.4	22
Benzo(b)fluoranthene	81.9	69.8	16
Benzo(k)fluoranthene	47.0	42.2	11
Benzo(a)pyrene	81.6	71.1	14

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT592A	LDW21-IT592A-FD	
Indeno(1,2,3-cd)pyrene	40.9	34.5	17
Dibenzo(a,h)anthracene	13.6	10.1	30

XI. Internal Standards

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

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration r^2 and LCS %R, 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 21G0079

Sample	Analyte	Flag	A or P	Reason
LDW21-IT592A LDW21-IT592A-FD	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW21-IT592A LDW21-IT592A-FD	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene	J (all detects) J (all detects)	P	Laboratory control samples (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

LDC #: 52054K2b

SDG #: 21G0079

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/W	RSD ≤ 20%. r² ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples / SRM	A/W	LCS
X.	Field duplicates	W	D=1+2
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-IT592A	21G0079-01	Sediment	07/06/21
2	LDW21-IT592A-FD	21G0079-02	Sediment	07/06/21
3				
4				
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52054K2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Reviewer: 9K

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 Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?

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

Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?_____

Y N N/A Did the initial calibration meet the acceptance criteria?

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

#	Date	Standard ID	Compound	Finding %RSD (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	7/27/21	1CAL	44K	r^2=0.9891		All (dots)	J/UN/A

INICAL.2SD

LDC #: 52054K2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:

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

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
[✓ Y] N N/A Was a LCS required?
Y [✓ N] N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BJF0328-BS1	JJJ	55.3 (67-132)	( )	( )	All (det)	J/UJ/P
			KKK	60.1 (66-139)	( )	( )		↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

METHOD: GCMS SVOCs (EPA SW846 Method 8270E-SIM)

Compound	Concentration (ug/kg)		RPD
	1	2	
CCC	86.9	85.0	2
DDD	71.4	89.4	22
GGG	81.9	69.8	16
HHH	47.0	42.2	11
III	81.6	71.1	14
JJJ	40.9	34.5	17
KKK	13.6	10.1	30

LDC Report# 52054K3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0079

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT592A	21G0079-01	Sediment	07/06/21
LDW21-IT592A-FD	21G0079-02	Sediment	07/06/21
LDW21-IT638	21G0079-03	Sediment	07/06/21
LDW21-IT639	21G0079-04	Sediment	07/06/21
LDW21-IT604B	21G0079-05	Sediment	07/06/21
LDW21-IT604C	21G0079-06	Sediment	07/06/21
LDW21-IT604E	21G0079-07	Sediment	07/06/21
LDW21-IT602	21G0079-08	Sediment	07/06/21
LDW21-IT602-FD	21G0079-09	Sediment	07/06/21
LDW21-IT603	21G0079-10	Sediment	07/06/21
LDW21-IT543A	21G0079-11	Sediment	07/06/21
LDW21-IT543B	21G0079-12	Sediment	07/06/21
LDW21-IT543C	21G0079-13	Sediment	07/06/21
LDW21-IT543E	21G0079-14	Sediment	07/06/21
LDW21-IT637B	21G0079-15	Sediment	07/06/21
LDW21-IT637C	21G0079-16	Sediment	07/06/21
LDW21-IT637E	21G0079-17	Sediment	07/06/21
LDW21-IT603MS	21G0079-10MS	Sediment	07/06/21
LDW21-IT603MSD	21G0079-10MSD	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent 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

Samples LDW21-IT592A and LDW21-IT592A-FD and samples and LDW21-IT602 and LDW21-IT602-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT592A	LDW21-IT592A-FD	
Aroclor-1248	22.2	20.7	7
Aroclor-1254	110	108	2
Aroclor-1260	43.0	41.5	4

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT602	LDW21-IT602-FD	
Aroclor-1254	561	502	11
Aroclor-1260	317	303	5

X. Target Analyte Quantitation

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

Sample	Analyte	RPD	Flag	A or P
LDW21-IT543C	Aroclor-1248	48	J (all detects)	A
LDW21-IT543E	Aroclor-1254	53	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, data were qualified as estimated in two samples.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0079

Sample	Analyte	Flag	A or P	Reason
LDW21-IT543C	Aroclor-1248	J (all detects)	A	Target analyte quantitation (RPD between two columns)
LDW21-IT543E	Aroclor-1254	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

LDC #: 52054K3b

SDG #: 21G0079

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/22/21

Page: 1 of 2

Reviewer: 9

2nd Reviewer: AC

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A / A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	SW	D = 1+2, 8+9
X.	Target analyte quantitation	SW N	
XI.	Target analyte 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	LDW21-IT592A	21G0079-01	Sediment	07/06/21
2	LDW21-IT590A-FD	21G0079-02	Sediment	07/06/21
3	LDW21-IT638	21G0079-03	Sediment	07/06/21
4	LDW21-IT639	21G0079-04	Sediment	07/06/21
5	LDW21-IT604B	21G0079-05	Sediment	07/06/21
6	LDW21-IT604C	21G0079-06	Sediment	07/06/21
7	LDW21-IT604E	21G0079-07	Sediment	07/06/21
8	LDW21-IT602	21G0079-08	Sediment	07/06/21
9	LDW21-IT602-FD	21G0079-09	Sediment	07/06/21
10	LDW21-IT603	21G0079-10	Sediment	07/06/21
11	LDW21-IT543A	21G0079-11	Sediment	07/06/21
12	LDW21-IT543B	21G0079-12	Sediment	07/06/21
13	LDW21-IT543C	21G0079-13	Sediment	07/06/21
14	LDW21-IT543E	21G0079-14	Sediment	07/06/21
15	LDW21-IT637B	21G0079-15	Sediment	07/06/21
16	LDW21-IT637C	21G0079-16	Sediment	07/06/21
17	LDW21-IT637E	21G0079-17	Sediment	07/06/21

LDC #: 52054K3b
SDG #: 21G0079
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21

Reviewer: CY
2nd Reviewer: M

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

	Client ID	Lab ID	Matrix	Date
18	LDW21-IT603MS	21G0079-10MS	Sediment	07/06/21
19	LDW21-IT603MSD	21G0079-10MSD	Sediment	07/06/21
20				
21				
22				

Notes:

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	8	9	
Aroclor 1248	22.2	20.7	7
Aroclor 1254	110	108	2
Aroclor 1260	43.0	41.5	4

Compound	Concentration (ug/kg)		RPD
	1	2	
Aroclor 1254	561	502	11
Aroclor 1260	317	303	5

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054K3b_Windward.wpd

LDC #: 52054K36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9

METHOD: 1 GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1248	13	48	J det/A
	Aroclor-1254	14	53	↓

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0079

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT592A	21G0079-01	Sediment	07/06/21
LDW21-IT604B	21G0079-05	Sediment	07/06/21
LDW21-IT604C	21G0079-06	Sediment	07/06/21
LDW21-IT604E	21G0079-07	Sediment	07/06/21
LDW21-IT602	21G0079-08	Sediment	07/06/21
LDW21-IT603	21G0079-10	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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

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

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

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 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 method. 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. Target Analyte Quantitation

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 21G0079

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

LDC #: 52054K4a

SDG #: 21G0079

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer: CA

2nd Reviewer:

METHOD: Arsenic (EPA SW 846 Method 6020A)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Target Analyte Quantitation	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	LDW21-IT592A	21G0079-01	Sediment	07/06/21
2	LDW21-IT604B	21G0079-05	Sediment	07/06/21
3	LDW21-IT604C	21G0079-06	Sediment	07/06/21
4	LDW21-IT604E	21G0079-07	Sediment	07/06/21
5	LDW21-IT602	21G0079-08	Sediment	07/06/21
6	LDW21-IT603	21G0079-10	Sediment	07/06/21
7				
8				
9				
10				
11				
12				
13				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 4, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0079

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT592A	21G0079-01	Sediment	07/06/21
LDW21-IT592A-FD	21G0079-02	Sediment	07/06/21
LDW21-IT638	21G0079-03	Sediment	07/06/21
LDW21-IT639	21G0079-04	Sediment	07/06/21
LDW21-IT604B	21G0079-05	Sediment	07/06/21
LDW21-IT604C	21G0079-06	Sediment	07/06/21
LDW21-IT604E	21G0079-07	Sediment	07/06/21
LDW21-IT602	21G0079-08	Sediment	07/06/21
LDW21-IT602-FD	21G0079-09	Sediment	07/06/21
LDW21-IT603	21G0079-10	Sediment	07/06/21
LDW21-IT543A	21G0079-11	Sediment	07/06/21
LDW21-IT543B	21G0079-12	Sediment	07/06/21
LDW21-IT543C	21G0079-13	Sediment	07/06/21
LDW21-IT543E	21G0079-14	Sediment	07/06/21
LDW21-IT637B	21G0079-15	Sediment	07/06/21
LDW21-IT637C	21G0079-16	Sediment	07/06/21
LDW21-IT637E	21G0079-17	Sediment	07/06/21
LDW21-IT592ADUP1	21G0079-01DUP1	Sediment	07/06/21
LDW21-IT592ADUP2	21G0079-01DUP2	Sediment	07/06/21
LDW21-IT637BMS	21G0079-15MS	Sediment	07/06/21
LDW21-IT637BDUP	21G0079-15DUP	Sediment	07/06/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0079

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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW21-IT637BDUP (LDW21-IT637B LDW21-IT637C LDW21-IT637E LDW21-IT637BDUP)	Total organic carbon	54.6 (≤20)	-	J (all detects)	A

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 LDW21-IT592A and LDW21-IT592A-FD and samples LDW21-IT602 and LDW21-IT602-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-IT592A	LDW21-IT592A-FD	
Total organic carbon	1.69	1.72	2
Total solids	63.16	64.45	2

Analyte	Concentration (%)		RPD
	LDW21-IT602	LDW21-IT602-FD	
Total organic carbon	1.50	0.34	126
Total solids	76.49	75.57	1

X. Target Analyte Quantitation

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.

Due to DUP RPD, 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
Wet Chemistry - Data Qualification Summary - SDG 21G0079

Sample	Analyte	Flag	A or P	Reason
LDW21-IT637B LDW21-IT637C LDW21-IT637E LDW21-IT637BDUP	Total organic carbon	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0079

No Sample Data Qualified in this SDG

LDC #: 52054K6
SDG #: 21G0079
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(1,2) (8,9)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT592A	21G0079-01	Sediment	07/06/21
2	LDW21-IT592A-FD	21G0079-02	Sediment	07/06/21
3	LDW21-IT638	21G0079-03	Sediment	07/06/21
4	LDW21-IT639	21G0079-04	Sediment	07/06/21
5	LDW21-IT604B	21G0079-05	Sediment	07/06/21
6	LDW21-IT604C	21G0079-06	Sediment	07/06/21
7	LDW21-IT604E	21G0079-07	Sediment	07/06/21
8	LDW21-IT602	21G0079-08	Sediment	07/06/21
9	LDW21-IT602-FD	21G0079-09	Sediment	07/06/21
10	LDW21-IT603	21G0079-10	Sediment	07/06/21
11	LDW21-IT543A	21G0079-11	Sediment	07/06/21
12	LDW21-IT543B	21G0079-12	Sediment	07/06/21
13	LDW21-IT543C	21G0079-13	Sediment	07/06/21
14	LDW21-IT543E	21G0079-14	Sediment	07/06/21
15	LDW21-IT637B	21G0079-15	Sediment	07/06/21
16	LDW21-IT637C	21G0079-16	Sediment	07/06/21
17	LDW21-IT637E	21G0079-17	Sediment	07/06/21

LDC #: 52054K6
SDG #: 21G0079
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21

Reviewer: C
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-IT592ADUP \	21G0079-01DUP \	Sediment	07/06/21
19	LDW21-IT592A~~TRP~~ DUP	21G0079-01~~TRP~~ DUP	Sediment	07/06/21
20	LDW21-IT637BMS	21G0079-15MS	Sediment	07/06/21
21	LDW21-IT637BDUP	21G0079-15DUP	Sediment	07/06/21
22				
23				
24				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
18, 19	TS
20, 21	TOC

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

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

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

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

VALIDATION FINDINGS WORKSHEETS
Laboratory Duplicates

METHOD: Inorganics

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 reproting limits, the difference was with 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Assocaited Samples	Qualification	Det/ND
21	s	TOC	54.6	20			15-17, 21	J/UJ/A	Det

Comments:

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	1	2	
TOC	1.69	1.72	2
Total solids	63.16	64.45	2

Analyte	Concentration (%)		RPD
	8	9	
TOC	1.50	0.34	126
Total solids	76.49	75.57	1

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0082

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW-21-SC583	21G0082-01	Sediment	07/07/21
LDW-21-SC586	21G0082-02	Sediment	07/07/21
LDW-21-SC590	21G0082-03	Sediment	07/07/21
LDW-21-SC589	21G0082-08	Sediment	07/07/21
LDW-21-SC583MS	21G0082-01MS	Sediment	07/07/21
LDW-21-SC583MSD	21G0082-01MSD	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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

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. Internal Standards

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

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

LDC #: 52054L2a
SDG #: 21G0082
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: A
2nd Reviewer: RC

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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. RF ≥ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW-21-SC583	2.A	21G0082-01	Sediment	07/07/21
2	LDW-21-SC586	A	21G0082-02	Sediment	07/07/21
3	LDW-21-SC590	A	21G0082-03	Sediment	07/07/21
4	LDW-21-SC589		21G0082-08	Sediment	07/07/21
5	LDW-21-SC583MS		21G0082-01MS	Sediment	07/07/21
6	LDW-21-SC583MSD		21G0082-01MSD	Sediment	07/07/21
7					
8					
9					

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0082

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW-21-SC590	21G0082-03	Sediment	07/07/21
LDW-21-SC589	21G0082-08	Sediment	07/07/21
LDW-21-SC589MS	21G0082-08MS	Sediment	07/07/21
LDW-21-SC589MSD	21G0082-08MSD	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	All samples in SDG 21G0082	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW-21-SC589MS/MSD (LDW-21-SC589)	Indeno(1,2,3-cd)pyrene Pyrene	58.4 (67-132) -	56.3 (67-132) 48.3 (49-120)	J (all detects) J (all detects)	A

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

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

LCS ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
BJG0353-BS1	Indeno(1,2,3-cd)pyrene	62.8 (67-132)	All samples in SDG 21G0082	J (all detects)	P

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration r^2, MS/MSD %R, and LCS %R, 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 21G0082

Sample	Analyte	Flag	A or P	Reason
LDW-21-SC590 LDW-21-SC589	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW-21-SC590 LDW-21-SC589	Indeno(1,2,3-cd)pyrene Pyrene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW-21-SC590 LDW-21-SC589	Indeno(1,2,3-cd)pyrene	J (all detects)	P	Laboratory control samples (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

LDC #: 52054L2b

VALIDATION COMPLETENESS WORKSHEET

SDG #: 21G0082

Stage 2B

Laboratory: Analytical Resources, Inc.

Date: 9/23/21

Page: 1 of 1

Reviewer: 9

2nd Reviewer: JL

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/N	RSD ≤ 20% . r² ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	MW	
IX.	Laboratory control samples / SRM	SW/A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW-21-SC590	21G0082-03	Sediment	07/07/21
2	LDW-21-SC589	21G0082-08	Sediment	07/07/21
3	LDW-21-SC589MS	21G0082-08MS	Sediment	07/07/21
4	LDW-21-SC589MSD	21G0082-08MSD	Sediment	07/07/21
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #52054L2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Reviewer: Q

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

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

- (Y) N N/A Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?
- (Y) N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
- (Y) N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?________
- Y N N/A Did the initial calibration meet the acceptance criteria?
- Y (N) N/A Were all %RSDs and RRFs within the validation criteria of ≤20 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	7/27/21	ICAL	KKK	r^2=0.9891		All (dets)	J/UJ/A

INICAL.2SD

LDC #: 52054k2b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: Q

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

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

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

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

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

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		3/4	VV	58.4 (67-132)	56.3 (67-132)	( )	2 (dets)	J/UJ/A
			ZZ	( )	48.3 (49-120)	( )		d
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		

LDC #: 52054L2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:

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

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

[✓ Y] N N/A Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		BJ40353-BS1	HH	62.8 (67-132)	( )	( )	All (dets)	J/UJ/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0082

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW-21-SC583	21G0082-01	Sediment	07/07/21
LDW-21-SC586	21G0082-02	Sediment	07/07/21
LDW-21-SC590	21G0082-03	Sediment	07/07/21
LDW-21-SC510B	21G0082-04	Sediment	07/07/21
LDW-21-SC510C	21G0082-05	Sediment	07/07/21
LDW-21-SC510C-FD	21G0082-06	Sediment	07/07/21
LDW-21-SC510E	21G0082-07	Sediment	07/07/21
LDW-21-SC589	21G0082-08	Sediment	07/07/21
LDW-21-SC584B	21G0082-09	Sediment	07/07/21
LDW-21-SC584B-FD	21G0082-10	Sediment	07/07/21
LDW-21-SC599	21G0082-11	Sediment	07/07/21
LDW-21-IT647	21G0082-12	Sediment	07/07/21
LDW-21-IT647-FD	21G0082-13	Sediment	07/07/21
LDW-21-IT609B	21G0082-14	Sediment	07/07/21
LDW-21-IT609C	21G0082-15	Sediment	07/07/21
LDW-21-IT609E	21G0082-16	Sediment	07/07/21
LDW-21-IT615B	21G0082-17	Sediment	07/07/21
LDW-21-IT615C	21G0082-18	Sediment	07/07/21
LDW-21-IT617B	21G0082-19	Sediment	07/07/21
LDW-21-IT617C	21G0082-20	Sediment	07/07/21
LDW-21-IT611	21G0082-21	Sediment	07/07/21
LDW-21-SC583MS	21G0082-01MS	Sediment	07/07/21
LDW-21-SC583MSD	21G0082-01MSD	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Analyte	%D	Associated Samples	Flag	A or P
07/25/21	07242143	Col. 2	Aroclor-1260	20.7	LDW-21-SC583 LDW-21-SC586 LDW-21-SC590	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/Internal Standards

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample LDW-21-SC510B. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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

Samples LDW-21-SC510C and LDW-21-SC510C-FD, samples LDW-21-SC584B and LDW-21-SC584B-FD, and samples LDW-21-IT647 and LDW-21-IT647-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW-21-SC510C	LDW-21-SC510C-FD	
Aroclor-1248	478	478	0
Aroclor-1254	753	761	1
Aroclor-1260	309	314	2

Analyte	Concentration (ug/Kg)		RPD
	LDW-21-SC584B	LDW-21-SC584B-FD	
Aroclor-1254	1.7	4.0U	Not calculable
Aroclor-1260	2.8	2.2	24

Analyte	Concentration (ug/Kg)		RPD
	LDW-21-IT647	LDW-21-IT647-FD	
Aroclor-1248	17.7	16.7	6
Aroclor-1254	30.2	27.5	9

Analyte	Concentration (ug/Kg)		RPD
	LDW-21-IT647	LDW-21-IT647-FD	
Aroclor-1260	45.1	18.2	85

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 continuing calibration %D, 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 Biphenyls - Data Qualification Summary - SDG 21G0082

Sample	Analyte	Flag	A or P	Reason
LDW-21-SC583 LDW-21-SC586 LDW-21-SC590	Aroclor-1260	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

LDC #: 52054L3b

SDG #: 21G0082

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 2

Reviewer: Q

2nd Reviewer: K

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	
II.	Initial calibration/ICV	A / A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / DS	SW / A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	SW	D = 5+6 · 9+10 · 12+13
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW-21-SC583	21G0082-01	Sediment	07/07/21
2	LDW-21-SC586	21G0082-02	Sediment	07/07/21
3	LDW-21-SC590	21G0082-03	Sediment	07/07/21
4	LDW-21-SC510B	21G0082-04	Sediment	07/07/21
5	LDW-21-SC510C	21G0082-05	Sediment	07/07/21
6	LDW-21-SC510C-FD	21G0082-06	Sediment	07/07/21
7	LDW-21-SC510E	21G0082-07	Sediment	07/07/21
8	LDW-21-SC589	21G0082-08	Sediment	07/07/21
9	LDW-21-SC584B	21G0082-09	Sediment	07/07/21
10	LDW-21-SC584B-FD	21G0082-10	Sediment	07/07/21
11	LDW-21-SC599	21G0082-11	Sediment	07/07/21
12	LDW-21-IT647	21G0082-12	Sediment	07/07/21
13	LDW-21-IT647-FD	21G0082-13	Sediment	07/07/21
14	LDW-21-IT609B	21G0082-14	Sediment	07/07/21
15	LDW-21-IT609C	21G0082-15	Sediment	07/07/21
16	LDW-21-IT609E	21G0082-16	Sediment	07/07/21
17	LDW-21-IT615B	21G0082-17	Sediment	07/07/21

LDC #: 52054L3b

SDG #: 21G0082

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Reviewer: 2Q

2nd Reviewer: A

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

	Client ID	Lab ID	Matrix	Date
18	LDW-21-IT615C	21G0082-18	Sediment	07/07/21
19	LDW-21-IT617B	21G0082-19	Sediment	07/07/21
20	LDW-21-IT617C	21G0082-20	Sediment	07/07/21
21	LDW-21-IT611	21G0082-21	Sediment	07/07/21
22	LDW-21-SC583MS	21G0082-01MS	Sediment	07/07/21
23	LDW-21-SC583MSD	21G0082-01MSD	Sediment	07/07/21
24				
25				
26				

Notes:

LDC #: 52054L36

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Page: 1 of 1
Reviewer: Q

METHOD: ✓ GC __ HPLC

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

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

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

Level IV Only

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

#	Date	Standard ID	~~Detector/~~ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/25/21	07242143	2	Aroclor1260	20.7	( )	1-3, MB, 22-23	~~dets~~ J/UJ/A
						( )	(dets)	
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
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						( )		
						( )		

LDC #: 52054L36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

METHOD: ✓ GC __ HPLC

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	~~Detector/~~ Column	Surrogate Compound	%R (Limits)	Qualifications
	4	1	O	127 (40-126)	No Qual (OF>5x)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

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

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	5	6	
Aroclor 1248	478	478	0
Aroclor 1254	753	761	1
Aroclor 1260	309	314	2

Compound	Concentration (ug/kg)		RPD
	9	10	
Aroclor 1254	1.7	4.0U	NC
Aroclor 1260	2.8	2.2	24

Compound	Concentration (ug/kg)		RPD
	12	13	
Aroclor 1248	17.7	16.7	6
Aroclor 1254	30.2	27.5	9
Aroclor 1260	45.1	18.2	85

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054L3b_Windward.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0082

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW-21-SC583	21G0082-01	Sediment	07/07/21
LDW-21-SC586	21G0082-02	Sediment	07/07/21
LDW-21-SC590	21G0082-03	Sediment	07/07/21
LDW-21-SC589	21G0082-08	Sediment	07/07/21
LDW-21-IT615B	21G0082-17	Sediment	07/07/21
LDW-21-IT615C	21G0082-18	Sediment	07/07/21
LDW-21-IT617B	21G0082-19	Sediment	07/07/21
LDW-21-IT617C	21G0082-20	Sediment	07/07/21
LDW-21-SC583MS	21G0082-01MS	Sediment	07/07/21
LDW-21-SC583MSD	21G0082-01MSD	Sediment	07/07/21
LDW-21-SC583DUP	21G0082-01DUP	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020B

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

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW-21-SC583MS/MSD (All samples in SDG 21G0082)	Arsenic	74.5 (75-125)	-	J (all detects)	A
LDW-21-SC583MS/MSD (LDW-21-SC586 LDW-21-SC590 LDW-21-SC589)	Zinc	72.6 (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 method. 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. Target Analyte Quantitation

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 MS/MSD %R, 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
Metals - Data Qualification Summary - SDG 21G0082

Sample	Analyte	Flag	A or P	Reason
LDW-21-SC583 LDW-21-SC586 LDW-21-SC590 LDW-21-SC589 LDW-21-IT615B LDW-21-IT615C LDW-21-IT617B LDW-21-IT617C LDW-21-SC583DUP	Arsenic	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW-21-SC586 LDW-21-SC590 LDW-21-SC589	Zinc	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

LDC #: 52054L4a

SDG #: 21G0082

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: Arsenic & Zinc (EPA SW 846 Method 6020A) B

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Target Analyte Quantitation	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	LDW-21-SC583	21G0082-01	Sediment	07/07/21
2	LDW-21-SC586	21G0082-02	Sediment	07/07/21
3	LDW-21-SC590	21G0082-03	Sediment	07/07/21
4	LDW-21-SC589	21G0082-08	Sediment	07/07/21
5	LDW-21-IT615B	21G0082-17	Sediment	07/07/21
6	LDW-21-IT615C	21G0082-18	Sediment	07/07/21
7	LDW-21-IT617B	21G0082-19	Sediment	07/07/21
8	LDW-21-IT617C	21G0082-20	Sediment	07/07/21
9	LDW-21-SC583MS	21G0082-01MS	Sediment	07/07/21
10	LDW-21-SC583MSD	21G0082-01MSD	Sediment	07/07/21
11	LDW-21-SC583DUP	21G0082-01DUP	Sediment	07/07/21
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1, 5-8	As
2, 3, 4	As, Zn

Analysis Method

ICP	
ICP-MS	As, Zn
CVAA	

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

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

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND	Post spike
9, 10	s	As	74.5		75-125			All	J/UJ/A	Det	
		Zn	72.6		75-125			2 to 4	J/UJ/A	Det	

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0082

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW-21-SC583	21G0082-01	Sediment	07/07/21
LDW-21-SC586	21G0082-02	Sediment	07/07/21
LDW-21-SC590	21G0082-03	Sediment	07/07/21
LDW-21-SC510B	21G0082-04	Sediment	07/07/21
LDW-21-SC510C	21G0082-05	Sediment	07/07/21
LDW-21-SC510C-FD	21G0082-06	Sediment	07/07/21
LDW-21-SC510E	21G0082-07	Sediment	07/07/21
LDW-21-SC589	21G0082-08	Sediment	07/07/21
LDW-21-SC584B	21G0082-09	Sediment	07/07/21
LDW-21-SC584B-FD	21G0082-10	Sediment	07/07/21
LDW-21-SC599	21G0082-11	Sediment	07/07/21
LDW-21-IT647	21G0082-12	Sediment	07/07/21
LDW-21-IT647-FD	21G0082-13	Sediment	07/07/21
LDW-21-IT609B	21G0082-14	Sediment	07/07/21
LDW-21-IT609C	21G0082-15	Sediment	07/07/21
LDW-21-IT609E	21G0082-16	Sediment	07/07/21
LDW-21-IT615B	21G0082-17	Sediment	07/07/21
LDW-21-IT615C	21G0082-18	Sediment	07/07/21
LDW-21-IT617B	21G0082-19	Sediment	07/07/21
LDW-21-IT617C	21G0082-20	Sediment	07/07/21
LDW-21-IT611	21G0082-21	Sediment	07/07/21
LDW-21-SC583DUP1	21G0082-01DUP1	Sediment	07/07/21
LDW-21-SC583DUP2	21G0082-01DUP2	Sediment	07/07/21
LDW-21-IT615CMS	21G0082-18MS	Sediment	07/07/21
LDW-21-IT615CDUP	21G0082-18DUP	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0082

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 LDW-21-SC510C and LDW-21-SC510C-FD, samples LDW-21-SC584B and LDW-21-SC584B-FD, and samples LDW-21-IT647 and LDW-21-IT647-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW-21-SC510C	LDW-21-SC510C-FD	
Total organic carbon	0.94	0.85	10
Total solids	69.07	69.60	1

Analyte	Concentration (%)		RPD
	LDW-21-SC584B	LDW-21-SC584B-FD	
Total organic carbon	2.38	2.57	8
Total solids	58.74	58.26	1

Analyte	Concentration (%)		RPD
	LDW-21-IT647	LDW-21-IT647-FD	
Total organic carbon	1.70	1.66	2
Total solids	50.69	50.74	0

X. Target Analyte Quantitation

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 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0082

No Sample Data Qualified in this SDG

LDC #: 52054L6
SDG #: 21G0082
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(5,6) (9,10) (12,13)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
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5	LDW-21-SC510C	21G0082-05	Sediment	07/07/21
6	LDW-21-SC510C-FD	21G0082-06	Sediment	07/07/21
7	LDW-21-SC510E	21G0082-07	Sediment	07/07/21
8	LDW-21-SC589	21G0082-08	Sediment	07/07/21
9	LDW-21-SC584B	21G0082-09	Sediment	07/07/21
10	LDW-21-SC584B-FD	21G0082-10	Sediment	07/07/21
11	LDW-21-SC599	21G0082-11	Sediment	07/07/21
12	LDW-21-IT647	21G0082-12	Sediment	07/07/21
13	LDW-21-IT647-FD	21G0082-13	Sediment	07/07/21
14	LDW-21-IT609B	21G0082-14	Sediment	07/07/21
15	LDW-21-IT609C	21G0082-15	Sediment	07/07/21
16	LDW-21-IT609E	21G0082-16	Sediment	07/07/21
17	LDW-21-IT615B	21G0082-17	Sediment	07/07/21

LDC #: 52054L6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0082 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW-21-IT615C	21G0082-18	Sediment	07/07/21
19	LDW-21-IT617B	21G0082-19	Sediment	07/07/21
20	LDW-21-IT617C	21G0082-20	Sediment	07/07/21
21	LDW-21-IT611	21G0082-21	Sediment	07/07/21
22	LDW-21-SC583DUP	21G0082-01DUP	Sediment	07/07/21
23	LDW-21-SC583~~TRP~~ D R2	21G0082-01~~TRP~~ D R2	Sediment	07/07/21
24	LDW-21-IT615CMS	21G0082-18MS	Sediment	07/07/21
25	LDW-21-IT615CDUP	21G0082-18DUP	Sediment	07/07/21
26				
27				
28				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
22, 23	TS
24, 25	TOC

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

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

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

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

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	5	6	
TOC	0.94	0.85	10
Total solids	69.07	69.60	1

Analyte	Concentration (%)		RPD
	9	10	
TOC	2.38	2.57	8
Total solids	58.74	58.26	1

Analyte	Concentration (%)		RPD
	12	13	
TOC	1.70	1.66	2
Total solids	50.69	50.74	0

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0089

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT618B	21G0089-01	Sediment	07/07/21
LDW21-IT618C	21G0089-02	Sediment	07/07/21
LDW21-IT605	21G0089-03	Sediment	07/07/21
LDW21-IT606	21G0089-04	Sediment	07/07/21
LDW21-IT624B	21G0089-05	Sediment	07/07/21
LDW21-IT624C	21G0089-06	Sediment	07/07/21
LDW21-IT626B	21G0089-07	Sediment	07/07/21
LDW21-IT626C	21G0089-08	Sediment	07/07/21
LDW21-IT606MS	21G0089-04MS	Sediment	07/07/21
LDW21-IT606MSD	21G0089-04MSD	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 LDW21-IT624C. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standards	%R (Limits)	Affected Analyte	Flag	A or P
LDW21-IT626C	Hexabromobiphenyl	49 (50-200)	Aroclor-1260	J (all detects)	P

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) and relative percent differences (RPD) were not within the QC limits for LDW21-IT606MS/MSD. No data were qualified for MS/MSD samples analyzed greater than or equal to a 5X dilution.

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 internal standard %R, data were qualified as estimated in one sample.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0089

Sample	Analyte	Flag	A or P	Reason
LDW21-IT626C	Aroclor-1260	J (all detects)	P	Internal standards (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0089

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0089

No Sample Data Qualified in this SDG

LDC #: 52054M3b
SDG #: 21G0089
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	KW/KW	
VII.	Matrix spike/Matrix spike duplicates	KW	9/10: %R and RPD out > SWOF
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-IT618B	21G0089-01	Sediment	07/07/21
2	LDW21-IT618C	21G0089-02	Sediment	07/07/21
3	LDW21-IT605	21G0089-03	Sediment	07/07/21
4	LDW21-IT606	21G0089-04	Sediment	07/07/21
5	LDW21-IT624B	21G0089-05	Sediment	07/07/21
6	LDW21-IT624C	21G0089-06	Sediment	07/07/21
7	LDW21-IT626B	21G0089-07	Sediment	07/07/21
8	LDW21-IT626C	21G0089-08	Sediment	07/07/21
9	LDW21-IT606MS	21G0089-04MS	Sediment	07/07/21
10	LDW21-IT606MSD	21G0089-04MSD	Sediment	07/07/21
11				
12				
13				

Notes:

LDC #: 52665A126

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	~~Detector/~~ Column	Surrogate Compound	%R (Limits)	Qualifications
	6	1	O	132 (40-126)	No Qual (5X)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

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

LDC #: 52054M3c

VALIDATION FINDINGS WORKSHEET
Internal Standards

Page: 1 of 1
Reviewer: 9

METHOD: GC

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

Y (N) N/A — Were all internal standard area counts within -50 to +100% of the ICAL midpoint standard?

(Y) N N/A — Were the retention times of the internal standards within +/- 0.05 min seconds of the retention times of the ICAL midpoint standard?

#	Date	Sample ID	Internal Standard	Area (Limits)	RT (Limits)	Qualifications
		8 (dets)	B	49 (50-200)		J/UJ/P (BB)
			B=Hexabromobiphenyl			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0089

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT618B	21G0089-01	Sediment	07/07/21
LDW21-IT618C	21G0089-02	Sediment	07/07/21
LDW21-IT624B	21G0089-05	Sediment	07/07/21
LDW21-IT624C	21G0089-06	Sediment	07/07/21
LDW21-IT626B	21G0089-07	Sediment	07/07/21
LDW21-IT626C	21G0089-08	Sediment	07/07/21
LDW21-IT618BMS	21G0089-01MS	Sediment	07/07/21
LDW21-IT618BMSD	21G0089-01MSD	Sediment	07/07/21
LDW21-IT618BDUP	21G0089-01DUP	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-IT618BMS/MSD (All samples in SDG 21G0089)	Arsenic	72.3 (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 method. 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. Target Analyte Quantitation

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

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

Duwamish AOC4
Arsenic - Data Qualification Summary - SDG 21G0089

Sample	Analyte	Flag	A or P	Reason
LDW21-IT618B LDW21-IT618C LDW21-IT624B LDW21-IT624C LDW21-IT626B LDW21-IT626C LDW21-IT618BDUP	Arsenic	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0089

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0089

No Sample Data Qualified in this SDG

LDC #: 52054M4a

SDG #: 21G0089

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/25

Page: 1 of 1

Reviewer: G

2nd Reviewer: G

METHOD: Arsenic (EPA SW 846 Method 6020A)B

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	not reviewed
XIII.	Target Analyte Quantitation	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	LDW21-IT618B	21G0089-01	Sediment	07/07/21
2	LDW21-IT618C	21G0089-02	Sediment	07/07/21
3	LDW21-IT624B	21G0089-05	Sediment	07/07/21
4	LDW21-IT624C	21G0089-06	Sediment	07/07/21
5	LDW21-IT626B	21G0089-07	Sediment	07/07/21
6	LDW21-IT626C	21G0089-08	Sediment	07/07/21
7	LDW21-IT618BMS	21G0089-01MS	Sediment	07/07/21
8	LDW21-IT618BMSD	21G0089-01MSD	Sediment	07/07/21
9	LDW21-IT618BDUP	21G0089-01DUP	Sediment	07/07/21
10				
11				
12				
13				

Notes:

VALIDATION FINDINGS WORKSHEETS

Matrix Spike/Matrix Spike Duplicates

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

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

MS/MSD ID	Matrix	Analyte	MS %R	MSD %R	%R Limit	RPD	RPD Limit	Associated Samples	Qualification	Det/ND	Post spike
7, 8	s	As	72.3		75-125			All	J/UJ/A	Det	

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0089

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT618B	21G0089-01	Sediment	07/07/21
LDW21-IT618C	21G0089-02	Sediment	07/07/21
LDW21-IT605	21G0089-03	Sediment	07/07/21
LDW21-IT606	21G0089-04	Sediment	07/07/21
LDW21-IT624B	21G0089-05	Sediment	07/07/21
LDW21-IT624C	21G0089-06	Sediment	07/07/21
LDW21-IT626B	21G0089-07	Sediment	07/07/21
LDW21-IT626C	21G0089-08	Sediment	07/07/21
LDW21-IT618BDUP1	21G0089-01DUP1	Sediment	07/07/21
LDW21-IT618BDUP2	21G0089-01DUP2	Sediment	07/07/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0089

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. Target Analyte Quantitation

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 21G0089

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0089

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0089

No Sample Data Qualified in this SDG

LDC #: 52054M6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0089 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT618B	21G0089-01	Sediment	07/07/21
2	LDW21-IT618C	21G0089-02	Sediment	07/07/21
3	LDW21-IT605	21G0089-03	Sediment	07/07/21
4	LDW21-IT606	21G0089-04	Sediment	07/07/21
5	LDW21-IT624B	21G0089-05	Sediment	07/07/21
6	LDW21-IT624C	21G0089-06	Sediment	07/07/21
7	LDW21-IT626B	21G0089-07	Sediment	07/07/21
8	LDW21-IT626C	21G0089-08	Sediment	07/07/21
9	LDW21-IT618BDUP	21G0089-01DUP	Sediment	07/07/21
10	LDW21-IT618B ~~TRP~~ DUP	21G0089-01 ~~TRP~~ DUP	Sediment	07/07/21
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Butylbenzylphthalate

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC594	21G0094-01	Sediment	07/08/21
LDW21-SC623	21G0094-06	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Butylbenzylphthalate 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

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. Internal Standards

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

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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
Butylbenzylphthalate - Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Laboratory Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Field Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

LDC #: 52054N2a

SDG #: 21G0094

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: CL

2nd Reviewer: A

METHOD: GC/MS Butylbenzylphthalate (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 70%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC594	21G0094-01	Sediment	07/08/21
2	LDW21-SC623	21G0094-06	Sediment	07/08/21
3				
4				
5				
6				
7				
8				
9				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC594	21G0094-01	Sediment	07/08/21
LDW21-SC519A	21G0094-02	Sediment	07/08/21
LDW21-SC519A-FD	21G0094-03	Sediment	07/08/21
LDW21-SC610	21G0094-04	Sediment	07/08/21
LDW21-SC612	21G0094-05	Sediment	07/08/21
LDW21-SC623	21G0094-06	Sediment	07/08/21
LDW21-IT651	21G0094-07	Sediment	07/08/21
LDW21-IT651-FD	21G0094-08	Sediment	07/08/21
LDW21-SC640A	21G0094-09	Sediment	07/08/21
LDW21-IT656	21G0094-10	Sediment	07/08/21
LDW21-IT656-FD	21G0094-11	Sediment	07/08/21
LDW21-SC535B	21G0094-12	Sediment	07/08/21
LDW21-SC535C	21G0094-13	Sediment	07/08/21
LDW21-SC535E	21G0094-14	Sediment	07/08/21
LDW21-IT668	21G0094-15	Sediment	07/08/21
LDW21-IT668-FD	21G0094-16	Sediment	07/08/21
LDW21-IT627	21G0094-17	Sediment	07/08/21
LDW21-SC594MS	21G0094-01MS	Sediment	07/08/21
LDW21-SC594MSD	21G0094-01MSD	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Analyte	%D	Associated Samples	Flag	A or P
07/26/21	07262104	Col. 2	Aroclor-1254	21.4	LDW21-SC594 LDW21-SC519A LDW21-SC519A-FD LDW21-SC610 LDW21-SC612 LDW21-SC623 LDW21-IT651 LDW21-IT651-FD LDW21-SC640A LDW21-IT656	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/Internal Standards

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample LDW21-IT627. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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

Samples LDW21-SC519A and LDW21-SC519A-FD, samples LDW21-IT651 and LDW21-IT651-FD, samples LDW21-IT656 and LDW21-IT656-FD, and samples LDW21-IT668 and LDW21-IT668-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC519A	LDW21-SC519A-FD	
Aroclor-1248	66.8	64.2	4
Aroclor-1254	116	110	5
Aroclor-1260	93.7	83.9	11

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT651	LDW21-IT651-FD	
Aroclor-1248	17.8	19.9	11
Aroclor-1254	44.1	43.4	2
Aroclor-1260	29.7	26.0	13

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT656	LDW21-IT656-FD	
Aroclor-1248	12.3	12.1	2
Aroclor-1254	22.8	23.7	4
Aroclor-1260	18.4	17.9	3

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT668	LDW21-IT668-FD	
Aroclor-1248	205	185	10
Aroclor-1254	389	380	2
Aroclor-1260	133	132	1

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 continuing calibration %D, data were qualified as estimated in ten samples.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0094

Sample	Analyte	Flag	A or P	Reason
LDW21-SC594 LDW21-SC519A LDW21-SC519A-FD LDW21-SC610 LDW21-SC612 LDW21-SC623 LDW21-IT651 LDW21-IT651-FD LDW21-SC640A LDW21-IT656	Aroclor-1254	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

LDC #: 52054N3b

SDG #: 21G0094

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 2

Reviewer: CK

2nd Reviewer: KC

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	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / TCMX	SW/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	SW	D=2+3. 7+8. 10+11. 15+16
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC594	21G0094-01	Sediment	07/08/21
2	LDW21-SC519A	21G0094-02	Sediment	07/08/21
3	LDW21-SC519A-FD	21G0094-03	Sediment	07/08/21
4	LDW21-SC610	21G0094-04	Sediment	07/08/21
5	LDW21-SC612	21G0094-05	Sediment	07/08/21
6	LDW21-SC623	21G0094-06	Sediment	07/08/21
7	LDW21-IT651	21G0094-07	Sediment	07/08/21
8	LDW21-IT651-FD	21G0094-08	Sediment	07/08/21
9	LDW21-SC640A	21G0094-09	Sediment	07/08/21
10	LDW21-IT656	21G0094-10	Sediment	07/08/21
11	LDW21-IT656-FD	21G0094-11	Sediment	07/08/21
12	LDW21-SC535B	21G0094-12	Sediment	07/08/21
13	LDW21-SC535C	21G0094-13	Sediment	07/08/21
14	LDW21-SC535E	21G0094-14	Sediment	07/08/21
15	LDW21-IT668	21G0094-15	Sediment	07/08/21
16	LDW21-IT668-FD	21G0094-16	Sediment	07/08/21
17	LDW21-IT627	21G0094-17	Sediment	07/08/21

LDC #: 52054N3b

SDG #: 21G0094

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Reviewer: 9

2nd Reviewer: 9

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

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC594MS	21G0094-01MS	Sediment	07/08/21
19	LDW21-SC594MSD	21G0094-01MSD	Sediment	07/08/21
20				
21				
22				

Notes:

LDC #: 52054N3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: q

METHOD: ✓ GC ___ HPLC

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

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

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

Level IV Only

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

#	Date	Standard ID	~~Detector~~/ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/26/21	07262104	2	Arodor 1254	21.4	( )	1-10.18-19. MB	J/UJ/A
						( )	(dets)	
						( )		
						( )		
						( )		
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LDC #: 52054N36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: K

METHOD: √ GC ___ HPLC

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	~~Detector~~/ Column	Surrogate Compound	%R (Limits)	Qualifications
	17	1	O	129 (40-126)	No qual (10x)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1.4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	2	3	
Aroclor 1248	66.8	64.2	4
Aroclor 1254	116	110	5
Aroclor 1260	93.7	83.9	11

Compound	Concentration (ug/kg)		RPD
	7	8	
Aroclor 1248	17.8	19.9	11
Aroclor 1254	44.1	43.4	2
Aroclor 1260	29.7	26.0	13

Compound	Concentration (ug/kg)		RPD
	10	11	
Aroclor 1248	12.3	12.1	2
Aroclor 1254	22.8	23.7	4
Aroclor 1260	18.4	17.9	3

Compound	Concentration (ug/kg)		RPD
	15	16	
Aroclor 1248	205	185	10
Aroclor 1254	389	380	2
Aroclor 1260	133	132	1

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054N3b_Windward.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC594	21G0094-01	Sediment	07/08/21
LDW21-SC623	21G0094-06	Sediment	07/08/21
LDW21-IT627	21G0094-17	Sediment	07/08/21
LDW21-SC623MS	21G0094-06MS	Sediment	07/08/21
LDW21-SC623MSD	21G0094-06MSD	Sediment	07/08/21
LDW21-SC623DUP	21G0094-06DUP	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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, Lead, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020B
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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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. Target Analyte Quantitation

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 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

LDC #: 52054N4a

SDG #: 21G0094

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer: G

2nd Reviewer: G

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	NR
XIII.	Target Analyte Quantitation	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	LDW21-SC594	21G0094-01	Sediment	07/08/21
2	LDW21-SC623	21G0094-06	Sediment	07/08/21
3	LDW21-IT627	21G0094-17	Sediment	07/08/21
4	LDW21-SC623MS	21G0094-06MS	Sediment	07/08/21
5	LDW21-SC623MSD	21G0094-06MSD	Sediment	07/08/21
6	LDW21-SC623DUP	21G0094-06DUP	Sediment	07/08/21
7				
8				
9				
10				
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1, 3	As
2	Zn, Hg, Pb
QC:	
4, 5, 6	Hg

Analysis Method

ICP	
ICP-MS	As, Zn, Pb
CVAA	Hg

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC594	21G0094-01	Sediment	07/08/21
LDW21-SC519A	21G0094-02	Sediment	07/08/21
LDW21-SC519A-FD	21G0094-03	Sediment	07/08/21
LDW21-SC610	21G0094-04	Sediment	07/08/21
LDW21-SC612	21G0094-05	Sediment	07/08/21
LDW21-SC623	21G0094-06	Sediment	07/08/21
LDW21-IT651	21G0094-07	Sediment	07/08/21
LDW21-IT651-FD	21G0094-08	Sediment	07/08/21
LDW21-SC640A	21G0094-09	Sediment	07/08/21
LDW21-IT656	21G0094-10	Sediment	07/08/21
LDW21-IT656-FD	21G0094-11	Sediment	07/08/21
LDW21-SC535B	21G0094-12	Sediment	07/08/21
LDW21-SC535C	21G0094-13	Sediment	07/08/21
LDW21-SC535E	21G0094-14	Sediment	07/08/21
LDW21-IT668	21G0094-15	Sediment	07/08/21
LDW21-IT668-FD	21G0094-16	Sediment	07/08/21
LDW21-IT627	21G0094-17	Sediment	07/08/21
LDW21-SC594DUP1	21G0094-01DUP1	Sediment	07/08/21
LDW21-SC594DUP2	21G0094-01DUP2	Sediment	07/08/21
LDW21-SC640AMS	21G0094-09SMS	Sediment	07/08/21
LDW21-SC640ADUP	21G0094-09DUP	Sediment	07/08/21
LDW21-IT627MS	21G0094-17MS	Sediment	07/08/21
LDW21-IT627DUP	21G0094-17DUP	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0094

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 LDW21-SC519A and LDW21-SC519A-FD, samples LDW21-IT651 and LDW21-IT651-FD, samples LDW21-IT656 and LDW21-IT656-FD, and samples LDW21-IT668 and LDW21-IT668-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-SC519A	LDW21-SC519A-FD	
Total organic carbon	1.55	1.34	15
Total solids	55.88	56.07	0

Analyte	Concentration (%)		RPD
	LDW21-IT651	LDW21-IT651-FD	
Total organic carbon	1.57	1.62	3
Total solids	54.02	52.28	3

Analyte	Concentration (%)		RPD
	LDW21-IT656	LDW21-IT656-FD	
Total organic carbon	1.65	1.77	7
Total solids	51.32	50.65	1

Analyte	Concentration (%)		RPD
	LDW21-IT668	LDW21-IT668-FD	
Total organic carbon	1.92	1.64	16
Total solids	60.74	61.07	1

X. Target Analyte Quantitation

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 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0094

No Sample Data Qualified in this SDG

LDC #: 52054N6
SDG #: 21G0094
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/23/21
Page: 1 of 1
Reviewer: CR
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(2,3)(7,8)(10,11)(15,16)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC594	21G0094-01	Sediment	07/08/21
2	LDW21-SC519A	21G0094-02	Sediment	07/08/21
3	LDW21-SC519A-FD	21G0094-03	Sediment	07/08/21
4	LDW21-SC610	21G0094-04	Sediment	07/08/21
5	LDW21-SC612	21G0094-05	Sediment	07/08/21
6	LDW21-SC623	21G0094-06	Sediment	07/08/21
7	LDW21-IT651	21G0094-07	Sediment	07/08/21
8	LDW21-IT651-FD	21G0094-08	Sediment	07/08/21
9	LDW21-SC640A	21G0094-09	Sediment	07/08/21
10	LDW21-IT656	21G0094-10	Sediment	07/08/21
11	LDW21-IT656-FD	21G0094-11	Sediment	07/08/21
12	LDW21-SC535B	21G0094-12	Sediment	07/08/21
13	LDW21-SC535C	21G0094-13	Sediment	07/08/21
14	LDW21-SC535E	21G0094-14	Sediment	07/08/21
15	LDW21-IT668	21G0094-15	Sediment	07/08/21
16	LDW21-IT668-FD	21G0094-16	Sediment	07/08/21
17	LDW21-IT627	21G0094-17	Sediment	07/08/21

LDC #: 52054N6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0094 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer: GF
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC594DUP	21G0094-01DUP	Sediment	07/08/21
19	LDW21-SC594~~TRP~~ DUP	21G0094-01~~TRP~~DUP	Sediment	07/08/21
20	LDW21-SC640AMS	21G0094-09SMS	Sediment	07/08/21
21	LDW21-SC640ADUP	21G0094-09DUP	Sediment	07/08/21
22	LDW21-IT627MS	21G0094-17MS	Sediment	07/08/21
23	LDW21-IT627DUP	21G0094-17DUP	Sediment	07/08/21
24				
25				
26				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
18, 19	TS
20-23	TOC

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

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

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

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

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	2	3	
TOC	1.55	1.34	15
Total solids	55.88	56.07	0

Analyte	Concentration (%)		RPD
	7	8	
TOC	1.57	1.62	3
Total solids	54.02	52.28	3

Analyte	Concentration (%)		RPD
	10	11	
TOC	1.65	1.77	7
Total solids	51.32	50.65	1

Analyte	Concentration (%)		RPD
	15	16	
TOC	1.92	1.64	16
Total solids	60.74	61.07	1

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0108

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT641	21G0108-01	Sediment	07/08/21
LDW21-IT654B	21G0108-02	Sediment	07/08/21
LDW21-IT654C	21G0108-03	Sediment	07/08/21
LDW21-IT654E	21G0108-04	Sediment	07/08/21
LDW21-IT679	21G0108-05	Sediment	07/08/21
LDW21-IT649B	21G0108-06	Sediment	07/08/21
LDW21-IT649C	21G0108-07	Sediment	07/08/21
LDW21-IT649E	21G0108-08	Sediment	07/08/21
LDW21-IT669B	21G0108-09	Sediment	07/08/21
LDW21-IT669C	21G0108-10	Sediment	07/08/21
LDW21-IT669E	21G0108-11	Sediment	07/08/21
LDW21-IT598A	21G0108-12	Sediment	07/08/21
LDW21-IT641MS	21G0108-01MS	Sediment	07/08/21
LDW21-IT641MSD	21G0108-01MSD	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 LDW21-IT598A. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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 not within the QC limits for LDW21-IT641MS/MSD. No data were qualified for MS/MSD samples analyzed greater than or equal to a 5X dilution. 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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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.

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

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

LDC #: 52054O3b

SDG #: 21G0108

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: Q

2nd Reviewer: A

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A / A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	1/A: 70R out ≥ 5x OF
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-IT641	21G0108-01	Sediment	07/08/21
2	LDW21-IT654B	21G0108-02	Sediment	07/08/21
3	LDW21-IT654C	21G0108-03	Sediment	07/08/21
4	LDW21-IT654E	21G0108-04	Sediment	07/08/21
5	LDW21-IT679	21G0108-05	Sediment	07/08/21
6	LDW21-IT649B	21G0108-06	Sediment	07/08/21
7	LDW21-IT649C	21G0108-07	Sediment	07/08/21
8	LDW21-IT649E	21G0108-08	Sediment	07/08/21
9	LDW21-IT669B	21G0108-09	Sediment	07/08/21
10	LDW21-IT669C	21G0108-10	Sediment	07/08/21
11	LDW21-IT669E	21G0108-11	Sediment	07/08/21
12	LDW21-IT598A	21G0108-12	Sediment	07/08/21
13	LDW21-IT641MS	21G0108-01MS	Sediment	07/08/21
14	LDW21-IT641MSD	21G0108-01MSD	Sediment	07/08/21
15				
16				
17				

LDC #: 52054D36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: 9

METHOD: 1 **GC** __ **HPLC**

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	~~Detector/~~ Column	Surrogate Compound	%R (Limits)	Qualifications
	12	1	O	152 (40-126)	No Qual (25x)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0108

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT598A	21G0108-12	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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

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

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

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 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 method. 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. Target Analyte Quantitation

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 21G0108

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

LDC #: 52054O4a

SDG #: 21G0108

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer: G

2nd Reviewer: G

METHOD: Arsenic (EPA SW 846 Method 6020B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	N	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	NR
XIII.	Target Analyte Quantitation	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	LDW21-IT598A	21G0108-12	Sediment	07/08/21
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0108

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT641	21G0108-01	Sediment	07/08/21
LDW21-IT654B	21G0108-02	Sediment	07/08/21
LDW21-IT654C	21G0108-03	Sediment	07/08/21
LDW21-IT654E	21G0108-04	Sediment	07/08/21
LDW21-IT679	21G0108-05	Sediment	07/08/21
LDW21-IT649B	21G0108-06	Sediment	07/08/21
LDW21-IT649C	21G0108-07	Sediment	07/08/21
LDW21-IT649E	21G0108-08	Sediment	07/08/21
LDW21-IT669B	21G0108-09	Sediment	07/08/21
LDW21-IT669C	21G0108-10	Sediment	07/08/21
LDW21-IT669E	21G0108-11	Sediment	07/08/21
LDW21-IT598A	21G0108-12	Sediment	07/08/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0108

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

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

VIII. Laboratory Control Samples

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. Target Analyte Quantitation

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 21G0108

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0108

No Sample Data Qualified in this SDG

LDC #: 52054O6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0108 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A+A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT641	21G0108-01	Sediment	07/08/21
2	LDW21-IT654B	21G0108-02	Sediment	07/08/21
3	LDW21-IT654C	21G0108-03	Sediment	07/08/21
4	LDW21-IT654E	21G0108-04	Sediment	07/08/21
5	LDW21-IT679	21G0108-05	Sediment	07/08/21
6	LDW21-IT649B	21G0108-06	Sediment	07/08/21
7	LDW21-IT649C	21G0108-07	Sediment	07/08/21
8	LDW21-IT649E	21G0108-08	Sediment	07/08/21
9	LDW21-IT669B	21G0108-09	Sediment	07/08/21
10	LDW21-IT669C	21G0108-10	Sediment	07/08/21
11	LDW21-IT669E	21G0108-11	Sediment	07/08/21
12	LDW21-IT598A	21G0108-12	Sediment	07/08/21
13				
14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0111

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS602	21G0111-05	Sediment	07/09/21
LDW21-SS603	21G0111-06	Sediment	07/09/21
LDW21-SS578	21G0111-07	Sediment	07/09/21
LDW21-SS580	21G0111-08	Sediment	07/09/21
LDW21-SS590	21G0111-09	Sediment	07/09/21
LDW21-SS661	21G0111-12	Sediment	07/09/21
LDW21-SS631	21G0111-13	Sediment	07/09/21
LDW21-SS602MS	21G0111-05MS	Sediment	07/09/21
LDW21-SS602MSD	21G0111-05MSD	Sediment	07/09/21

Introduction

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

The analyses were performed by the following method:

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

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

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

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

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes 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 analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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	Analyte	Concentration	Associated Samples
BJG0411-BLK1	07/19/21	Bis(2-ethylhexyl)phthalate	6.0 ug/Kg	LDW21-SS602 LDW21-SS603 LDW21-SS631

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	Analyte	Reported Concentration	Modified Final Concentration
LDW21-SS602	Bis(2-ethylhexyl)phthalate	12.8 ug/Kg	12.8U 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-SS602MS/MSD (LDW21-SS602)	Fluoranthene Chrysene	147 (53-145) 135 (47-120)	- -	J (all detects) J (all detects)	A

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

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LDW21-SS602MS/MSD (LDW21-SS602)	Fluoranthene	40.4 (≤35)	J (all detects)	A

IX. Laboratory Control Samples/Standard Reference Materials

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

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

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. Target Analyte Quantitation

All target analyte quantitations were within validation criteria.

XIII. Target Analyte Identification

All target analyte identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

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

Due to laboratory blank contamination, data were qualified as not detected in 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 21G0111

Sample	Analyte	Flag	A or P	Reason
LDW21-SS602	Fluoranthene Chrysene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW21-SS602	Fluoranthene	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0111

Sample	Analyte	Modified Final Concentration	A or P
LDW21-SS602	Bis(2-ethylhexyl)phthalate	12.8U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

LDC #: 52054P2a
SDG #: 21G0111
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 9/24/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: RC

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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%, r² ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples /SRM	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	A	
XIII.	Target analyte identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS602	21G0111-05	Sediment	07/09/21
2	LDW21-SS603	21G0111-06	Sediment	07/09/21
3	LDW21-SS578 MA	21G0111-07	Sediment	07/09/21
4	LDW21-SS580	21G0111-08	Sediment	07/09/21
5	LDW21-SS590	21G0111-09	Sediment	07/09/21
6	LDW21-SS661 A	21G0111-12	Sediment	07/09/21
7	LDW21-SS631 2	21G0111-13	Sediment	07/09/21
8	LDW21-SS602MS	21G0111-05MS	Sediment	07/09/21
9	LDW21-SS602MSD	21G0111-05MSD	Sediment	07/09/21
10				

Notes:

	BJG 0411						

LDC #: 52054pod

VALIDATION FINDINGS CHECKLIST

Reviewer: Q

Method: Semivolatiles (EPA SW 846 Method 8270D)

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

Validation Area	Yes	No	NA	Findings/Comments
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52054D29

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: 4
~~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 method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
Y N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 7/19/21 **Blank analysis date:** 7/28/21
Conc. units: ug/kg Associated Samples: 1-2, 7

Compound	Blank ID	Sample Identification								
	BLK0411-BLK1	1								
Bis(2-ethylhexyl)phthalate	6.0		10.8 U							

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

Compound	Blank ID	Sample Identification								

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

LDC #: 52054P2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: Cr

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

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

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

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

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

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		8/9	YY	147 (53-145)	( )	( )	1 (dets)	J dets/A
			DDD	135 (47-120)	( )	( )		
			YY	( )	( )	40.4 (≤35)		↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC #: 52059B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (1 std)	Recalculated RRF (1 std)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported %RSD	Recalculated %RSD
1	ICAL	7/20/21	Phenol (1st internal standard)	2.113997	2.113997	2.042364	2.042364	4.0	4.0
			Naphthalene (2nd internal standard)	0.9865737	0.9865737	1.058607	1.058607	4.7	4.7
			Fluorene (3rd internal standard)	1.856569	1.856569	1.899319	1.899319	4.6	4.6
			Phenanthrene (4th internal standard)	1.027404	1.027404	1.081707	1.081707	4.9	4.9
			Butylbenzylphthalate (4th internal standard)	0.5754632	0.5754632	0.604397	0.604397	4.8	4.8
			Bis(2-ethylhexyl)phthalate (5th internal standard)	0.4194407	0.4194404	0.4400686	0.4400686	7.3	7.3
			Benzo(g,h,i) perylene (6th internal standard)	1.409262	1.409262	1.438734	1.438734	1.9	1.9
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Phenanthrene (4th internal standard)						
			Butylbenzylphthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						
3			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Phenanthrene (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						

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 #: 52054P2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: PG

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	NT1021072802	7/28/21	Phenol (1st internal standard)	2.042364	2.0994300	2.0994300	2.8	2.8
			Naphthalene (2nd internal standard)	1.058607	1.0785400	1.0785401	1.9	1.9
			Fluorene (3rd internal standard)	1.899319	1.8457510	1.8457511	2.8	2.8
			Phenanthrene (4th internal standard)	1.081707	1.0913400	1.0913405	0.9	0.9
			Butylbenzylphthalate (4th internal standard)	0.604397	0.7091334	0.7091334	17.3	17.3
			Bis(2-ethylhexyl)phthalate (5th internal standard)	0.4400686	0.4968827	0.4968827	12.9	12.9
			Benzo(g,h,i)perylene (6th internal standard)	1.438734	1.3446330	1.3446331	6.5	6.5
2	NT1021072908	7/29/21	Phenol (1st internal standard)	2.042364	1.8657980	1.8657980	8.6	8.6
			Naphthalene (2nd internal standard)					
			Fluorene (3rd internal standard)					
			Phenanthrene (4th internal standard)					
			Butylbenzylphthalate (5th internal standard)	0.604397	0.6143739	0.6143739	1.7	1.7
			Bis(2-ethylhexyl)phthalate (6th internal standard)	0.4400686	0.5252249	0.5252248	19.4	19.4
			2,4-Dimethylphenol(2nd internal standard)					
			Fluorene (3rd internal standard)					
			Anthracene (4th internal standard)					
			Butylbenzylphthalate (5th internal standard)					
			Benzo(g,h,i)perylene (6th internal standard)					

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

LDC #: 52054P29

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: Q

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	5.00	3.69265	73.9	73.9	
2-Fluorobiphenyl	↓	3.71918	74.4	74.4	
Terphenyl-d14	↓	3.72946	74.6	74.6	
Phenol-d5	7.50	4.42747	59.0	59.0	
2-Fluorophenol	↓	4.19354	55.9	55.9	
2,4,6-Tribromophenol	↓	6.08212	81.1	81.1	
2-Chlorophenol-d4	↓	5.44928	72.7	72.7	
1,2-Dichlorobenzene-d4	5.00	3.25273	65.1	65.1	

Sample ID: _____

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

Sample ID: _____

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

LDC #: 52054P29

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD samples: 8/9

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	499	499	ND	357	366	71.6	71.6	73.3	73.3	2.36	2.49
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene	499	499	ND	361	406	72.3	72.3	81.4	81.4	1.74	1.17
Pentachlorophenol											
Pyrene	499	499	120	743	539	125	125	84.0	84.0	31.9	31.8

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

LDC #: 52054P2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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

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

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

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

LCS/LCSD samples: BJG0411-BS1

Compound	Spike Added (UG/KG)		Spike Concentration (UG/KG)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	500	NA	321	NA	64.2	64.2				
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene	"	"	338	"	67.6	67.6				
Pentachlorophenol										
Pyrene	"	"	413	"	82.5	82.5				

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

LDC #: 52054P29

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: A

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

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

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

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

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

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

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

V_i = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

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

2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 2, A:

Conc. = $\frac{(11790)(4.0)(1000)(1)(\quad)}{(7262)(2.0334)(1469)(0.6807)}$

= 31.8 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration ( )	Qualification
	2	A	31.8		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0111

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS602	21G0111-05	Sediment	07/09/21
LDW21-SS603	21G0111-06	Sediment	07/09/21
LDW21-SS590	21G0111-09	Sediment	07/09/21
LDW21-SS631	21G0111-13	Sediment	07/09/21
LDW21-SS602MS	21G0111-05MS	Sediment	07/09/21
LDW21-SS602MSD	21G0111-05MSD	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0% with the following exceptions:

Date	Analyte	%RSD	Associated Samples	Flag	A or P
07/20/21	Benzoic acid	57.7	LDW21-SS602 LDW21-SS603	J (all detects)	A

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	LDW21-SS590 LDW21-SS631	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes with the following exceptions:

Date	Analyte	%D	Associated Samples	Flag	A or P
07/28/21	Pentachlorophenol	58.4	LDW21-SS602 LDW21-SS603	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.

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration %RSD and r^2 and continuing calibration %D, data were qualified as estimated in four samples.

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

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 21G0111

Sample	Analyte	Flag	A or P	Reason
LDW21-SS602 LDW21-SS603	Benzoic acid	J (all detects)	A	Initial calibration (%RSD)
LDW21-SS590 LDW21-SS631	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW21-SS602 LDW21-SS603	Pentachlorophenol	UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

LDC #: 52054P2b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

SDG #: 21G0111

Page: 1 of 1

Laboratory: Analytical Resources, Inc.

Reviewer: [illegible]

2nd Reviewer: [illegible]

SVOA

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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	AW/A	RSD ≤ 20%. r² ICV ≤ 30%
IV.	Continuing calibration	AW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples LCS/SRM	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SS602		21G0111-05	Sediment	07/09/21
2	LDW21-SS603		21G0111-06	Sediment	07/09/21
3	LDW21-SS590	2	21G0111-09	Sediment	07/09/21
4	LDW21-SS631	2	21G0111-13	Sediment	07/09/21
5	LDW21-SS602MS		21G0111-05MS	Sediment	07/09/21
6	LDW21-SS602MSD		21G0111-05MSD	Sediment	07/09/21
7					
8					
9					

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52694p2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

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

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

(Y) N N/A Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?

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

(Y) N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?_____

(Y) N N/A Did the initial calibration meet the acceptance criteria?

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

#	Date	Standard ID	Compound	Finding %RSD (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	7/20/21	ICAL	PPP	57.7		1-2. 5-6. MB (dets)	J/UN/A
	7/27/21	ICAL	HHH	r^2= 0.9891		3-4. MB (dets)	J/UN/A

INICAL.2SD

LDC #: 52084B6

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: Q

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

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	7/28/21	NT7021072803S	TT	58.4		1-2, 5-6, MB (ND)	J/UJ/A

CONCAL.2S

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Hexachlorobenzene

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0111

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS602	21G0111-05	Sediment	07/09/21
LDW21-SS603	21G0111-06	Sediment	07/09/21
LDW21-SS603MS	21G0111-06MS	Sediment	07/09/21
LDW21-SS603MSD	21G0111-06MSD	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

V. Laboratory Blanks

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

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. Target Analyte Quantitation

All target analyte quantitations met validation criteria.

XII. Target Analyte Identification

All target analyte 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.

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

Duwamish AOC4
Hexachlorobenzene - Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

LDC #: 52054P3a

SDG #: 21G0111

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 9/24/21

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /FS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Target analyte quantitation	A	
XII.	Target analyte identification	A	
XIII.	System Performance	A	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS602	21G0111-05	Sediment	07/09/21
2	LDW21-SS603	21G0111-06	Sediment	07/09/21
3	LDW21-SS603MS	21G0111-06MS	Sediment	07/09/21
4	LDW21-SS603MSD	21G0111-06MSD	Sediment	07/09/21
5				
6				
7				
8				
9				
10				

Notes:

LDC #: 52054P30

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: Q

Method: Pesticides (EPA SW 846 Method 8081A)

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

LDC #: 52054D39

VALIDATION FINDINGS CHECKLIST

Reviewer: 4

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

VALIDATION FINDINGS WORKSHEET

METHOD: 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 #: 52054P3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

METHOD: GC Pesticides (EPA SW 846 Method 8081A)

The calibration factors (CF) and relative standard deviation (%RSD) were recalculated using the following calculations:

CF = A/C
Average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where: A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (10 std)	Recalculated CF (10 std)	Reported Ave CF (initial)	Recalculated Ave CF (intial)	Reported %RSD	Recalculated %RSD
1	ICAL	6/25/21	FF (1C)	1.292649	1.292649	1.29694	1.29694	12.7	12.7
			FF (2C)	1.247978	1.247978	1.240281	1.240281	12.5	12.5
2									
3									
4									

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 #: 52054P30

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: PG

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

Percent difference (%D) = 100 * (N - C)/N

Where: N = Initial Calibration Factor or Nominal Amount (ng)
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount (ng)

Standard ID	Calibration Date/Time	Compound	Average CF/ CCV Conc	Reported CF/Conc CCV	Recalculated CF/Conc CCV	Reported %D	Recalculated %D
210728A	7/28/21	FF (1C)	1.296940	1.487288	1.487288	14.5	14.7
12:27		FF (2C)	1.240281	1.304409	1.304409	5.0	5.2

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

LDC #: 52054P3a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: Q

METHOD: GC Pesticides (EPA SW 846 Method 8081~~B~~A)

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene	1	40.00	31.90	79.8	79.8	
Decachlorobiphenyl	1	↓	33.01	82.5	82.5	
Tetrachloro-m-xylene	2		~~33.01~~ 32.63	81.6	81.6	
Decachlorobiphenyl	2		31.33	78.3	78.3	

Sample ID:

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

Sample ID:

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

Sample ID:

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

Notes:

LDC #: 60054A39

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: 9

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

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

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

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

RPD = I SSCMS - SSCMSD I * 2/(SSCMS + SSCMSD)

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

MS/MSD samples: 3/4

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	--	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
gamma-BHC											
4,4'-DDT											
Aroclor 1260											
FF	4.00	4.00	0.21	2.95	2.96	68.5	68.5	68.8	68.8	0.348	0.338

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

LDC #: 52054P3a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Page: 1 of 1
Reviewer: 9

METHOD: GC Pesticides (EPA SW 846 Method 8081~~A~~)

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

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

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

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

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: BJ40491-BS1

Compound	Spike Added (ug/kg)		Spiked Sample Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC										
4,4'-DDT										
FF	4.00	NA	3.28	NA	82.1	82.0				

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

LDC #: 52054D3a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: Q

METHOD: GC Pesticides (EPA SW 846 Method 8081~~B~~)

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

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

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 2, FF:

Conc. = $\frac{(26404)(80)(2.5)(1)(\quad)}{(1575)(22)(1.39694)(18.39)(0.680T)}$

= 0.21 ~~ug/kg~~

#	Sample ID	Compound	Reported Concentration (~~ug/kg~~)	Calculated Concentration ( )	Qualification
	2	FF	0.21		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0111

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS552	21G0111-01	Sediment	07/09/21
LDW21-SS508	21G0111-02	Sediment	07/09/21
LDW21-SS513	21G0111-03	Sediment	07/09/21
LDW21-SS514	21G0111-04	Sediment	07/09/21
LDW21-SS602	21G0111-05	Sediment	07/09/21
LDW21-SS603	21G0111-06	Sediment	07/09/21
LDW21-SS578	21G0111-07	Sediment	07/09/21
LDW21-SS580	21G0111-08	Sediment	07/09/21
LDW21-SS590	21G0111-09	Sediment	07/09/21
LDW21-SS542	21G0111-10	Sediment	07/09/21
LDW21-SS546	21G0111-11	Sediment	07/09/21
LDW21-SS661	21G0111-12	Sediment	07/09/21
LDW21-SS631	21G0111-13	Sediment	07/09/21
LDW21-SS552MS	21G0111-01MS	Sediment	07/09/21
LDW21-SS552MSD	21G0111-01MSD	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 percent 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. Target Analyte Quantitation

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

Sample	Analyte	RPD	Flag	A or P
LDW21-SS578	Aroclor-1260	84.1	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, 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 21G0111

Sample	Analyte	Flag	A or P	Reason
LDW21-SS578	Aroclor-1260	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

LDC #: 52054P3b

SDG #: 21G0111

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: CL

2nd Reviewer: JC

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	
II.	Initial calibration/ICV	A / A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	A / N	
XI.	Target analyte 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	LDW21-SS552	21G0111-01	Sediment	07/09/21
2	LDW21-SS508	21G0111-02	Sediment	07/09/21
3	LDW21-SS513	21G0111-03	Sediment	07/09/21
4	LDW21-SS514	21G0111-04	Sediment	07/09/21
5	LDW21-SS602	21G0111-05	Sediment	07/09/21
6	LDW21-SS603	21G0111-06	Sediment	07/09/21
7	LDW21-SS578	21G0111-07	Sediment	07/09/21
8	LDW21-SS580	21G0111-08	Sediment	07/09/21
9	LDW21-SS590	21G0111-09	Sediment	07/09/21
10	LDW21-SS542	21G0111-10	Sediment	07/09/21
11	LDW21-SS546	21G0111-11	Sediment	07/09/21
12	LDW21-SS661	21G0111-12	Sediment	07/09/21
13	LDW21-SS631	21G0111-13	Sediment	07/09/21
14	LDW21-SS552MS	21G0111-01MS	Sediment	07/09/21
15	LDW21-SS552MSD	21G0111-01MSD	Sediment	07/09/21
16				
17				

LDC #: 32054D26

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: 9

METHOD: / GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1260	7	84.1	Jdets/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Metals

Validation Level: Stage 2B & 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0111

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS602	21G0111-05	Sediment	07/09/21
LDW21-SS603	21G0111-06	Sediment	07/09/21
LDW21-SS578	21G0111-07	Sediment	07/09/21
LDW21-SS580	21G0111-08	Sediment	07/09/21
LDW21-SS590	21G0111-09	Sediment	07/09/21
LDW21-SS631	21G0111-13	Sediment	07/09/21

Metals by EPA SW 846 Method 6020B were reviewed at Stage 4. Mercury by EPA SW 846 Method 7471B was reviewed at Stage 2B.

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 6020B
Mercury by EPA SW 846 Method 7471B

All sample results for mercury were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples that were analyzed for 6020B metals 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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

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. Target Analyte Quantitation

All target analyte quantitations were within validation criteria 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 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

LDC #: 52054P4a

SDG #: 21G0111

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 9/29/21

Page: 1 of 1

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	A	
XIII.	Target Analyte Quantitation	A	Not reviewed for Stage 2B 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:

Metals by EPA SW846 Method 6020A was reviewed at Stage 4. Mercury by EPA SW846 Method 7471B was reviewed by Stage 2B

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS602	21G0111-05	Sediment	07/09/21
2	LDW21-SS603	21G0111-06	Sediment	07/09/21
3	LDW21-SS578	21G0111-07	Sediment	07/09/21
4	LDW21-SS580	21G0111-08	Sediment	07/09/21
5	LDW21-SS590	21G0111-09	Sediment	07/09/21
6	LDW21-SS631	21G0111-13	Sediment	07/09/21
7				
8				
9				
10				
11				
12				
13				

Notes:

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

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

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1, 2	As, Cd, Cr Cu, Pb, Ag, Zn, Hg
3, 4, 6	As
5	As, Zn

Analysis Method

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

VALIDATION FINDINGS CHECKLIST
Calibration Calculation Verification

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	48.5	50	97	97.1	Y
CCV	ICP-MS	Ag	49.7	50	99.4	99.5	Y
LLCC	ICP-MS	Pb	0.104	0.1	104	104	Y
ICSAB	ICP-MS	Cr	19.91	20	99.6	99.6	Y
ICV	CVAA	Hg	3.951	4	98.8	98.8	Y
CCV	CVAA	Hg	3.5897	4	89.7	89.7	Y

ICP-MS Tune	QC Parameter	Mass	Actual	Required
7/26/2021	Mass Axis	Be	9	± 0.1 amu
7/26/2021	%RSD	Be	1	≤ 5%

Quality Control Sample Recalculations

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

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

%R = (Found/True) x 100

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

True = concentration of each analyte in the source

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

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

S = Original sample concentration

D = Duplicate sample concentration

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

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

I = Initial sample result

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

Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	Recalcuated %R/RPD/%D	Reported %R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Pb	24.3	25	97.2	97.4	Y
	MS						
	Duplicate						
	PDS						
	Serial dilution						

VALIDATION FINDINGS CHECKLIST

Sample Calculation Verification

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

Analytes were recalculated and verified using the following equation:

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

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight/ Volume (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	Ag	0.048	20	1.073	50	79.2	0.06	0.06	Y
	Hg	0.1169	1	0.22	50	79.2	0.0335	0.0335	Y
2	Cr	12.206	20	1.08	50	67.73	16.7	16.7	Y
	Hg	0.3016	1	0.214	50	67.73	0.104	0.104	Y
3	As	27.17	20	1.071	50	47.47	53.4	53.4	Y
4	As	5.406	20	1.086	50	53.7	9.27	9.27	Y
5	Zn	42.482	20	1.061	50	55.68	71.9	71.9	Y
6	As	2.948	20	1.01	50	35.96	8.12	8.12	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0111

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS552	21G0111-01	Sediment	07/09/21
LDW21-SS508	21G0111-02	Sediment	07/09/21
LDW21-SS513	21G0111-03	Sediment	07/09/21
LDW21-SS514	21G0111-04	Sediment	07/09/21
LDW21-SS602	21G0111-05	Sediment	07/09/21
LDW21-SS603	21G0111-06	Sediment	07/09/21
LDW21-SS578	21G0111-07	Sediment	07/09/21
LDW21-SS580	21G0111-08	Sediment	07/09/21
LDW21-SS590	21G0111-09	Sediment	07/09/21
LDW21-SS542	21G0111-10	Sediment	07/09/21
LDW21-SS546	21G0111-11	Sediment	07/09/21
LDW21-SS661	21G0111-12	Sediment	07/09/21
LDW21-SS631	21G0111-13	Sediment	07/09/21
LDW21-SS552DUP1	21G0111-01DUP1	Sediment	07/09/21
LDW21-SS552DUP2	21G0111-01DUP2	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 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 21G0111

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. Target Analyte Quantitation

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 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0111

No Sample Data Qualified in this SDG

LDC #: 52054P6
SDG #: 21G0111
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer: GT
2nd Reviewer: GT

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	CCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS552	21G0111-01	Sediment	07/09/21
2	LDW21-SS508	21G0111-02	Sediment	07/09/21
3	LDW21-SS513	21G0111-03	Sediment	07/09/21
4	LDW21-SS514	21G0111-04	Sediment	07/09/21
5	LDW21-SS602	21G0111-05	Sediment	07/09/21
6	LDW21-SS603	21G0111-06	Sediment	07/09/21
7	LDW21-SS578	21G0111-07	Sediment	07/09/21
8	LDW21-SS580	21G0111-08	Sediment	07/09/21
9	LDW21-SS590	21G0111-09	Sediment	07/09/21
10	LDW21-SS542	21G0111-10	Sediment	07/09/21
11	LDW21-SS546	21G0111-11	Sediment	07/09/21
12	LDW21-SS661	21G0111-12	Sediment	07/09/21
13	LDW21-SS631	21G0111-13	Sediment	07/09/21
14	LDW21-SS552DUP	21G0111-01DUP	Sediment	07/09/21
15	LDW21-SS552~~TRP~~ DUP	21G0111-01~~TRP~~ DUP	Sediment	07/09/21
16				
17				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
14, 15	TS

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

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

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

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

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Butylbenzylphthalate

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0112

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC591B	21G0112-07	Sediment	07/09/21
LDW21-SC591C	21G0112-08	Sediment	07/09/21
LDW21-SC591E	21G0112-09	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Butylbenzylphthalate 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

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. Internal Standards

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

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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
Butylbenzylphthalate - Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Laboratory Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Field Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

LDC #: 52054Q2a

SDG #: 21G0112

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2A

Date: 9/23/21

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC/MS Butylbenzylphthalate (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. %Dev ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC591B	21G0112-07	Sediment	07/09/21
2	LDW21-SC591C	21G0112-08	Sediment	07/09/21
3	LDW21-SC591E	21G0112-09	Sediment	07/09/21
4				
5				
6				
7				
8				
9				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0112

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC591B	21G0112-07	Sediment	07/09/21
LDW21-SC591C	21G0112-08	Sediment	07/09/21
LDW21-SC591E	21G0112-09	Sediment	07/09/21
LDW21-IT593A	21G0112-13	Sediment	07/09/21
LDW21-IT593B	21G0112-14	Sediment	07/09/21
LDW21-IT593C	21G0112-15	Sediment	07/09/21
LDW21-IT593E	21G0112-16	Sediment	07/09/21
LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21
LDW21-IT593EMS	21G0112-16MS	Sediment	07/09/21
LDW21-IT593EMSD	21G0112-16MSD	Sediment	07/09/21

Introduction

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

The analyses were performed by the following method:

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

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

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

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

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes 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 analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	All samples in SDG 21G0112	J (all detects) UJ (all non-detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples/Standard Reference Materials

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

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

X. Field Duplicates

Samples LDW21-IT593B and LDW21-IT593B-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT593B	LDW21-IT593B-FD	
Benzo(a)anthracene	0.88	1.03	16
Chrysene	1.35	1.41	4
Benzo(b)fluoranthene	1.54	1.45	6
Benzo(a)pyrene	0.87	1.19	31
Indeno(1,2,3-cd)pyrene	5.00U	1.05	Not calculable

XI. Internal Standards

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

XII. Target Analyte Quantitation

All target analyte quantitations were within validation criteria.

XIII. Target Analyte Identification

All target analyte identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

Due to initial calibration r^2, 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 21G0112

Sample	Analyte	Flag	A or P	Reason
LDW21-SC591B LDW21-SC591C LDW21-SC591E LDW21-IT593A LDW21-IT593B LDW21-IT593C LDW21-IT593E LDW21-IT593B-FD	Dibenzo(a,h)anthracene	J (all detects) UJ (all non-detects)	A	Initial calibration (r^2)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

LDC #: 52054Q2b **VALIDATION COMPLETENESS WORKSHEET** Date: 9/23/21
SDG #: 21G0112 Stage 4 Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	SW/A	RSD≤ 20% . r^2 ICV≤ 30%
IV.	Continuing calibration	A	CCV≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples /SRM	A	LCS
X.	Field duplicates	SW	D=5+8
XI.	Internal standards	A	
XII.	Target analyte quantitation	A	
XIII.	Target analyte identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC591B	21G0112-07	Sediment	07/09/21
2	LDW21-SC591C	21G0112-08	Sediment	07/09/21
3	LDW21-SC591E	21G0112-09	Sediment	07/09/21
4	LDW21-IT593A S	21G0112-13	Sediment	07/09/21
5	LDW21-IT593B D	21G0112-14	Sediment	07/09/21
6	LDW21-IT593C	21G0112-15	Sediment	07/09/21
7	LDW21-IT593E	21G0112-16	Sediment	07/09/21
8	LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21
9	LDW21-IT593EMS	21G0112-16MS	Sediment	07/09/21
10	LDW21-IT593EMSD	21G0112-16MSD	Sediment	07/09/21
11				
12				
13				
14				

LDC #: 52054Q26

VALIDATION FINDINGS CHECKLIST

Reviewer: Q

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤30%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data	✓			
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 52054Q2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Reviewer: [illegible]

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

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

(Y) N N/A Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?
(Y) N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
(Y) N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?________
(Y) N N/A Did the initial calibration meet the acceptance criteria?
Y (N) N/A Were all %RSDs and RRFs within the validation criteria of ≤20 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	7/27/21	ICAL	KK	r^2=0.9891		All (dets+ND)	J/UJ/A

LDC#: 52054Q2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: PG

METHOD: GCMS SVOCs (EPA SW846 Method 8270E-SIM)

Compound	Concentration (ug/kg)		RPD
	5	8	
CCC	0.88	1.03	16
DDD	1.35	1.41	4
GGG	1.54	1.45	6
III	0.87	1.19	31
JJJ	5.00U	1.05	NC

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LDC #: 52054Q-26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: 9

METHOD: GC/MS PCB (EPA SW 846 Method 8270DSIM)

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (/ std)	Recalculated RRF (/ std)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported %RSD	Recalculated %RSD
1	1CAL	7/27/21	(1st internal standard)						
			S (2nd internal standard)	1.183175	1.183175	1.223066	1.223066	9.9	9.9
			NN (3rd internal standard)	1.396803	1.396803	1.438825	1.438825	9.3	9.3
			UU (4th internal standard)	1.27677	1.27677	1.308262	1.308262	13.0	13.0
			CCC (5th internal standard)	1.30427	1.30427	1.364664	1.364664	11.0	11.0
			##111 (6th internal standard)	1.12581	1.12581	1.162486	1.162486	14.7	14.7
2			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
			(4th internal standard)						
			(5th internal standard)						
			(6th internal standard)						
3			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
			(4th internal standard)						
			(5th internal standard)						
			(6th internal standard)						

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 #: 52054Q2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

METHOD: GC/MS PCB (EPA SW 846 Method 8270DSIM)

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	NT122107902	7/28/21	(1st internal standard)					
			S (2nd internal standard)	1.223066	1.259850	1.225985	0.2	0.2
			NN (3rd internal standard)	1.438825	1.4688740	1.4688736	2.1	2.1
			UU (4th internal standard)	1.308762	1.334750	1.334748	5.6	5.6
			CCC (5th internal standard)	1.364664	1.3563040	1.3563035	0.6	0.6
			III (6th internal standard)	1.162486	1.1462490	1.1462488	1.4	1.4
2	NT122107902	8/29/21	(1st internal standard)					
			S (2nd internal standard)	1.223066	1.2204910	1.2204913	0.2	0.2
			NN (3rd internal standard)	1.438825	1.5494700	1.5494698	7.7	7.7
			UU (4th internal standard)	1.308762	1.2842050	1.2842049	1.8	1.8
			CCC (5th internal standard)	1.364664	1.5036510	1.5036570	10.2	10.2
			III (6th internal standard)	1.162486	1.300478	1.300478	11.9	11.9
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
			(5th internal standard)					
			(6th internal standard)					

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

LDC #: 52054B26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: 9

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
~~Nitrobenzene-d5~~ W-d10	3.00	1.97679	65.9	65.9	
2-Fluorobiphenyl KKK-d14	↓	3.45989	115	115	
Terphenyl-d14 YY-d10	↓	3.05540	102	102	
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
~~1,2-Dichlorobenzene-d4~~					

Sample ID:

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

Sample ID:

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

LDC #: 52054R26

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: 9

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

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

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

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD samples: 9/10

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene	300	300	1.87	178	176	58.8	58.8	58.0	58.0	1.38	1.13
Pyrene	V	V	11.9	223	198	70.3	70.3	62.1	62.1	11.7	11.9

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

LDC #: 52054Q=6

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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

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

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

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

LCS/LCSD samples: BIG0489-BS1

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene	300	NA	170	NA	56.7	56.7				
Pyrene	↓	↓	193	↓	64.2	64.2				

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

LDC #: 52054Q26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: Q

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

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

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

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

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

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

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

V_i = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

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

2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 1, S:

Conc. = $\frac{(9686)(2.00)(500)(1)(\quad)}{(146526)(1.22)3066)(13.93)(0.7184)}$

= 5.4 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration ( )	Qualification
	1	3	5.4		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0112

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC553B	21G0112-01	Sediment	07/09/21
LDW21-SC553C	21G0112-02	Sediment	07/09/21
LDW21-SC554A	21G0112-03	Sediment	07/09/21
LDW21-SC554B	21G0112-04	Sediment	07/09/21
LDW21-SC554C	21G0112-05	Sediment	07/09/21
LDW21-SC554E	21G0112-06	Sediment	07/09/21
LDW21-SC591B	21G0112-07	Sediment	07/09/21
LDW21-SC591C	21G0112-08	Sediment	07/09/21
LDW21-SC591E	21G0112-09	Sediment	07/09/21
LDW21-SC607A	21G0112-10	Sediment	07/09/21
LDW21-SC607B	21G0112-11	Sediment	07/09/21
LDW21-SC607C	21G0112-12	Sediment	07/09/21
LDW21-IT593A	21G0112-13	Sediment	07/09/21
LDW21-IT593B	21G0112-14	Sediment	07/09/21
LDW21-IT593C	21G0112-15	Sediment	07/09/21
LDW21-IT593E	21G0112-16	Sediment	07/09/21
LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21
LDW21-SC553BMS	21G0112-01MS	Sediment	07/09/21
LDW21-SC553BMSD	21G0112-01MSD	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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 LDW21-SC554E. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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

Samples LDW21-IT593B and LDW21-IT593B-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-IT593B	LDW21-IT593B-FD	
Aroclor-1248	1.6	4.0U	Not calculable
Aroclor-1254	2.6	2.0	26
Aroclor-1260	1.2	1.1	9

X. Target Analyte Quantitation

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

Sample	Analyte	RPD	Flag	A or P
LDW21-IT593C	Aroclor-1260	43.5	J (all detects)	A
LDW21-IT593B-FD	Aroclor-1260	58.8	J (all detects)	A
LDW21-IT593B	Aroclor-1248	45.0	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, 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 Biphenyls - Data Qualification Summary - SDG 21G0112

Sample	Analyte	Flag	A or P	Reason
LDW21-IT593C LDW21-IT593B-FD	Aroclor-1260	J (all detects)	A	Target analyte quantitation (RPD between two columns)
LDW21-IT593B	Aroclor-1248	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

LDC #: 52054Q3b

SDG #: 21G0112

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/27/21

Page: 1 of 2

Reviewer: 9

2nd Reviewer: M

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD≤20%. ICV≤20%
III.	Continuing calibration	A	CCV≤20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /ES	SW/	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	SW	D=14+17
X.	Target analyte quantitation	A/N	
XI.	Target analyte 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	LDW21-SC553B	21G0112-01	Sediment	07/09/21
2	LDW21-SC553C	21G0112-02	Sediment	07/09/21
3	LDW21-SC554A	21G0112-03	Sediment	07/09/21
4	LDW21-SC554B	21G0112-04	Sediment	07/09/21
5	LDW21-SC554C	21G0112-05	Sediment	07/09/21
6	LDW21-SC554E	21G0112-06	Sediment	07/09/21
7	LDW21-SC591B	21G0112-07	Sediment	07/09/21
8	LDW21-SC591C	21G0112-08	Sediment	07/09/21
9	LDW21-SC591E	21G0112-09	Sediment	07/09/21
10	LDW21-SC607A	21G0112-10	Sediment	07/09/21
11	LDW21-SC607B	21G0112-11	Sediment	07/09/21
12	LDW21-SC607C	21G0112-12	Sediment	07/09/21
13	LDW21-IT593A	21G0112-13	Sediment	07/09/21
14	LDW21-IT593B D	21G0112-14	Sediment	07/09/21
15	LDW21-IT593C	21G0112-15	Sediment	07/09/21
16	LDW21-IT593E	21G0112-16	Sediment	07/09/21
17	LDW21-IT593B-FD D	21G0112-17	Sediment	07/09/21

LDC #: 52054Q3b

SDG #: 21G0112

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Reviewer: [illegible]

2nd Reviewer: [illegible]

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

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC553BMS	21G0112-01MS	Sediment	07/09/21
19	LDW21-SC553BMSD	21G0112-01MSD	Sediment	07/09/21
20				
21				
22				

Notes:

LDC #: 5205A23b

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

METHOD: ✓ GC __ HPLC

Are surrogates required by the method? Yes____ or No____.

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

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

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

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	6		surr	out (-)	No Qual (DF ≥ 5X)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

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

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	14	17	
Aroclor 1248	1.6	4.0U	NC
Aroclor 1254	2.6	2.0	26
Aroclor 1260	1.2	1.1	9

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054Q3b_Windward.wpd

LDC #: 52054R36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9

METHOD: 1 GC __ HPLC

Level IV/D Only

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

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1260	15	43.5	Hets/A
	↓			
		17	58.8	
	Aroclor 1248	14	45.0	↓

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0112

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC591B	21G0112-07	Sediment	07/09/21
LDW21-SC591C	21G0112-08	Sediment	07/09/21
LDW21-SC591E	21G0112-09	Sediment	07/09/21
LDW21-IT593A	21G0112-13	Sediment	07/09/21
LDW21-IT593B	21G0112-14	Sediment	07/09/21
LDW21-IT593C	21G0112-15	Sediment	07/09/21
LDW21-IT593E	21G0112-16	Sediment	07/09/21
LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21
LDW21-SC591BMS	21G0112-07MS	Sediment	07/09/21
LDW21-SC591BMSD	21G0112-07MSD	Sediment	07/09/21
LDW21-SC591BDUP	21G0112-07DUP	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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

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

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

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

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

III. Instrument Calibration

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

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

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples LDW21-IT593B and LDW21-IT593B-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW21-IT593B	LDW21-IT593B-FD	
Arsenic	9.33	9.33	0

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Target Analyte Quantitation

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 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

LDC #: 52054Q4a

SDG #: 21G0112

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: Arsenic (EPA SW 846 Method 6020A) (B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	SW	(5,8)
XII.	Internal Standard (ICP-MS)	N	MR
XIII.	Target Analyte Quantitation	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	LDW21-SC591B	21G0112-07	Sediment	07/09/21
2	LDW21-SC591C	21G0112-08	Sediment	07/09/21
3	LDW21-SC591E	21G0112-09	Sediment	07/09/21
4	LDW21-IT593A	21G0112-13	Sediment	07/09/21
5	LDW21-IT593B	21G0112-14	Sediment	07/09/21
6	LDW21-IT593C	21G0112-15	Sediment	07/09/21
7	LDW21-IT593E	21G0112-16	Sediment	07/09/21
8	LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21
9	LDW21-SC591BMS	21G0112-07MS	Sediment	07/09/21
10	LDW21-SC591BMSD	21G0112-07MSD	Sediment	07/09/21
11	LDW21-SC591BDUP	21G0112-07DUP	Sediment	07/09/21
12				
13				

Notes:

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	5	8	
Arsenic	9.33	9.33	0

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0112

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC553B	21G0112-01	Sediment	07/09/21
LDW21-SC553C	21G0112-02	Sediment	07/09/21
LDW21-SC554A	21G0112-03	Sediment	07/09/21
LDW21-SC554B	21G0112-04	Sediment	07/09/21
LDW21-SC554C	21G0112-05	Sediment	07/09/21
LDW21-SC554E	21G0112-06	Sediment	07/09/21
LDW21-SC591B	21G0112-07	Sediment	07/09/21
LDW21-SC591C	21G0112-08	Sediment	07/09/21
LDW21-SC591E	21G0112-09	Sediment	07/09/21
LDW21-SC607A	21G0112-10	Sediment	07/09/21
LDW21-SC607B	21G0112-11	Sediment	07/09/21
LDW21-SC607C	21G0112-12	Sediment	07/09/21
LDW21-IT593A	21G0112-13	Sediment	07/09/21
LDW21-IT593B	21G0112-14	Sediment	07/09/21
LDW21-IT593C	21G0112-15	Sediment	07/09/21
LDW21-IT593E	21G0112-16	Sediment	07/09/21
LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21
LDW21-SC553BDUP1	21G0112-01DUP1	Sediment	07/09/21
LDW21-SC553BDUP2	21G0112-01DUP2	Sediment	07/09/21
LDW21-SC591BMS	21G0112-07MS	Sediment	07/09/21
LDW21-SC591BDUP	21G0112-07DUP	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0112

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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW21-SC591BDUP (LDW21-SC591B LDW21-SC591C LDW21-SC591E LDW21-SC607A LDW21-SC607B LDW21-SC607C LDW21-IT593A LDW21-IT593B LDW21-IT593C LDW21-IT593E LDW21-IT593B-FD LDW21-SC591BDUP)	Total organic carbon	33.7 (≤20)	-	J (all detects)	A

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 LDW21-IT593B and LDW21-IT593B-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-IT593B	LDW21-IT593B-FD	
Total organic carbon	0.09	0.13	36
Total solids	80.20	79.14	1

X. Target Analyte Quantitation

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.

Due to DUP RPD, 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
Wet Chemistry - Data Qualification Summary - SDG 21G0112

Sample	Analyte	Flag	A or P	Reason
LDW21-SC591B LDW21-SC591C LDW21-SC591E LDW21-SC607A LDW21-SC607B LDW21-SC607C LDW21-IT593A LDW21-IT593B LDW21-IT593C LDW21-IT593E LDW21-IT593B-FD LDW21-SC591BDUP	Total organic carbon	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0112

No Sample Data Qualified in this SDG

LDC #: 52054Q6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0112 Stage 2B Page: 1 of 2
Laboratory: Analytical Resources, Inc. Reviewer: [signature]
2nd Reviewer: [signature]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	SW	
VIII.	Laboratory control samples	A	LCS (14,17)
IX.	Field duplicates	SW	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC553B	21G0112-01	Sediment	07/09/21
2	LDW21-SC553C	21G0112-02	Sediment	07/09/21
3	LDW21-SC554A	21G0112-03	Sediment	07/09/21
4	LDW21-SC554B	21G0112-04	Sediment	07/09/21
5	LDW21-SC554C	21G0112-05	Sediment	07/09/21
6	LDW21-SC554E	21G0112-06	Sediment	07/09/21
7	LDW21-SC591B	21G0112-07	Sediment	07/09/21
8	LDW21-SC591C	21G0112-08	Sediment	07/09/21
9	LDW21-SC591E	21G0112-09	Sediment	07/09/21
10	LDW21-SC607A	21G0112-10	Sediment	07/09/21
11	LDW21-SC607B	21G0112-11	Sediment	07/09/21
12	LDW21-SC607C	21G0112-12	Sediment	07/09/21
13	LDW21-IT593A	21G0112-13	Sediment	07/09/21
14	LDW21-IT593B	21G0112-14	Sediment	07/09/21
15	LDW21-IT593C	21G0112-15	Sediment	07/09/21
16	LDW21-IT593E	21G0112-16	Sediment	07/09/21
17	LDW21-IT593B-FD	21G0112-17	Sediment	07/09/21

LDC #: 52054Q6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0112 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC553BDUP	21G0112-01DUP	Sediment	07/09/21
19	LDW21-SC553B~~TRP~~ DUP2	21G0112-01~~TRP~~ DUP2	Sediment	07/09/21
20	LDW21-SC591BMS	21G0112-07MS	Sediment	07/09/21
21	LDW21-SC591BDUP	21G0112-07DUP	Sediment	07/09/21
22				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
18, 19	TS
20, 21	TOC

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

VALIDATION FINDINGS WORKSHEETS
Laboratory Duplicates

METHOD: Inorganics

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 reproting limits, the difference was with 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Assocaited Samples	Qualification	Det/ND
21	s	TOC	33.7	20			7 to 17 21	J/UJ/A	Det

Comments:

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	14	17	
TOC	0.09	0.13	36
Total solids	80.20	79.14	1

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 4, 2021

Parameters: Butylbenzylphthalate

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC577A	21G0114-01	Sediment	07/09/21
LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Butylbenzylphthalate 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

Average relative response factors (RRF) for all analytes were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

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

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples LDW21-SC577A and LDW21-SC577A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC577A	LDW21-SC577A-FD	
Butylbenzylphthalate	27.3	100U	Not calculable

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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
Butylbenzylphthalate - Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Laboratory Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Field Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

LDC #: 52054R2a
SDG #: 21G0114
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 9/23/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Butylbenzylphthalate (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D=1+2
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC277A	21G0114-01	Sediment	07/09/21
2	LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21
3				
4				
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC#: 52054R2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: GCMS SVOA (EPA Method 8270E)

Compound	Concentration (ug/kg)		RPD
	1	2	
AAA	27.3	100U	NC

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054R2a.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 4, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC577A	21G0114-01	Sediment	07/09/21
LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 percent recoveries (%R) 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 LDW21-SC577A and LDW21-SC577A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC577A	LDW21-SC577A-FD	
Aroclor-1248	31.3	31.2	0
Aroclor-1254	61.1	64.9	6
Aroclor-1260	55.5	53.7	3

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

LDC #: 52054R3b
SDG #: 21G0114
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: CW
2nd Reviewer: AC

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	SW	D = 1+2
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC577A	21G0114-01	Sediment	07/09/21
2	LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	1	2	
Aroclor 1248	31.3	31.2	0
Aroclor 1254	61.1	64.9	6
Aroclor 1260	55.5	53.7	3

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054R3b_Windward.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 4, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC577A	21G0114-01	Sediment	07/09/21
LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 method. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples LDW21-SC577A and LDW21-SC577A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW21-SC577A	LDW21-SC577A-FD	
Arsenic	8.45	7.39	13

XII. Internal Standards (ICP-MS)

ICP-MS was not utilized in this SDG.

XIII. Target Analyte Quantitation

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 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

LDC #: 52054R4a

SDG #: 21G0114

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer: CT

2nd Reviewer: 4

METHOD: Arsenic (EPA SW 846 Method 6020A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A-1	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	~~A~~ A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	SW	(1,2)
XII.	Internal Standard (ICP-MS)	N	NR
XIII.	Target Analyte Quantitation	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	LDW21-SC577A	21G0114-01	Sediment	07/09/21
2	LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	1	2	
Arsenic	8.45	7.39	13

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 4, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0114

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC577A	21G0114-01	Sediment	07/09/21
LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0114

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

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples LDW21-SC577A and LDW21-SC577A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-SC577A	LDW21-SC577A-FD	
Total organic carbon	1.46	1.50	3
Total solids	54.13	54.99	2

X. Target Analyte Quantitation

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 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0114

No Sample Data Qualified in this SDG

LDC #: 52054R6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0114 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [signature]
2nd Reviewer: [signature]

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	~~A~~ SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(1,2)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC277A	21G0114-01	Sediment	07/09/21
2	LDW21-SC577A-FD	21G0114-02	Sediment	07/09/21
3				
4				
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14				
15				
16				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	1	2	
TOC	1.46	1.50	3
Total solids	54.13	54.99	2

LDC Report# 52054S3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0126

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT653B	21G0126-07	Sediment	07/12/21
LDW21-IT653C	21G0126-08	Sediment	07/12/21
LDW21-IT653E	21G0126-09	Sediment	07/12/21
LDW21-IT652B	21G0126-10	Sediment	07/12/21
LDW21-IT652C	21G0126-11	Sediment	07/12/21
LDW21-IT652E	21G0126-12	Sediment	07/12/21
LDW21-IT632B	21G0126-13	Sediment	07/12/21
LDW21-IT632C	21G0126-14	Sediment	07/12/21
LDW21-IT632BMS	21G0126-13MS	Sediment	07/12/21
LDW21-IT632BMSD	21G0126-13MSD	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 samples LDW21-IT653B, LDW21-IT653C, and LDW21-IT652B. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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 not within the QC limits for LDW21-IT632BMS/MSD. No data were qualified since the parent sample results were greater than 4X the spiked concentration. 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. Target Analyte Quantitation

The sample results for detected analytes from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Analyte	RPD	Flag	A or P
LDW21-IT652C	Aroclor-1248	69	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, 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 21G0126

Sample	Analyte	Flag	A or P	Reason
LDW21-IT652C	Aroclor-1248	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0126

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0126

No Sample Data Qualified in this SDG

LDC #: 52054S3b
SDG #: 21G0126
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: 9
2nd Reviewer: K

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	
II.	Initial calibration/ICV	A/A	RSD ≤ 20%. RRV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /ES	NA/A	
VII.	Matrix spike/Matrix spike duplicates	NA	9/10 : TOR >4x
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	SW N	
XI.	Target analyte 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	LDW21-IT653B	21G0126-07	Sediment	07/12/21
2	LDW21-IT653C	21G0126-08	Sediment	07/12/21
3	LDW21-IT653E	21G0126-09	Sediment	07/12/21
4	LDW21-IT652B	21G0126-10	Sediment	07/12/21
5	LDW21-IT652C	21G0126-11	Sediment	07/12/21
6	LDW21-IT652E	21G0126-12	Sediment	07/12/21
7	LDW21-IT632B	21G0126-13	Sediment	07/12/21
8	LDW21-IT632C	21G0126-14	Sediment	07/12/21
9	LDW21-IT632BMS	21G0126-13MS	Sediment	07/12/21
10	LDW21-IT632BMSD	21G0126-13MSD	Sediment	07/12/21
11				
12				
13				

Notes:

LDC #: 52054S36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: 9

METHOD: / **GC** __ **HPLC**

Are surrogates required by the method? Yes____ or No____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N N/A Were surrogates spiked into all samples and blanks?

Y N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	1-2,4		SURR	out (-)	No Qual (OF ≥ 5X)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 52054S2b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: 9

METHOD: / GC __ HPLC

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1248	5	69	Hets/A

LDC Report# 52054S6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0126

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT665B	21G0126-01	Sediment	07/12/21
LDW21-IT665C	21G0126-02	Sediment	07/12/21
LDW21-IT665E	21G0126-03	Sediment	07/12/21
LDW21-IT664B	21G0126-04	Sediment	07/12/21
LDW21-IT664C	21G0126-05	Sediment	07/12/21
LDW21-IT664E	21G0126-06	Sediment	07/12/21
LDW21-IT653B	21G0126-07	Sediment	07/12/21
LDW21-IT653C	21G0126-08	Sediment	07/12/21
LDW21-IT653E	21G0126-09	Sediment	07/12/21
LDW21-IT652B	21G0126-10	Sediment	07/12/21
LDW21-IT652C	21G0126-11	Sediment	07/12/21
LDW21-IT652E	21G0126-12	Sediment	07/12/21
LDW21-IT632B	21G0126-13	Sediment	07/12/21
LDW21-IT632C	21G0126-14	Sediment	07/12/21
LDW21-IT653BMS	21G0126-07MS	Sediment	07/12/21
LDW21-IT653BDUP	21G0126-07DUP	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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%	LDW21-IT653B LDW21-IT653C LDW21-IT653E LDW21-IT652B LDW21-IT652C LDW21-IT652E LDW21-IT632B LDW21-IT632C

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. Target Analyte Quantitation

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 21G0126

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0126

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0126

No Sample Data Qualified in this SDG

LDC #: 52054S6
SDG #: 21G0126
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT665B	21G0126-01	Sediment	07/12/21
2	LDW21-IT665C	21G0126-02	Sediment	07/12/21
3	LDW21-IT665E	21G0126-03	Sediment	07/12/21
4	LDW21-IT664B	21G0126-04	Sediment	07/12/21
5	LDW21-IT664C	21G0126-05	Sediment	07/12/21
6	LDW21-IT664E	21G0126-06	Sediment	07/12/21
7	LDW21-IT653B	21G0126-07	Sediment	07/12/21
8	LDW21-IT653C	21G0126-08	Sediment	07/12/21
9	LDW21-IT653E	21G0126-09	Sediment	07/12/21
10	LDW21-IT652B	21G0126-10	Sediment	07/12/21
11	LDW21-IT652C	21G0126-11	Sediment	07/12/21
12	LDW21-IT652E	21G0126-12	Sediment	07/12/21
13	LDW21-IT632B	21G0126-13	Sediment	07/12/21
14	LDW21-IT632C	21G0126-14	Sediment	07/12/21
15	LDW21-IT653BMS	21G0126-07MS	Sediment	07/12/21
16	LDW21-IT653BDUP	21G0126-07DUP	Sediment	07/12/21
17				

Notes:

Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS
7 to 14	TOC
QC:	
15, 16	TOC

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:7-14

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0127

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS633	21G0127-05	Sediment	07/12/21
LDW21-SS643	21G0127-06	Sediment	07/12/21
LDW21-SS643-FD	21G0127-07	Sediment	07/12/21
LDW21-SS645	21G0127-08	Sediment	07/12/21
LDW21-SS623	21G0127-13	Sediment	07/12/21
LDW21-SS620	21G0127-14	Sediment	07/12/21
LDW21-SS599	21G0127-15	Sediment	07/12/21
LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
LDW21-SS616	21G0127-18	Sediment	07/12/21
LDW21-SS619	21G0127-20	Sediment	07/12/21
LDW21-SS619MS	21G0127-20MS	Sediment	07/12/21
LDW21-SS619MSD	21G0127-20MSD	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

Samples LDW21-SS643 and LDW21-SS643-FD and samples LDW21-SS599 and LDW21-SS599-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS643	LDW21-SS643-FD	
Butylbenzylphthalate	43.3	10.5	122

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Phenol	20.6	18.5	11
4-Methylphenol	9.2	20.0U	Not calculable
Naphthalene	7.7	5.8	28
2-Methylnaphthalene	6.3	4.8	27
Dimethylphthalate	14.6	20.0U	Not calculable
Acenaphthene	6.7	20.0U	Not calculable
Phenanthrene	114	81.5	33

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Anthracene	28.2	18.3	43
Fluoranthene	253	199	24
Pyrene	297	218	31
Butylbenzylphthalate	43.8	35.1	22
Benzo(a)anthracene	128	94.3	30
Chrysene	251	155	47
Bis(2-ethylhexyl)phthalate	1210	134	160
Benzofluoranthenes, Total	214	263	21
Benzo(a)pyrene	97.7	116	17
Indeno(1,2,3-cd)pyrene	63.1	80.1	24
Dibenzo(a,h)anthracene	22.2	29.8	29
Benzo(g,h,i)perylene	68.0	83.4	20

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

LDC #: 52054T2a
SDG #: 21G0127
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20%. r² ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples /SRM	A	LCS
X.	Field duplicates	SW	D=2+3. 7+8
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SS633	E	21G0127-05	Sediment	07/12/21
2	LDW21-SS643	A	21G0127-06	Sediment	07/12/21
3	LDW21-SS643-FD	A	21G0127-07	Sediment	07/12/21
4	LDW21-SS645	E,A	21G0127-08	Sediment	07/12/21
5	LDW21-SS623	A	21G0127-13	Sediment	07/12/21
6	LDW21-SS620	A	21G0127-14	Sediment	07/12/21
7	LDW21-SS599		21G0127-15	Sediment	07/12/21
8	LDW21-SS599-FD		21G0127-16	Sediment	07/12/21
9	LDW21-SS616	A	21G0127-18	Sediment	07/12/21
10	LDW21-SS619	A	21G0127-20	Sediment	07/12/21
11	LDW21-SS619MS		21G0127-20MS	Sediment	07/12/21
12	LDW21-SS619MSD		21G0127-20MSD	Sediment	07/12/21
13					
14					

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1.Dibenz(a,h)+(a,c)anthracene
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1.Benzo(j)fluoranthene
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1.Benzo(b)naphtho(2,1-d)thiophene
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1.
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1.
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1.
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1.
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1.
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1.
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1.
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1.
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1.
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1.
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1.
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1.
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1.
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1.
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1.
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1.
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1.
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW. Chrysene/Triphenylene	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX.Benzo(j)+(k)fluoranthene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. Naphthobenzophiophene	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ.Benzofluoranthenes, Total	Z1.

LDC#: 52054T2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: 9

METHOD: GCMS SVOA (EPA Method 8270E)

Compound	Concentration (ug/kg)		RPD
	2	3	
AAA	43.3	10.5	122

Compound	Concentration (ug/kg)		RPD
	7	8	
A	20.6	18.5	11
I	9.2	20.0U	NC
S	7.7	5.8	28
W	6.3	4.8	27
CC	14.6	20.0U	NC
GG	6.7	20.0U	NC
UU	114	81.5	33
VV	28.2	18.3	43
YY	253	199	24
ZZ	297	218	31
AAA	43.8	35.1	22
CCC	128	94.3	30
DDD	251	155	47
EEE	1210	134	160
ZZZZ	214	263	21
III	97.7	116	17
JJJ	63.1	80.1	24
KKK	22.2	29.8	29
LLL	68.0	83.4	20

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0127

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS633	21G0127-05	Sediment	07/12/21
LDW21-SS645	21G0127-08	Sediment	07/12/21
LDW21-SS599	21G0127-15	Sediment	07/12/21
LDW21-SS599-FD	21G0127-16	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0% with the following exceptions:

Date	Analyte	%RSD	Associated Samples	Flag	A or P
07/20/21	Benzoic acid	57.7	LDW21-SS599 LDW21-SS599-FD	J (all detects) UJ (all non-detects)	A

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	LDW21-SS633 LDW21-SS645	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes with the following exceptions:

Date	Analyte	%D	Associated Samples	Flag	A or P
07/31/21	Benzoic acid	40.8	LDW21-SS599 LDW21-SS599-FD	J (all detects) UJ (all non-detects)	A
	Pentachlorophenol	78.6		J (all detects) UJ (all non-detects)	

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

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

Samples LDW21-SS599 and LDW21-SS599-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
1,4-Dichlorobenzene	1.4	5.0U	Not calculable

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Benzyl alcohol	10.2	20U	Not calculable
Benzoic acid	65.8	100U	Not calculable

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration %RSD and r^2 and continuing calibration %D, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 21G0127

Sample	Analyte	Flag	A or P	Reason
LDW21-SS599 LDW21-SS599-FD	Benzoic acid	J (all detects) UJ (all non-detects)	A	Initial calibration (%RSD)
LDW21-SS633 LDW21-SS645	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW21-SS599 LDW21-SS599-FD	Benzoic acid Pentachlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

LDC #: 52054T2b

SDG #: 21G0127

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: Q

2nd Reviewer: TC

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/W	RSD ≤ 20%. r² ICV ≤ 30%
IV.	Continuing calibration	W	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples / SRM	A	LCS
X.	Field duplicates	W	D = 3+4
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1 2	LDW21-SS633		21G0127-05	Sediment	07/12/21
2 2	LDW21-SS645		21G0127-08	Sediment	07/12/21
3 1	LDW21-SS599	R	21G0127-15	Sediment	07/12/21
4 11	LDW21-SS599-FD	R	21G0127-16	Sediment	07/12/21
5					
6					
7					
8					
9					

Notes:

	BKG488						
	BKG0489						

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 #: 52054T-b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?

Y N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?

Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?_____

Y N N/A Did the initial calibration meet the acceptance criteria?

Y N N/A Were all %RSDs and RRFs within the validation criteria of ≤20 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	7/30/21	ICAL2	PPP	57.7		3-4. MB	J/UN/A
						(dets + NO)	
	7/27/21	ICAL2	KKK	r^2=0.9891		1-2. MB (dets)	J/UN/A

INICAL.2SD

LDC #: 52054T3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: 9

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?
(Y) N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y (N) N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	7/31/21	NT102107310445	PPP	40.8		3-4. MB (det+ND)	J/UJ/A
			TT	78.6			↓

LDC#: 52054T2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: PG

METHOD: GCMS SVOCs (EPA SW846 Method 8270E)

Compound	Concentration (ug/kg)		RPD
	3	4	
E	1.4	5.0U	NC
QQQ	10.2	20U	NC
PPP	65.8	100U	NC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0127

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS599	21G0127-15	Sediment	07/12/21
LDW21-SS599-FD	21G0127-16	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples LDW21-SS599 and LDW21-SS599-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Hexachlorobenzene	3.77	0.50U	Not calculable

XI. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Analyte 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 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

LDC #: 52054T3a
SDG #: 21G0127
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer: 2
2nd Reviewer: AC

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	RSD≤ 20%. ICV≤ 20%
IV.	Continuing calibration	A	CCV≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /IS	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	A/N	D=1+2
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank
SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS599	21G0127-15	Sediment	07/12/21
2	LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

LDC#:52054T3a **VALIDATION FINDINGS WORKSHEET** Page:_1_of_1__
Field Duplicates Reviewer:__PG___

METHOD: Pesticides (EPA SW 846 Method 8081B)

Compound	Concentration (ug/kg)		RPD
	1	2	
Hexachlorobenzene	3.77	0.50U	NC

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054T3a_Windward.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0127

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS668	21G0127-01	Sediment	07/12/21
LDW21-SS667	21G0127-02	Sediment	07/12/21
LDW21-SS651	21G0127-03	Sediment	07/12/21
LDW21-SS636	21G0127-04	Sediment	07/12/21
LDW21-SS633	21G0127-05	Sediment	07/12/21
LDW21-SS643	21G0127-06	Sediment	07/12/21
LDW21-SS643-FD	21G0127-07	Sediment	07/12/21
LDW21-SS645	21G0127-08	Sediment	07/12/21
LDW21-SS694	21G0127-09	Sediment	07/12/21
LDW21-SS656	21G0127-10	Sediment	07/12/21
LDW21-SS647	21G0127-11	Sediment	07/12/21
LDW21-SS634	21G0127-12	Sediment	07/12/21
LDW21-SS623	21G0127-13	Sediment	07/12/21
LDW21-SS620	21G0127-14	Sediment	07/12/21
LDW21-SS599	21G0127-15	Sediment	07/12/21
LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
LDW21-IT616A	21G0127-17	Sediment	07/12/21
LDW21-SS616	21G0127-18	Sediment	07/12/21
LDW21-IT619A	21G0127-19	Sediment	07/12/21
LDW21-SS619	21G0127-20	Sediment	07/12/21
LDW21-IT616AMS	21G0127-17MS	Sediment	07/12/21
LDW21-IT616AMSD	21G0127-17MSD	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 LDW21-SS694. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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

Samples LDW21-SS643 and LDW21-SS643-FD and samples LDW21-SS599 and LDW21-SS599-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS643	LDW21-SS643-FD	
Aroclor-1248	13.6	14.3	5
Aroclor-1254	29.0	30.9	6
Aroclor-1260	21.6	28.3	27

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Aroclor-1248	41.2	31.2	28
Aroclor-1254	87.5	64.4	30
Aroclor-1260	55.6	47.4	16

X. Target Analyte Quantitation

The sample results for detected analytes from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Analyte	RPD	Flag	A or P
LDW21-IT619A	Aroclor-1254	52.1	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, 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 21G0127

Sample	Analyte	Flag	A or P	Reason
LDW21-IT619A	Aroclor-1254	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

LDC #: 52054T3b

SDG #: 21G0127

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 2

Reviewer: CJ

2nd Reviewer: MC

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	SW/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D = 6+7 · 15+16
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SS668	21G0127-01	Sediment	07/12/21
2	LDW21-SS667	21G0127-02	Sediment	07/12/21
3	LDW21-SS651	21G0127-03	Sediment	07/12/21
4	LDW21-SS636	21G0127-04	Sediment	07/12/21
5	LDW21-SS633	21G0127-05	Sediment	07/12/21
6	LDW21-SS643	21G0127-06	Sediment	07/12/21
7	LDW21-SS643-FD	21G0127-07	Sediment	07/12/21
8	LDW21-SS645	21G0127-08	Sediment	07/12/21
9	LDW21-SS694	21G0127-09	Sediment	07/12/21
10	LDW21-SS656	21G0127-10	Sediment	07/12/21
11	LDW21-SS647	21G0127-11	Sediment	07/12/21
12	LDW21-SS634	21G0127-12	Sediment	07/12/21
13	LDW21-SS623	21G0127-13	Sediment	07/12/21
14	LDW21-SS620	21G0127-14	Sediment	07/12/21
15	LDW21-SS599	21G0127-15	Sediment	07/12/21
16	LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
17	LDW21-IT616A	21G0127-17	Sediment	07/12/21

LDC #: 52054T3b

SDG #: 21G0127

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Reviewer: 9

2nd Reviewer: MC

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SS616	21G0127-18	Sediment	07/12/21
19	LDW21-IT619A	21G0127-19	Sediment	07/12/21
20	LDW21-SS619	21G0127-20	Sediment	07/12/21
21	LDW21-IT616AMS	21G0127-17MS	Sediment	07/12/21
22	LDW21-IT616AMSD	21G0127-17MSD	Sediment	07/12/21
23				
24				
25				

Notes:

LDC #: 52054T36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: 4

METHOD: ✓ GC ___ HPLC

Are surrogates required by the method? Yes___ or No___.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	9		SURR	out (-)	No Qual (OF 25x1
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	6	7	
Aroclor 1248	13.6	14.3	5
Aroclor 1254	29.0	30.9	6
Aroclor 1260	21.6	28.3	27

Compound	Concentration (ug/kg)		RPD
	15	16	
Aroclor 1248	41.2	31.2	28
Aroclor 1254	87.5	64.4	30
Aroclor 1260	55.6	47.4	16

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054T3b_Windward.wpd

LDC #: 52054T36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9

METHOD: 1 GC __ HPLC

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1254	19	52.1	Det3/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Metals

Validation Level: Stage 4

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0127

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS651	21G0127-03	Sediment	07/12/21
LDW21-SS633	21G0127-05	Sediment	07/12/21
LDW21-SS645	21G0127-08	Sediment	07/12/21
LDW21-SS647	21G0127-11	Sediment	07/12/21
LDW21-SS623	21G0127-13	Sediment	07/12/21
LDW21-SS620	21G0127-14	Sediment	07/12/21
LDW21-SS599	21G0127-15	Sediment	07/12/21
LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
LDW21-SS616	21G0127-18	Sediment	07/12/21
LDW21-SS619	21G0127-20	Sediment	07/12/21
LDW21-SS651MS	21G0127-03MS	Sediment	07/12/21
LDW21-SS651MSD	21G0127-03MSD	Sediment	07/12/21
LDW21-SS651DUP	21G0127-03DUP	Sediment	07/12/21
LDW21-SS633MS	21G0127-05MS	Sediment	07/12/21
LDW21-SS633MSD	21G0127-05MSD	Sediment	07/12/21
LDW21-SS633DUP	21G0127-05DUP	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B
Mercury by EPA SW 846 Method 7471B

All sample results were subjected to Stage 4 evaluation, 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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
LDW21-SS633MS/MSD (LDW21-SS599 LDW21-SS599-FD)	Cadmium Chromium Silver	- - 45.4 (75-125)	74.4 (75-125) 65.5 (75-125) 37.3 (75-125)	J (all detects) J (all detects) J (all detects)	A
LDW21-SS633MS/MSD (LDW21-SS620 LDW21-SS599 LDW21-SS599-FD LDW21-SS616 LDW21-SS619)	Zinc	-	74 (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 LDW21-SS599 and LDW21-SS599-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Mercury	0.143	0.0991	36
Arsenic	9.81	7.06	33
Cadmium	0.25	0.20	22
Copper	32.3	27.8	15
Zinc	77.5	66.2	16
Chromium	21.1	18.4	14
Lead	22.9	17.8	25
Silver	0.19	0.19	0

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Target Analyte Quantitation

All target analyte quantitations were within validation criteria.

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 five samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Metals - Data Qualification Summary - SDG 21G0127

Sample	Analyte	Flag	A or P	Reason
LDW21-SS599 LDW21-SS599-FD	Cadmium Chromium Silver	J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LDW21-SS620 LDW21-SS599 LDW21-SS599-FD LDW21-SS616 LDW21-SS619	Zinc	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

LDC #: 52054T4a

SDG #: 21G0127

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 9/29/21

Page: 1 of 2

Reviewer:

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	
XI.	Field Duplicates	SW	(7,8)
XII.	Internal Standard (ICP-MS)	A	
XIII.	Target Analyte Quantitation	A	
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	LDW21-SS651		21G0127-03	Sediment	07/12/21
2	LDW21-SS633	As	21G0127-05	Sediment	07/12/21
3	LDW21-SS645	As	21G0127-08	Sediment	07/12/21
4	LDW21-SS647		21G0127-11	Sediment	07/12/21
5	LDW21-SS623	Pb, Zn	21G0127-13	Sediment	07/12/21
6	LDW21-SS620	Pb, Zn	21G0127-14	Sediment	07/12/21
7	LDW21-SS599	3+b	21G0127-15	Sediment	07/12/21
8	LDW21-SS599-FD	3+b	21G0127-16	Sediment	07/12/21
9	LDW21-SS616	Pb, Zn	21G0127-18	Sediment	07/12/21
10	LDW21-SS619	Pb, Zn	21G0127-20	Sediment	07/12/21
11	LDW21-SS651MS		21G0127-03MS	Sediment	07/12/21
12	LDW21-SS651MSD		21G0127-03MSD	Sediment	07/12/21
13	LDW21-SS651DUP		21G0127-03DUP	Sediment	07/12/21
14	LDW21-SS633MS		21G0127-05MS	Sediment	07/12/21
15	LDW21-SS633MSD		21G0127-05MSD	Sediment	07/12/21

LDC #: 52054T4a

SDG #: 21G0127

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 9/29/21

Reviewer: G

2nd Reviewer: G

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

	Client ID	Lab ID	Matrix	Date
16	LDW21-SS633DUP	21G0127-05DUP	Sediment	07/12/21
17				
18				
19				

Notes:

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	X			
Were all water samples preserved to a pH of <2.			X	
II. ICP-MS Tune				
Were mass resolutions within 0.1 amu for all isotopes in the tuning solution?	X			
Were %RSDs of isoptoes in the tuning solution ≤5%?	X			
III. Calibration				
Were all instuments calibrated daily?	X			
Were the proper standards used?	X			
Were all initial and continuing calibration verifications within the 90-110% (80-120% for mercury) QC limits?	X			
Were the low level standard checks within 70-130%?	X			
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	X			
Was there contamination in the method blanks?		X		
Was there contamination in the initial and continuing calibration blanks?		X		
V. Interference Check Sample				
Were the interference check samples performed daily?	X			
Were the AB solution recoveries within 80-120%?	X			
VI. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)		X		
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?	X			
VII. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)				
Validation Area	**Yes**	**No**	**NA**	**Comments**
VIII. Internal Standards				
Were all percent recoveries within the 30-120% (60-125% for EPA Method 200.8) QC limits?	X			
If the recoveries were outside the limits, was a reanalysis performed?		X		
IX. Serial Dilution				
Were all percent differences <10%?			X	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			X	
X. Sample Result Verification				
Were all reporting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			
XII. Field Duplicates				
Were field duplicates identifed in this SDG?	X			
Were target analytes detected in the field duplicates?	X			
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			X	

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1, 4-10	Hg
2, 3	As
5	~~As, Pb~~
6, 9, 10, 5-6	Zn, Pb Zn - 2
7, 8	As, Cd, Cr, Cu, Pb, Ag, Zn
QC:	
11 to 13	Hg
14 to 16	As, Cd, Cr, Cu, Pb, Ag, Zn

Analysis Method

ICP	
ICP-MS	As, Cd, Cr Cu, Pb, Ag, Zn
CVAA	Hg

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

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	Post spike
14, 15	s	Cd		74.4	75-125			7, 8	J/UJ/A	Det	
		Zn		74	75-125			6 to 10	J/UJ/A	Det	
		Cr		65.5	75-125			7, 8	J/UJ/A	Det	
		Ag	45.4	37.3	75-125			7, 8	J/UJ/A	Det	

Comments:

Method: Metals

Analyte	Concentration (mg/Kg)		RPD
	7	8	
Mercury	0.143	0.0991	36
Arsenic	9.81	7.06	33
Cadmium	0.25	0.20	22
Copper	32.3	27.8	15
Zinc	77.5	66.2	16
Chromium	21.1	18.4	14
Lead	22.9	17.8	25
Silver	0.19	0.19	0

VALIDATION FINDINGS CHECKLIST
Calibration Calculation Verification

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	Cu	49	50	98	98	Y
CCV	ICP-MS	Cd	48.9	50	97.8	97.8	Y
LLCC	ICP-MS	As	0.188	0.2	94	94	Y
ICSAB	ICP-MS	Zn	21.926	20	110	110	Y
ICV	CVAA	Hg	3.7816	4	94.5	94.5	Y
CCV	CVAA	Hg	3.6776	4	91.9	91.9	Y

ICP-MS Tune	QC Parameter	Mass	Actual	Required
7/29/2021	Mass Axis	115	114.9	± 0.1 amu
7/29/2021	%RSD	115	0.8	≤ 5%

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)

Percent recoveries (%R) for the laboratory control sample (LCS), matrix spike (MS), and post digestion spike (PDS) were recalculated using the following formula:

%R = (Found/True) x 100

Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)

True = concentration of each analyte in the source

The sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = (Absolute value(S-D)x 200) / (S+D)

S = Original sample concentration

D = Duplicate sample concentration

The serial dilution percent difference (%D) was recalculated using the following formula.

%D = (Absolute value (I - SDR)) x 100 / (I)

I = Initial sample result

SDR = Serial dilution result (with a 5x dilution applied)

Sample ID	Type of Analysis	Element	Found/S/I	True/D/SDR	Recalcuated %R/RPD/%D	Reported %R/RPD/%D	Acceptable (Y/N)
LCS	LCS	Zn	67.9	80	84.9	84.9	Y
11	MS	Hg	0.3715	0.347	107	107	Y
16	Duplicate	Pb	15.5	16.4	5.64	5.37	Y
	PDS						
	Serial dilution						

VALIDATION FINDINGS CHECKLIST
Sample Calculation Verification

METHOD: Trace Metals (EPA SW 846 Methods 6010/6020/7000)
Analytes were recalculated and verified using the following equation:
Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids x Initial weight)

Sample ID	Analyte	Raw Data (ug/L)	Dilution	Initial Weight/ Volume (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	Hg	0.1722	1	0.264	50	54.77	0.0595	0.0595	Y
2	As	3.819	20	1.09	50	47.73	7.34	7.34	Y
3	As	7.497	20	1.078	50	53.61	13	13.0	Y
4	Hg	0.2266	1	0.27	50	48.95	0.0857	0.0857	Y
5	Zn	40.571	20	1.048	50	48.85	79.3	79.2	Y
6	Hg	0.2192	1	0.218	50	49.5	0.102	0.102	Y
7	Cr	10.974	20	1.012	50	51.32	21.1	21.1	Y
8	Cd	0.109	20	1.019	50	53.09	0.2	0.20	Y
9	Hg	0.0814	1	0.267	50	78.78	0.0193	0.0193	Y
10	Hg	0.5377	1	0.232	50	69.18	0.168	0.168	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0127

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS668	21G0127-01	Sediment	07/12/21
LDW21-SS667	21G0127-02	Sediment	07/12/21
LDW21-SS651	21G0127-03	Sediment	07/12/21
LDW21-SS636	21G0127-04	Sediment	07/12/21
LDW21-SS633	21G0127-05	Sediment	07/12/21
LDW21-SS643	21G0127-06	Sediment	07/12/21
LDW21-SS643-FD	21G0127-07	Sediment	07/12/21
LDW21-SS645	21G0127-08	Sediment	07/12/21
LDW21-SS694	21G0127-09	Sediment	07/12/21
LDW21-SS656	21G0127-10	Sediment	07/12/21
LDW21-SS647	21G0127-11	Sediment	07/12/21
LDW21-SS634	21G0127-12	Sediment	07/12/21
LDW21-SS623	21G0127-13	Sediment	07/12/21
LDW21-SS620	21G0127-14	Sediment	07/12/21
LDW21-SS599	21G0127-15	Sediment	07/12/21
LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
LDW21-IT616A	21G0127-17	Sediment	07/12/21
LDW21-SS616	21G0127-18	Sediment	07/12/21
LDW21-IT619A	21G0127-19	Sediment	07/12/21
LDW21-SS619	21G0127-20	Sediment	07/12/21
LDW21-SS668DUP1	21G0127-01DUP1	Sediment	07/12/21
LDW21-SS668DUP2	21G0127-01DUP2	Sediment	07/12/21
LDW21-SS623MS	21G0127-13MS	Sediment	07/12/21
LDW21-SS623DUP	21G0127-13DUP	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0127

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 LDW21-SS643 and LDW21-SS643-FD and samples LDW21-SS599 and LDW21-SS599-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-SS643	LDW21-SS643-FD	
Total solids	46.76	43.35	8
Total organic carbon	1.81	1.91	5

Analyte	Concentration (%)		RPD
	LDW21-SS599	LDW21-SS599-FD	
Total solids	51.32	53.09	3
Total organic carbon	1.62	1.80	11

X. Target Analyte Quantitation

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 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0127

No Sample Data Qualified in this SDG

LDC #: 52054T6
SDG #: 21G0127
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(6,7) (15,16)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS668	21G0127-01	Sediment	07/12/21
2	LDW21-SS667	21G0127-02	Sediment	07/12/21
3	LDW21-SS651	21G0127-03	Sediment	07/12/21
4	LDW21-SS636	21G0127-04	Sediment	07/12/21
5	LDW21-SS633	21G0127-05	Sediment	07/12/21
6	LDW21-SS643	21G0127-06	Sediment	07/12/21
7	LDW21-SS643-FD	21G0127-07	Sediment	07/12/21
8	LDW21-SS645	21G0127-08	Sediment	07/12/21
9	LDW21-SS694	21G0127-09	Sediment	07/12/21
10	LDW21-SS656	21G0127-10	Sediment	07/12/21
11	LDW21-SS647	21G0127-11	Sediment	07/12/21
12	LDW21-SS634	21G0127-12	Sediment	07/12/21
13	LDW21-SS623	21G0127-13	Sediment	07/12/21
14	LDW21-SS620	21G0127-14	Sediment	07/12/21
15	LDW21-SS599	21G0127-15	Sediment	07/12/21
16	LDW21-SS599-FD	21G0127-16	Sediment	07/12/21
17	LDW21-IT616A	21G0127-17	Sediment	07/12/21

LDC #: 52054T6
SDG #: 21G0127
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21

Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SS616	21G0127-18	Sediment	07/12/21
19	LDW21-IT619A	21G0127-19	Sediment	07/12/21
20	LDW21-SS619	21G0127-20	Sediment	07/12/21
21	LDW21-SS623MS	21G0127-13MS	Sediment	07/12/21
22	LDW21-SS623DUP	21G0127-13DUP	Sediment	07/12/21
23	#1 DUP1			
24	J DUP2			
25				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
21, 22	TOC
23, 24	TS

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples: ~~7-14~~ All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	6	7	
~~TOC~~ Total solids	46.76	43.35	8
~~Total solids~~ TOC	1.81	1.91	5

Analyte	Concentration (%)		RPD
	15	16	
~~TOC~~ Total Solids	51.32	53.09	3
~~Total solids~~ TOC	1.62	1.80	11

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0138

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT608A	21G0138-01	Sediment	07/13/21
LDW21-IT662B	21G0138-02	Sediment	07/13/21
LDW21-IT662C	21G0138-03	Sediment	07/13/21
LDW21-IT662E	21G0138-04	Sediment	07/13/21
LDW21-IT659B	21G0138-05	Sediment	07/13/21
LDW21-IT659C	21G0138-06	Sediment	07/13/21
LDW21-IT659E	21G0138-07	Sediment	07/13/21
LDW21-IT658B	21G0138-08	Sediment	07/13/21
LDW21-IT658C	21G0138-09	Sediment	07/13/21
LDW21-IT658E	21G0138-10	Sediment	07/13/21
LDW21-IT657B	21G0138-11	Sediment	07/13/21
LDW21-IT657C	21G0138-12	Sediment	07/13/21
LDW21-IT648B	21G0138-13	Sediment	07/13/21
LDW21-IT648C	21G0138-14	Sediment	07/13/21
LDW21-SC630A	21G0138-15	Sediment	07/13/21
LDW21-IT658BMS	21G0138-08MS	Sediment	07/13/21
LDW21-IT658BMSD	21G0138-08MSD	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 percent 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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0138

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0138

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0138

No Sample Data Qualified in this SDG

LDC #: 52054U3b

SDG #: 21G0138

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: 4

2nd Reviewer: JC

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	
II.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes / IS	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-IT608A	21G0138-01	Sediment	07/13/21
2	LDW21-IT662B	21G0138-02	Sediment	07/13/21
3	LDW21-IT662C	21G0138-03	Sediment	07/13/21
4	LDW21-IT662E	21G0138-04	Sediment	07/13/21
5	LDW21-IT659B	21G0138-05	Sediment	07/13/21
6	LDW21-IT659C	21G0138-06	Sediment	07/13/21
7	LDW21-IT659E	21G0138-07	Sediment	07/13/21
8	LDW21-IT658B	21G0138-08	Sediment	07/13/21
9	LDW21-IT658C	21G0138-09	Sediment	07/13/21
10	LDW21-IT658E	21G0138-10	Sediment	07/13/21
11	LDW21-IT657B	21G0138-11	Sediment	07/13/21
12	LDW21-IT657C	21G0138-12	Sediment	07/13/21
13	LDW21-IT648B	21G0138-13	Sediment	07/13/21
14	LDW21-IT648C	21G0138-14	Sediment	07/13/21
15	LDW21-SC630A	21G0138-15	Sediment	07/13/21
16	LDW21-IT658BMS	21G0138-08MS	Sediment	07/13/21
17	LDW21-IT658BMSD	21G0138-08MSD	Sediment	07/13/21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0138

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT608A	21G0138-01	Sediment	07/13/21
LDW21-IT662B	21G0138-02	Sediment	07/13/21
LDW21-IT662C	21G0138-03	Sediment	07/13/21
LDW21-IT662E	21G0138-04	Sediment	07/13/21
LDW21-IT659B	21G0138-05	Sediment	07/13/21
LDW21-IT659C	21G0138-06	Sediment	07/13/21
LDW21-IT659E	21G0138-07	Sediment	07/13/21
LDW21-IT658B	21G0138-08	Sediment	07/13/21
LDW21-IT658C	21G0138-09	Sediment	07/13/21
LDW21-IT658E	21G0138-10	Sediment	07/13/21
LDW21-IT657B	21G0138-11	Sediment	07/13/21
LDW21-IT657C	21G0138-12	Sediment	07/13/21
LDW21-IT648B	21G0138-13	Sediment	07/13/21
LDW21-IT648C	21G0138-14	Sediment	07/13/21
LDW21-SC630A	21G0138-15	Sediment	07/13/21
LDW21-IT608ADUP1	21G0138-01DUP1	Sediment	07/13/21
LDW21-IT608ADUP2	21G0138-01DUP2	Sediment	07/13/21
LDW21-IT648BMS	21G0138-13MS	Sediment	07/13/21
LDW21-IT648BDUP	21G0138-13DUP	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0138

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. Target Analyte Quantitation

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 21G0138

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0138

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0138

No Sample Data Qualified in this SDG

LDC #: 52054U6
SDG #: 21G0138
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

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+D	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT608A	21G0138-01	Sediment	07/13/21
2	LDW21-IT662B	21G0138-02	Sediment	07/13/21
3	LDW21-IT662C	21G0138-03	Sediment	07/13/21
4	LDW21-IT662E	21G0138-04	Sediment	07/13/21
5	LDW21-IT659B	21G0138-05	Sediment	07/13/21
6	LDW21-IT659C	21G0138-06	Sediment	07/13/21
7	LDW21-IT659E	21G0138-07	Sediment	07/13/21
8	LDW21-IT658B	21G0138-08	Sediment	07/13/21
9	LDW21-IT658C	21G0138-09	Sediment	07/13/21
10	LDW21-IT658E	21G0138-10	Sediment	07/13/21
11	LDW21-IT657B	21G0138-11	Sediment	07/13/21
12	LDW21-IT657C	21G0138-12	Sediment	07/13/21
13	LDW21-IT648B	21G0138-13	Sediment	07/13/21
14	LDW21-IT648C	21G0138-14	Sediment	07/13/21
15	LDW21-SC630A	21G0138-15	Sediment	07/13/21
16	LDW21-IT608ADUP	21G0138-01DUP	Sediment	07/13/21
17	LDW21-IT608A~~TRP~~ DUP	21G0138-01~~TRP~~ DUP	Sediment	07/13/21

LDC #: 52054U6
SDG #: 21G0138
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 2 of 2
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

	Client ID	Lab ID	Matrix	Date
18	LDW21-IT648BMS	21G0138-13MS	Sediment	07/13/21
19	LDW21-IT648BDUP	21G0138-13DUP	Sediment	07/13/21
20				
21				
22				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
16, 17	TS
18, 19	TOC

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Butylbenzylphthalate

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0140

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC587B	21G0140-01	Sediment	07/12/21
LDW21-SC587C	21G0140-02	Sediment	07/12/21
LDW21-SC587E	21G0140-03	Sediment	07/12/21
LDW21-SC587BMS	21G0140-01MS	Sediment	07/12/21
LDW21-SC587BMSD	21G0140-01MSD	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Butylbenzylphthalate 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

Average relative response factors (RRF) for all analytes were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

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

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. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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
Butylbenzylphthalate - Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Laboratory Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Butylbenzylphthalate - Field Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

LDC #: 52054B2a

SDG #: 21G0140

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: Q

2nd Reviewer: M

METHOD: GC/MS Butylbenzylphthalate (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD≤ 20%. ICV≤ 30%
IV.	Continuing calibration	A	CCV≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SC587B	21G0140-01	Sediment	07/12/21
2	LDW21-SC587C	21G0140-02	Sediment	07/12/21
3	LDW21-SC587E	21G0140-03	Sediment	07/12/21
4	LDW21-SC587BMS	21G0140-01MS	Sediment	07/12/21
5	LDW21-SC587BMSD	21G0140-01MSD	Sediment	07/12/21
6				
7				
8				
9				

Notes:

	BN40525						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0140

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC587B	21G0140-01	Sediment	07/12/21
LDW21-SC587C	21G0140-02	Sediment	07/12/21
LDW21-SC587E	21G0140-03	Sediment	07/12/21
LDW21-SC634A	21G0140-04	Sediment	07/12/21
LDW21-SC634A-FD	21G0140-05	Sediment	07/12/21
LDW21-SC634B	21G0140-06	Sediment	07/12/21
LDW21-SC634C	21G0140-07	Sediment	07/12/21
LDW21-SC634E	21G0140-08	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 percent recoveries (%R) 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 LDW21-SC634A and LDW21-SC634A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC634A	LDW21-SC634A-FD	
Aroclor-1248	29.4	28.8	2
Aroclor-1254	53.8	51.7	4
Aroclor-1260	43.7	37.5	15

X. Target Analyte Quantitation

The sample results for detected analytes from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Analyte	RPD	Flag	A or P
LDW21-SC634E	Aroclor-1260	61	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 RPD between two columns, 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 21G0140

Sample	Analyte	Flag	A or P	Reason
LDW21-SC634E	Aroclor-1260	J (all detects)	A	Target analyte quantitation (RPD between two columns)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

LDC #: 52054V3b
SDG #: 21G0140
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/23/21
Page: 1 of 1
Reviewer:
2nd Reviewer: A

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A / A	RSD ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes DBS	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples SRM	A	LCS
IX.	Field duplicates	MW	D = A+5
X.	Target analyte quantitation	SN	
XI.	Target analyte 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	LDW21-SC587B	21G0140-01	Sediment	07/12/21
2	LDW21-SC587C	21G0140-02	Sediment	07/12/21
3	LDW21-SC587E	21G0140-03	Sediment	07/12/21
4	LDW21-SC634A	21G0140-04	Sediment	07/12/21
5	LDW21-SC634A-FD	21G0140-05	Sediment	07/12/21
6	LDW21-SC634B	21G0140-06	Sediment	07/12/21
7	LDW21-SC634C	21G0140-07	Sediment	07/12/21
8	LDW21-SC634E	21G0140-08	Sediment	07/12/21
9				
10				
11				
12				
13				

Notes:

	BIG0523						

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	4	5	
Aroclor 1248	29.4	28.8	2
Aroclor 1254	53.8	51.7	4
Aroclor 1260	43.7	37.5	15

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054V3b_Windward.wpd

LDC #: 52054V2b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: 9

METHOD: ✓ GC __ HPLC

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1260	8	61	Det/A

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0140

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC587B	21G0140-01	Sediment	07/12/21
LDW21-SC587C	21G0140-02	Sediment	07/12/21
LDW21-SC587E	21G0140-03	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6020B

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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 method. 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. Target Analyte Quantitation

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
Metals - Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

LDC #: 52054V4a

SDG #: 21G0140

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: Arsenic & Zinc (EPA SW 846 Method 6020A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	NB
XIII.	Target Analyte Quantitation	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	LDW21-SC587B	21G0140-01	Sediment	07/12/21
2	LDW21-SC587C	21G0140-02	Sediment	07/12/21
3	LDW21-SC587E	21G0140-03	Sediment	07/12/21
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	As, Zn

Analysis Method

ICP	
ICP-MS	As, Zn
CVAA	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0140

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC587B	21G0140-01	Sediment	07/12/21
LDW21-SC587C	21G0140-02	Sediment	07/12/21
LDW21-SC587E	21G0140-03	Sediment	07/12/21
LDW21-SC634A	21G0140-04	Sediment	07/12/21
LDW21-SC634A-FD	21G0140-05	Sediment	07/12/21
LDW21-SC6534B	21G0140-06	Sediment	07/12/21
LDW21-SC634C	21G0140-07	Sediment	07/12/21
LDW21-SC634E	21G0140-08	Sediment	07/12/21
LDW21-SC587BDUP1	21G0140-01DUP1	Sediment	07/12/21
LDW21-SC587BDUP2	21G0140-01DUP2	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0140

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

Samples LDW21-SC634A and LDW21-SC634A-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-SC634A	LDW21-SC634A-FD	
Total organic carbon	1.60	1.51	6
Total solids	55.79	55.97	0

X. Target Analyte Quantitation

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 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0140

No Sample Data Qualified in this SDG

LDC #: 52054V6
SDG #: 21G0140
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(4,5)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC587B	21G0140-01	Sediment	07/12/21
2	LDW21-SC587C	21G0140-02	Sediment	07/12/21
3	LDW21-SC587E	21G0140-03	Sediment	07/12/21
4	LDW21-SC634A	21G0140-04	Sediment	07/12/21
5	LDW21-SC634A-FD	21G0140-05	Sediment	07/12/21
6	LDW21-SC6534B	21G0140-06	Sediment	07/12/21
7	LDW21-SC634C	21G0140-07	Sediment	07/12/21
8	LDW21-SC634E	21G0140-08	Sediment	07/12/21
9	LDW21-SC587BDUP	21G0140-01DUP	Sediment	07/12/21
10	LDW21-SC587B~~TRP~~ DUP	21G0140-01~~TRP~~ DUP	Sediment	07/12/21
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
9, 10	TS

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	4	5	
TOC	1.60	1.51	6
Total solids	55.79	55.97	0

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0141

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS613	21G0141-03	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes with the following exceptions:

Date	Analyte	%D	Associated Samples	Flag	A or P
07/30/21	Bis(2-ethylhexyl)phthalate	21.9	All samples in SDG 21G0141	J (all detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
BJG0411-BLK1	07/19/21	Bis(2-ethylhexyl)phthalate	6.0 ug/Kg	All samples in SDG 21G0141

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 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 21G0141

Sample	Analyte	Flag	A or P	Reason
LDW21-SS613	Bis(2-ethylhexyl)phthalate	J (all detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

LDC #: 52054W2a
SDG #: 21G0141
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/27/21
Page: 1 of 1
Reviewer:
2nd Reviewer: AC

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20%. ICV ≤ 30%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples /SRM	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SS613	21G0141-03	Sediment	07/13/21
2				
3				
4				
5				
6				
7				
8				
9				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. 1,1'-Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 52054W29

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: Q

METHOD: GC/MS PAH (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/30/21	NT1021073002	ZCC	21.9		All (dets)	J/UJ/A

LDC #: 52054W29

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: Q

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N N/A Was a method blank analyzed for each matrix?
N N/A Was a method blank analyzed for each concentration preparation level?
N N/A Was a method blank associated with every sample?
N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 7/19/21 **Blank analysis date:** 7/28/21
Conc. units: ug/kg Associated Samples: All

Compound	Blank ID	Sample Identification								
BJG0411-BK1										
CRZ	60									

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0141

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS685	21G0141-02	Sediment	07/13/21
LDW21-SS613	21G0141-03	Sediment	07/13/21
LDW21-SS700	21G0141-05	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0% with the following exceptions:

Date	Analyte	%RSD	Associated Samples	Flag	A or P
07/20/21	Benzoic acid	57.7	LDW21-SS613 LDW21-SS700	J (all detects) UJ (all non-detects)	A

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	LDW21-SS685	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes with the following exceptions:

Date	Analyte	%D	Associated Samples	Flag	A or P
07/29/21	Benzoic acid	44.3	LDW21-SS700	UJ (all non-detects)	A
07/30/21	Pentachlorophenol	60.1	LDW21-SS613	UJ (all non-detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Associated Samples
BJG0524-BLK1	07/23/21	Pyrene Dibenzo(a,h)anthracene	0.67 ug/Kg 0.91 ug/Kg	LDW21-SS685

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration %RSD and r^2 and continuing calibration %D, 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
Semivolatiles - Data Qualification Summary - SDG 21G0141

Sample	Analyte	Flag	A or P	Reason
LDW21-SS613 LDW21-SS700	Benzoic acid	J (all detects) UJ (all non-detects)	A	Initial calibration (%RSD)
LDW21-SS685	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW21-SS700	Benzoic acid	UJ (all non-detects)	A	Continuing calibration (%D)
LDW21-SS613	Pentachlorophenol	UJ (all non-detects)	A	Continuing calibration (%D)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

LDC #: 52054W2b

SDG #: 21G0141

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/20/21

Page: 1 of 1

Reviewer: 9

2nd Reviewer: M

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	SW/A	RSD ≤ 20%, r² ICV ≤ 30%
IV.	Continuing calibration	SW/	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples /SRM	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SS685	21G0141-02	Sediment	07/13/21
2	LDW21-SS613	21G0141-03	Sediment	07/13/21
3	LDW21-SS700 PPP	21G0141-05	Sediment	07/13/21
4				
5				
6				
7				
8				
9				

Notes:

	BLK0524						
	BLK0411-BLK						
	BLK0586						

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 #: 52054W3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Page: 1 of 1
Reviewer: a
2nd 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 Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?
Y N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?_____
Y N N/A Did the initial calibration meet the acceptance criteria?
Y N N/A Were all %RSDs and RRFs within the validation criteria of ≤20 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	7/20/20	ICAL	PPP	57.7		2-3. MB (dets+ND)	J/UJ/A
	7/21/21	ICAL	KKK	r^2=0.9891		1. MB (dets)	J/UJ/A

INICAL 2SD

LDC #: 52054W26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y (N) N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	7/28/21	NT102107-8035	TT	58.4		MB	J/UN/A
	7/29/21	NT102107-9095	TT	44.3		3, MB (ND)	J/UN/A
	7/30/21	NT102107-3003S	TT	60.1		2 (ND)	J/UN/A

LDC #: 52054W2b

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: 9

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a method blank analyzed for each matrix?
(Y) N N/A Was a method blank analyzed for each concentration preparation level?
(Y) N N/A Was a method blank associated with every sample?
Y (N) N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 7/23/21 **Blank analysis date:** 8/2/21
Conc. units: ug/kg Associated Samples: 1

Compound	Blank ID	Sample Identification								
	BW0524-BK1									
ZZ	0.67									
KKK	0.91									

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Hexachlorobenzene

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0141

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS613	21G0141-03	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Analyte 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 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Laboratory Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Hexachlorobenzene - Field Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

LDC #: 52054W3a
SDG #: 21G0141
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/22/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Hexachlorobenzene (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A A	RSD ≤ 20% . ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes /IS	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	N	
XIII.	System Performance	N	
XIV	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank
SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS613	21G0141-03	Sediment	07/13/21
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0141

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS613	21G0141-03	Sediment	07/13/21
LDW21-SS544	21G0141-04	Sediment	07/13/21
LDW21-SS700	21G0141-05	Sediment	07/13/21
LDW21-SS705	21G0141-06	Sediment	07/13/21
LDW21-SS704	21G0141-07	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 LDW21-SS705. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

LDC #: 52054W3b
SDG #: 21G0141
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/27/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD≤20% ICV≤20%
III.	Continuing calibration	SW	CCV≤20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /±S	SW	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SS613	21G0141-03	Sediment	07/13/21
2	LDW21-SS544	21G0141-04	Sediment	07/13/21
3	LDW21-SS700	21G0141-05	Sediment	07/13/21
4	LDW21-SS705	21G0141-06	Sediment	07/13/21
5	LDW21-SS704	21G0141-07	Sediment	07/13/21
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

	BLK0405						
	BLK0527						

LDC #: 52054W36

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer:

METHOD: ✓ **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Were continuing calibration standards analyzed at the required frequencies?

Y [✓ N] N/A Did the continuing calibration standards meet the %D validation criteria of ≤20.0%?

Level IV Only

Y N [✓ N/A] Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	~~Detector/~~ Column	Compound	%D (Limit)	RT (limit)	Associated Samples	Qualifications
	7/28/21	07262104	2	Aroclor 1254	21.4	( )	MB	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
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						( )		
						( )		

LDC #: 52054W26

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

METHOD: 1 **GC** __ **HPLC**

Are surrogates required by the method? Yes___ or No____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	~~Detector/~~ Column	Surrogate Compound	%R (Limits)	Qualifications
	4	1	Y	175 (44-120)	No Qual (<5x)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0141

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS613	21G0141-03	Sediment	07/13/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B
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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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

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. Target Analyte Quantitation

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 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Laboratory Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Metals - Field Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

LDC #: 52054W4a

SDG #: 21G0141

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/29/21

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6020A/7471B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	MR
XIII.	Target Analyte Quantitation	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	LDW21-SS613	21G0141-03	Sediment	07/13/21
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	As, Cd, Cr, Cu, Pb, Ag, Zn, Hg

Analysis Method

ICP	
ICP-MS	As, Cd, Cr, Cu, Pb, Ag, Zn
CVAA	Hg

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B & 4

Laboratory: Analytical Resources, Inc./Materials Testing & Consulting, Inc.

Sample Delivery Group (SDG): 21G0141

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS682	21G0141-01	Sediment	07/13/21
LDW21-SS685	21G0141-02	Sediment	07/13/21
LDW21-SS613	21G0141-03	Sediment	07/13/21
LDW21-SS544	21G0141-04	Sediment	07/13/21
LDW21-SS700	21G0141-05	Sediment	07/13/21
LDW21-SS705	21G0141-06	Sediment	07/13/21
LDW21-SS704	21G0141-07	Sediment	07/13/21
LDW21-SS682MS	21G0141-01MS	Sediment	07/13/21
LDW21-SS682DUP1	21G0141-01DUP1	Sediment	07/13/21
LDW21-SS682DUP2	21G0141-01DUP2	Sediment	07/13/21

Ammonia as Nitrogen and Sulfide underwent Stage 4 review, all others underwent Stage 2B review

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:

Ammonia as Nitrogen by Standard Method 4500-NH 3
Sulfide by Standard Method 4500-S2 D and Puget Sound Estuary Protocols (PSEP) Method
Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G and PSEP Method

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples that underwent Ammonia as Nitrogen and Sulfide review 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 with the following exceptions:

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1	Ammonia as N Sulfide	13 days 14 days	7 days 7 days	J (all detects) J (all detects)	P

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 21G0141

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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	%R (Limits)	Flag	A or P
LDW21-SS682MS (LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1 LDW21-SS682DUP2)	Sulfide	53.5 (75-125)	J (all detects)	A

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW21-SS682DUP1 (LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1 LDW21-SS682DUP2)	Ammonia as N	20.6 (≤20)	-	J (all detects)	A
LDW21-SS682DUP1 (LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1)	Sulfide	59.8 (≤20)	-	J (all detects)	A

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. Target Analyte Quantitation

All target analyte quantitations were within validation criteria for samples which underwent Stage 4 validation. 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.

Due to technical holding time, MS %R, and DUP RPD, data were qualified as estimated in five samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 21G0141

Sample	Analyte	Flag	A or P	Reason
LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1	Ammonia as N Sulfide	J (all detects) J (all detects)	P	Technical holding times
LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1 LDW21-SS682DUP2	Sulfide	J (all detects)	A	Matrix spike (%R)
LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1 LDW21-SS682DUP2	Ammonia as N	J (all detects)	A	Duplicate sample analysis (RPD)
LDW21-SS682 LDW21-SS685 LDW21-SS613 LDW21-SS682DUP1	Sulfide	J (all detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0141

No Sample Data Qualified in this SDG

LDC #: 52054W6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0141 / 21B3218 Stage 2B/4 Page: 1 of 1
Laboratory: Analytical Resources, Inc./Materials Testing & Consulting, Inc. Reviewer: CT
2nd Reviewer: CT

METHOD: (Analyte) Ammonia-N (SM4500-NH 3), ~~Particle Size (ASTM D6913)~~, Sulfide (SM4500-S2 D), Sulfide (PSEP), TOC (EPA SW846 Method 9060A), Total Solids (SM2540G), Total Solids, Sulfide (PSEP)

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 SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	A	Not reviewed for Stage 2B validation.
XI	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

Ammonia-N and Sulfide underwent Stage 4 review, all others underwent Stage 2B review

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS682 B21-1149	21G0141-01	Sediment	07/13/21
2	LDW21-SS685 B21-1150	21G0141-02	Sediment	07/13/21
3	LDW21-SS613 B21-1146	21G0141-03	Sediment	07/13/21
4	LDW21-SS544	21G0141-04	Sediment	07/13/21
5	LDW21-SS700	21G0141-05	Sediment	07/13/21
6	LDW21-SS705	21G0141-06	Sediment	07/13/21
7	LDW21-SS704	21G0141-07	Sediment	07/13/21
8	LDW21-SS682MS	21G0141-01MS	Sediment	07/13/21
9	LDW21-SS682DUP	21G0141-01DUP	Sediment	07/13/21
10	LDW21-SS682~~TRP~~ DUP2	21G0141-01~~TRP~~ DUP2	Sediment	07/13/21
11				
12				
13				
14				
15				

Notes:

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times were met?		X		
II. Calibration				
Were all instuments calibrated at the requried frequency?	X			
Were the proper number of standards used?	X			
Were all initial and continuing calibration verifications within the QC limits?	X			
Were all initial calibration correlation coefficients within limits as specifed by the method?	X			
Were balance checks performed as required?			X	
III. Blanks				
Was a method blank assoicated with every sample in this SDG?	X			
Was there contamination in the method blanks?		X		
Was there contamination in the initial and continuing calibration blanks?		X		
IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries with the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)		X		
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?		X		
V. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	X			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	X			
X. Sample Result Verification				
Were all reproting limits adjusted to reflect sample dilutions?	X			
Were all soil samples dry weight corrected?	X			
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	X			

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
XII. Field Duplicates				
Were field duplicates identified in this SDG?		X		
Were target analytes detected in the field duplicates?			X	
XIII. Field Blanks				
Were field blanks identified in this SDG?		X		
Were target analytes detected in the field blanks?			X	

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
1 to 3	Sulfide total solids, NH3-N, Sulfide
QC:	
8	NH3-N, Sulfide
9	TS, sulifide TS, NH3-N, Sulfide
10	TS, NH3-N

METHOD: Inorganics

All samples were properly preserved and within the requried holding time with the following exceptions.

		Method: SM4500 NH3 H Analyte: NH3-N Holding Time: 7 days			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (days)	Qualifier	Det/ND
1 to 3, 9	7/13/2021	7/26/2021	13	J/UJ/P	Det

		Method: SM4500 S2 D Analyte: Sulfide Holding Time: 7 days			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (days)	Qualifier	Det/ND
1 to 3, 9	7/13/2021	7/27/2021	14	J/UJ/P	Det

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

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 Samples	Qualification	Det/ND
8	s	Sulfide	53.5	75-125	1 to 3 ,9,10	J/UJ/A	Det

Comments:

Laboratory Duplicates

METHOD: Inorganics

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 reproting limits, the difference was with 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed below.

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Assocaited Samples	Qualification	Det/ND
9	s	NH3-N	20.6	20			1 to 3, 9, 10	J/UJ/A	Det
		Sulfide	59.8	20			1 to 3, 9	J/UJ/A	Det

Comments:

LDC #: 52054W6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of NH3-N was recalculated.Calibration date: 7/26/21

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{\text{Found} \times 100}{\text{True}}$$

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution

True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (mg/l)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	NH3-N	s1	0	1.25	*0.99991*	0.99990	Y
		s2	0.04	1.87			
		s3	0.1	3.18			
		s4	0.2	5.71			
		s5	0.5	12.7			
		s6	0.8	19.8			
		s7	1	24.5			
Calibration verification	NH3-N	ICV	0.5	0.524	105	105	Y
Calibration verification	NH3-N	CCV	0.5	0.526	105	105	Y
Calibration verification	Sulfide	CCV	0.50066	0.472	94	94	Y

Comments:

METHOD: Inorganics

Percent recoveries (%R) for the laboratory control sample (LCS) and matrix spike (MS) were recalcuated using the following formula.
%R = (Found/True) x 100
Found = concentration of each analyte measured in the analysis. For the MS calculation, Found = SSR (Spiked Sample Result) - SR (Sample Result)
True = concentraiton of each analyte in the source
The sample and duplciate relative percent difference (RPD) was recalcuated using the following formula.
RPD = (Absolute value(S-D)x 200) / (S+D)
S = Original sample concentraiton
D = Duplciate sample concentration

Sample ID	Type of Analysis	Element	Found/S	True/D	Recalcuated %R/RPD	Reported %R/RPD	Acceptable (Y/N)
LCS	LCS	Sulfide	133	151	88.1	88.3	Y
8	MS	Sulfide	117	219	53.4	53.5	Y
9	Duplicate	NH3-N	21.2	26	20.3	20.6	Y

METHOD: Inorganics

Analytes were recalcuated and verified using the following equation.

Concentration = (Result from raw data x Final volume x Dilution factor) / (Percent solids (if applicable) x Initial weight or volume)

Sample ID	Analyte	Raw Data (area)	Coefficient	Intercept	Dilution	Initial Weight/ Volume (g)	Final Volume (mL)	Percent solids (%)	Reported Result (mg/Kg)	Recalcuated Result (mg/Kg)	Acceptable (Y/N)
1	NH3-N	18.4	0.0425	-0.0426	2	4.28	40	65.33	21.2	21.2	Y
2	NH3-N	15.4	0.0425	-0.0426	2	4.22	40	58.13	19.3	20.0	Y
3	NH3-N	24.2	0.0425	-0.0426	5	4.13	40	62.35	76.7	76.6	Y
1	Sulfide	0.224	1.65685	0.00663496	10	5.222	100	65.33	111	111	Y
2	Sulfide	0.135	1.65685	0.00663496	10	5.05	100	58.13	78.7	78.5	Y
3	Sulfide	0.158	1.65685	0.00663496	1	5.347	100	62.35	8.04	8.05	Y

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0145

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS686	21G0145-03	Sediment	07/12/21
LDW21-SS686MS	21G0145-03MS	Sediment	07/12/21
LDW21-SS686MSD	21G0145-03MSD	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-SS686MS/MSD (LDW21-SS686)	Phenanthrene	-	144 (49-120)	J (all detects)	A
	Fluoranthene	-	151 (53-145)	J (all detects)	
	Pyrene	-	135 (52-134)	J (all detects)	

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 MS/MSD %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 21G0145

Sample	Analyte	Flag	A or P	Reason
LDW21-SS686	Phenanthrene Fluoranthene Pyrene	J (all detects) J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0145

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0145

No Sample Data Qualified in this SDG

LDC #: 52054X2a

SDG #: 21G0145

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9/23/21

Page: 1 of 1

Reviewer: a

2nd Reviewer: a

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD≤20% ICV≤30%
IV.	Continuing calibration	A	
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples LCS/LCSD	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-SS686	21G0145-03	Sediment	07/12/21
2	LDW21-SS686MS	21G0145-03MS	Sediment	07/12/21
3	LDW21-SS686MSD	21G0145-03MSD	Sediment	07/12/21
4				
5				
6				
7				
8				
9				

Notes:

BJ40681

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 #: 52054X29

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: Q

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

[✓ Y] N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Y [✓ N] N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		2/3	UU	( )	144 (49-120)	( )	1 (dets)	J dets/A
			YY	( )	151 (53-145)	( )		↓
			ZZ	( )	135 (52-134)	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0145

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SS686	21G0145-03	Sediment	07/12/21
LDW21-SS686DUP1	21G0145-03DUP1	Sediment	07/12/21
LDW21-SS686DUP2	21G0145-03DUP2	Sediment	07/12/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0145

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. Target Analyte Quantitation

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 21G0145

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0145

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0145

No Sample Data Qualified in this SDG

LDC #: 52054X6
SDG #: 21G0145
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SS686	21G0145-03	Sediment	07/12/21
2	LDW21-SS686DUP	21G0145-03DUP	Sediment	07/12/21
3	LDW21-SS686~~TRP~~ DUP2	21G0145-03~~TRP~~ DUP2	Sediment	07/12/21
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
QC:	
2, 3	TS

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0156

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT685	21G0156-12	Sediment	07/14/21
LDW21-SC680	21G0156-23	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 21G0156

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

LDC #: 52054Y2a
SDG #: 21G0156
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/27/21
Page: 1 of 1
Reviewer: CV
2nd Reviewer: AC

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270E)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20% ICV ≤ 30%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples / SRM	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-IT685	21G0156-12	Sediment	07/14/21
2	LDW21-SC680	21G0156-23	Sediment	07/14/21
3				
4				
5				
6				
7				
8				
9				

Notes:

	#21G0156						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: September 30, 2021

Parameters: Semivolatiles

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0156

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT588B	21G0156-06	Sediment	07/14/21
LDW21-IT588C	21G0156-07	Sediment	07/14/21
LDW21-IT588E	21G0156-08	Sediment	07/14/21
LDW21-IT685	21G0156-12	Sediment	07/14/21
LDW21-SC680	21G0156-23	Sediment	07/14/21
LDW21-IT588CMS	21G0156-07MS	Sediment	07/14/21
LDW21-IT588CMSD	21G0156-07MSD	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990 with the following exceptions:

Date	Analyte	r^2	Associated Samples	Flag	A or P
07/27/21	Dibenzo(a,h)anthracene	0.9891	LDW21-IT588B LDW21-IT588C LDW21-IT588E	J (all detects)	A

Average relative response factors (RRF) for all analytes 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 analytes.

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 analytes.

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	Analyte	Concentration	Associated Samples
BJG0524-BLK1	07/23/21	Dibenzo(a,h)anthracene	0.91 ug/Kg	LDW21-IT588B LDW21-IT588C LDW21-IT588E

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	Analyte	Reported Concentration	Modified Final Concentration
LDW21-IT588B	Dibenzo(a,h)anthracene	3.65 ug/Kg	3.65U ug/Kg
LDW21-IT588C	Dibenzo(a,h)anthracene	3.56 ug/Kg	3.56U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-IT588CMS/MSD (LDW21-IT588C)	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene	58.9 (67-132) -	59.1 (67-132) 65.7 (66-139)	J (all detects) J (all detects)	A

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

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 initial calibration r^2 and MS/MSD %R, data were qualified as estimated in three samples.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Semivolatiles - Data Qualification Summary - SDG 21G0156

Sample	Analyte	Flag	A or P	Reason
LDW21-IT588B LDW21-IT588C LDW21-IT588E	Dibenzo(a,h)anthracene	J (all detects)	A	Initial calibration (r^2)
LDW21-IT588C	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 21G0156

Sample	Analyte	Modified Final Concentration	A or P
LDW21-IT588B	Dibenzo(a,h)anthracene	3.65U ug/Kg	A
LDW21-IT588C	Dibenzo(a,h)anthracene	3.56U ug/Kg	A

Duwamish AOC4
Semivolatiles - Field Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

LDC #: 52054Y2b
SDG #: 21G0156
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/27/21
Page: 1 of 1
Reviewer: 9
2nd Reviewer: AC

METHOD: GC/MS ~~Polynuclear Aromatic Hydrocarbons~~ SVOA (EPA SW 846 Method 8270E-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	MW/A	RSD ≤ 20% r^2 ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	MW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	MW	
IX.	Laboratory control samples / SRM	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte 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	LDW21-IT588B		21G0156-06	Sediment	07/14/21
2	LDW21-IT588C		21G0156-07	Sediment	07/14/21
3	LDW21-IT588E		21G0156-08	Sediment	07/14/21
4	LDW21-IT685	✓	21G0156-12	Sediment	07/14/21
5	LDW21-SC680	✓	21G0156-23	Sediment	07/14/21
6	LDW21-IT588CMS		21G0156-07MS	Sediment	07/14/21
7	LDW21-IT588CMSD		21G0156-07MSD	Sediment	07/14/21
8					
9					

Notes:

	BKF0524						
2	BKF0525 ✓						

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 #: 52054Y3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Page: 1 of 1
Reviewer: a
~~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 Did the laboratory conduct an acceptable 5 point calibration prior to sample analysis?
Y N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation?_____
Y N N/A Did the initial calibration meet the acceptance criteria?
Y N N/A Were all %RSDs and RRFs within the validation criteria of ≤20 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	7/7/21	ICAL	HHC	r^2=0.9891		1-3, MB (dets)	J/UJ/X

INICAL_2SD

LDC #: 52054Y3b

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: Q

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
Y N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 7/23/21 **Blank analysis date:** 8/2/21
Conc. units: ug/Kg Associated Samples: 1-3

Compound	Blank ID	Sample Identification								
BN0524-BK1		1	2							
KK	0.91		3.65/U	3.56/U						

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 52054Y26

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: Q

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

[✓ Y] N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

[✓ Y] N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Y [✓ N] N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	6/7	VVV	58.9 (67-132)	59.1 (67-132)	( )	2 (dets)	J/UJ/A
		KKK	( )	65.7 (66-139)	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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LDC Report# 52054Y3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 4, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0156

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT622A	21G0156-01	Sediment	07/14/21
LDW21-IT622B	21G0156-02	Sediment	07/14/21
LDW21-IT622C	21G0156-03	Sediment	07/14/21
LDW21-IT622E	21G0156-04	Sediment	07/14/21
LDW21-IT660B	21G0156-05	Sediment	07/14/21
LDW21-IT588B	21G0156-06	Sediment	07/14/21
LDW21-IT588BDL	21G0156-06DL	Sediment	07/14/21
LDW21-IT588C	21G0156-07	Sediment	07/14/21
LDW21-IT588E	21G0156-08	Sediment	07/14/21
LDW21-IT585B	21G0156-09	Sediment	07/14/21
LDW21-IT585C	21G0156-10	Sediment	07/14/21
LDW21-IT585E	21G0156-11	Sediment	07/14/21
LDW21-SC571A	21G0156-14	Sediment	07/14/21
LDW21-SC571A-FD	21G0156-15	Sediment	07/14/21
LDW21-SC571B	21G0156-16	Sediment	07/14/21
LDW21-SC571C	21G0156-17	Sediment	07/14/21
LDW21-SC571E	21G0156-18	Sediment	07/14/21
LDW21-SC568B	21G0156-19	Sediment	07/14/21
LDW21-SC568C	21G0156-20	Sediment	07/14/21
LDW21-SC568E-FD	21G0156-21	Sediment	07/14/21
LDW21-SC568E	21G0156-22	Sediment	07/14/21
LDW21-IT622CMS	21G0156-03MS	Sediment	07/14/21
LDW21-IT622CMSD	21G0156-03MSD	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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	Column	Surrogate	%R (Limits)	Affected Analyte	Flag	A or P
LDW21-SC568B	Col. 1	Decachlorobiphenyl	134 (40-126)	All analytes	J (all detects)	P

Surrogate recoveries (%R) were not within QC limits for samples LDW21-SC568C, LDW21-SC568E-FD, and LDW21-SC568E. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

All internal standard percent 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

Samples LDW21-SC571A and LDW21-SC571A-FD and samples LDW21-SC568E and LDW21-SC568E-FD were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC571A	LDW21-SC571A-FD	
Aroclor-1254	9.3	9.2	1
Aroclor-1260	4.7	5.0	6

Analyte	Concentration (ug/Kg)		RPD
	LDW21-SC568E-FD	LDW21-SC568E	
Aroclor-1248	516	436	17
Aroclor-1254	468	399	16
Aroclor-1260	207	199	4

X. Target Analyte Quantitation

The sample results for detected analytes from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Analyte	RPD	Flag	A or P
LDW21-SC571A	Aroclor-1254	48.0	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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	Analyte	Reason	Flag	A or P
LDW21-IT588B	Aroclor-1260	Results exceeded calibration range.	Not reportable	-
LDW21-IT588BDL	All analytes except Aroclor-1260	Results from undiluted analyses were more usable.	Not reportable	-

Due to surrogate %R and RPD between two columns, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0156

Sample	Analyte	Flag	A or P	Reason
LDW21-SC568B	All analytes	J (all detects)	P	Surrogates (%R)
LDW21-SC571A	Aroclor-1254	J (all detects)	A	Target analyte quantitation (RPD between two columns)
LDW21-IT588B	Aroclor-1260	Not reportable	-	Overall assessment of data
LDW21-IT588BDL	All analytes except Aroclor-1260	Not reportable	-	Overall assessment of data

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

LDC #: 52054Y3b
SDG #: 21G0156
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/27/21
Page: 1 of 2
Reviewer: C
2nd Reviewer: A

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD≤20%. ICV≤20%
III.	Continuing calibration	A	CCV≤20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /FS	SW/A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	SW	D=13+14, ~~19+20~~ 20+21
X.	Target analyte quantitation	A/N	
XI.	Target analyte identification	N	
XII.	Overall assessment of data	SW	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank
SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT622A	21G0156-01	Sediment	07/14/21
2	LDW21-IT622B	21G0156-02	Sediment	07/14/21
3	LDW21-IT622C	21G0156-03	Sediment	07/14/21
4	LDW21-IT622E	21G0156-04	Sediment	07/14/21
5	LDW21-IT660B	21G0156-05	Sediment	07/14/21
6	LDW21-IT588B	21G0156-06	Sediment	07/14/21
7	LDW21-IT588BDL	21G0156-06DL	Sediment	07/14/21
8	LDW21-IT588C	21G0156-07	Sediment	07/14/21
9	LDW21-IT588E	21G0156-08	Sediment	07/14/21
10	LDW21-IT585B	21G0156-09	Sediment	07/14/21
11	LDW21-IT585C	21G0156-10	Sediment	07/14/21
12	LDW21-IT585E	21G0156-11	Sediment	07/14/21
13	LDW21-SC571A	21G0156-14	Sediment	07/14/21
14	LDW21-SC571A-FD	21G0156-15	Sediment	07/14/21
15	LDW21-SC571B	21G0156-16	Sediment	07/14/21
16	LDW21-SC571C	21G0156-17	Sediment	07/14/21
17	LDW21-SC571E	21G0156-18	Sediment	07/14/21

LDC #: 52054Y3b
SDG #: 21G0156
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/22/21

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC568B	21G0156-19	Sediment	07/14/21
19	LDW21-SC568C	21G0156-20	Sediment	07/14/21
20	LDW21-SC568E-FD	21G0156-21	Sediment	07/14/21
21	LDW21-SC568E	21G0156-22	Sediment	07/14/21
22	LDW21-IT622CMS	21G0156-03MS	Sediment	07/14/21
23	LDW21-IT622CMSD	21G0156-03MSD	Sediment	07/14/21
24				
25				
26				

Notes:

LDC #: 52054Y36

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: 9

METHOD: ✓ GC ___ HPLC

Are surrogates required by the method? Yes____ or No____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were surrogates spiked into all samples and blanks?

Y N N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	~~Detector~~/ Column	Surrogate Compound	%R (Limits)	Qualifications
	18	1	0	134 (40-126)	Dets/ND (dets+ND)
				( )	
	19, 20-21		surr	out (-)	No Cmpd (DF≥5x)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: PCBs (EPA SW 846 Method 8082A)

Compound	Concentration (ug/kg)		RPD
	13	14	
Aroclor 1254	9.3	9.2	1
Aroclor 1260	4.7	5.0	6

Compound	Concentration (ug/kg)		RPD
	20	21	
Aroclor 1248	516	436	17
Aroclor 1254	468	399	16
Aroclor 1260	207	199	4

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2021\52054Y3b_Windward.wpd

LDC #: 52054A36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: 9

METHOD: ✓ GC __ HPLC

Level IV/D Only

Y N ~~N/A~~ Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N ~~N/A~~ Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y ~~N~~ N/A Did the relative percent differences of detected compounds between two columns/detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	Aroclor 1254	13	48.0	~~Det~~ / A
	~~R~~	~~2~~		
	~~Aroclor 1260~~			

LDC #: 52054Y36

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: SV

METHOD: / **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

(Y) N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	6	Aroclor 1260 > calib range		NR/A
	7	All except above		J

Comments: _____

OVRNew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Arsenic

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0156

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT588B	21G0156-06	Sediment	07/14/21
LDW21-IT588C	21G0156-07	Sediment	07/14/21
LDW21-IT588E	21G0156-08	Sediment	07/14/21
LDW21-IT585B	21G0156-09	Sediment	07/14/21
LDW21-IT585C	21G0156-10	Sediment	07/14/21
LDW21-IT585E	21G0156-11	Sediment	07/14/21
LDW21-IT588BMS	21G0156-06MS	Sediment	07/14/21
LDW21-IT588BMSD	21G0156-06MSD	Sediment	07/14/21
LDW21-IT588BDUP	21G0156-06DUP	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 6020B

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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LDW21-IT588BMS/MSD (All samples in SDG 21G0156)	Arsenic	57.7 (75-125)	40.8 (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 method. 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. Target Analyte Quantitation

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 MS/MSD %R, data were qualified as estimated in seven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Arsenic - Data Qualification Summary - SDG 21G0156

Sample	Analyte	Flag	A or P	Reason
LDW21-IT588B LDW21-IT588C LDW21-IT588E LDW21-IT585B LDW21-IT585C LDW21-IT585E LDW21-IT588BDUP	Arsenic	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Duwamish AOC4
Arsenic - Laboratory Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

Duwamish AOC4
Arsenic - Field Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

LDC #: 52054Y4a
SDG #: 21G0156
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer: EA
2nd Reviewer:

METHOD: Arsenic (EPA SW 846 Method 6020A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	A	
IX.	Serial Dilution	N	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	N	NR
XIII.	Target Analyte Quantitation	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	LDW21-IT588B	21G0156-06	Sediment	07/14/21
2	LDW21-IT588C	21G0156-07	Sediment	07/14/21
3	LDW21-IT588E	21G0156-08	Sediment	07/14/21
4	LDW21-IT585B	21G0156-09	Sediment	07/14/21
5	LDW21-IT585C	21G0156-10	Sediment	07/14/21
6	LDW21-IT585E	21G0156-11	Sediment	07/14/21
7	LDW21-IT588BMS	21G0156-06MS	Sediment	07/14/21
8	LDW21-IT588BMSD	21G0156-06MSD	Sediment	07/14/21
9	LDW21-IT588BDUP	21G0156-06DUP	Sediment	07/14/21
10				
11				
12				
13				

Notes:

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	Post spike
7, 8	s	As	57.7	40.8	75-125			All	J/UJ/A	Det	

Comments:

LDC Report# 52054Y6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0156

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-IT622A	21G0156-01	Sediment	07/14/21
LDW21-IT622B	21G0156-02	Sediment	07/14/21
LDW21-IT622C	21G0156-03	Sediment	07/14/21
LDW21-IT622E	21G0156-04	Sediment	07/14/21
LDW21-IT660B	21G0156-05	Sediment	07/14/21
LDW21-IT588B	21G0156-06	Sediment	07/14/21
LDW21-IT588C	21G0156-07	Sediment	07/14/21
LDW21-IT588E	21G0156-08	Sediment	07/14/21
LDW21-IT585B	21G0156-09	Sediment	07/14/21
LDW21-IT585C	21G0156-10	Sediment	07/14/21
LDW21-IT585E	21G0156-11	Sediment	07/14/21
LDW21-IT685	21G0156-12	Sediment	07/14/21
LDW21-SC571A	21G0156-14	Sediment	07/14/21
LDW21-SC571A-FD	21G0156-15	Sediment	07/14/21
LDW21-SC571B	21G0156-16	Sediment	07/14/21
LDW21-SC571C	21G0156-17	Sediment	07/14/21
LDW21-SC571E	21G0156-18	Sediment	07/14/21
LDW21-SC568B	21G0156-19	Sediment	07/14/21
LDW21-SC5688C	21G0156-20	Sediment	07/14/21
LDW21-SC568E-FD	21G0156-21	Sediment	07/14/21
LDW21-SC568E	21G0156-22	Sediment	07/14/21
LDW21-SC680	21G0156-23	Sediment	07/14/21
LDW21-IT588EMS	21G0156-08MS	Sediment	07/14/21
LDW21-IT588EDUP	21G0156-08DUP	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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:

Ammonia as Nitrogen by Standard Method 4500-NH 3
Sulfide by Standard Method 4500-S2 D and Puget Sound Estuary Protocols (PSEP) Method
Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G and PSEP Method

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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 with the following exceptions:

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
LDW21-IT685 LDW21-SC680	Ammonia as N	12 days	7 days	J (all detects) UJ (all non-detects)	P
	Sulfide	13 days	7 days	J (all detects) UJ (all non-detects)	

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 21G0156

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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	%R (Limits)	Flag	A or P
LDW21-SS682MS (LDW21-IT685 LDW21-SC680)	Sulfide	53.5 (75-125)	J (all detects) UJ (all non-detects)	A

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW21-SS682DUP1 (LDW21-IT685 LDW21-SC680)	Ammonia as N	20.6 (≤20)	-	J (all detects) UJ (all non-detects)	A
	Sulfide	59.8 (≤20)	-	J (all detects) UJ (all non-detects)	

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 LDW21-SC571A and LDW21-SC571A-FD and samples LDW21-SC568E-FD and LDW21-SC568E were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD
	LDW21-SC571A	LDW21-SC571A-FD	
Total organic carbon	0.80	0.86	7
Total solids	73.80	72.34	2

Analyte	Concentration (%)		RPD
	LDW21-SC568E-FD	LDW21-SC568E	
Total organic carbon	3.73	3.66	2
Total solids	56.02	57.30	2

X. Target Analyte Quantitation

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.

Due to technical holding time, MS %R, and DUP RPD, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 21G0156

Sample	Analyte	Flag	A or P	Reason
LDW21-IT685 LDW21-SC680	Ammonia as N Sulfide	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P	Technical holding times
LDW21-IT685 LDW21-SC680	Sulfide	J (all detects) UJ (all non-detects)	A	Matrix spike (%R)
LDW21-IT685 LDW21-SC680	Ammonia as N Sulfide	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (RPD)

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0156

No Sample Data Qualified in this SDG

LDC #: 52054Y6
SDG #: 21G0156
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 2
Reviewer: G
2nd Reviewer: G

METHOD: (Analyte) Ammonia-N (SM4500-NH 3), Sulfide (SM4500-S2 D), Sulfide (PSEP), TOC (EPA SW846 Method 9060A), Total Solids (SM2540G), Total Solids, Sulfide (PSEP)

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 SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(13,14) (20,21)
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-IT622A	21G0156-01	Sediment	07/14/21
2	LDW21-IT622B	21G0156-02	Sediment	07/14/21
3	LDW21-IT622C	21G0156-03	Sediment	07/14/21
4	LDW21-IT622E	21G0156-04	Sediment	07/14/21
5	LDW21-IT660B	21G0156-05	Sediment	07/14/21
6	LDW21-IT588B	21G0156-06	Sediment	07/14/21
7	LDW21-IT588C	21G0156-07	Sediment	07/14/21
8	LDW21-IT588E	21G0156-08	Sediment	07/14/21
9	LDW21-IT585B	21G0156-09	Sediment	07/14/21
10	LDW21-IT585C	21G0156-10	Sediment	07/14/21
11	LDW21-IT585E	21G0156-11	Sediment	07/14/21
12	LDW21-IT685	21G0156-12	Sediment	07/14/21
13	LDW21-SC571A	21G0156-14	Sediment	07/14/21
14	LDW21-SC571A-FD	21G0156-15	Sediment	07/14/21
15	LDW21-SC571B	21G0156-16	Sediment	07/14/21
16	LDW21-SC571C	21G0156-17	Sediment	07/14/21
17	LDW21-SC571E	21G0156-18	Sediment	07/14/21

LDC #: 52054Y6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/29/21
SDG #: 21G0156 Stage 2B Page: 2 of 2
Laboratory: Analytical Resources, Inc. Reviewer: C
2nd Reviewer: A

METHOD: (Analyte) Ammonia-N (SM4500-NH 3), Sulfide (SM4500-S2 D), Sulfide (PSEP), TOC (EPA SW846 Method 9060A), Total Solids (SM2540G), Total Solids, Sulfide (PSEP)

	Client ID	Lab ID	Matrix	Date
18	LDW21-SC568B	21G0156-19	Sediment	07/14/21
19	LDW21-SC5688C	21G0156-20	Sediment	07/14/21
20	LDW21-SC568E-FD	21G0156-21	Sediment	07/14/21
21	LDW21-SC568E	21G0156-22	Sediment	07/14/21
22	LDW21-SC680	21G0156-23	Sediment	07/14/21
23	LDW21-IT588EMS	21G0156-08MS	Sediment	07/14/21
24	LDW21-IT588EDUP	21G0156-08DUP	Sediment	07/14/21
25				
26				
27				

Notes:

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC
12, 22	Sulfide TS, NH3-N, Sulfide
QC:	
23	TOC
24	TOC

Holding Time

METHOD: Inorganics

All samples were properly preserved and within the requried holding time with the following exceptions.

		Method: SM4500 NH3 H Analyte: NH3-N Holding Time: 7 days			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (days)	Qualifier	Det/ND
12, 22	7/14/2021	7/26/2021	12	J/UJ/P	Det/ND

		Method: SM4500 S2 D Analyte: Sulfide Holding Time: 7 days			
Sample ID	Sampling Date	Analysis Date	Total Time from Collection to Analysis (days)	Qualifier	Det/ND
12, 22	7/14/2021	7/27/2021	13	J/UJ/P	Det

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									

VALIDATION FINDINGS WORKSHEETS
Matrix Spikes

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 Samples	Qualification	Det/ND
LDW21-SS682MS	s	Sulfide	53.5	75-125	12, 22	J/UJ/A	Det/ND
(SDG: 21G0156)							

Comments:

VALIDATION FINDINGS WORKSHEETS
Laboratory Duplicates

METHOD: Inorganics

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 reproting limits, the difference was with 1X the reporting limit for water samples and within 2X the reporting limit for soil samples for all samples with the exceptions listed

Duplicate ID	Matrix	Analyte	RPD	RPD Limit	Difference (units)	Difference Limit	Assocaited Samples	Qualification	Det/ND
LDW21-SS682DUP1	s	NH3-N	20.6	20			12, 22	J/UJ/A	Det/ND
(SDG: 21G0156)		Sulfide	59.8	20			12, 22	J/UJ/A	Det/ND

Comments:

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: Inorganics

Analyte	Concentration (%)		RPD
	13	14	
TOC	0.80	0.86	7
Total solids	73.80	72.34	2

Analyte	Concentration (%)		RPD
	20	21	
TOC	3.73	3.66	2
Total solids	56.02	57.30	2

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 1, 2021

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0176

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC529A	21G0176-01	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

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 percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standards	%R (Limits)	Affected Analyte	Flag	A or P
LDW21-SC529A	Hexabromobiphenyl	44 (50-200)	Aroclor-1260	J (all detects)	A

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte 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 internal standard %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 21G0176

Sample	Analyte	Flag	A or P	Reason
LDW21-SC529A	Aroclor-1260	J (all detects)	A	Internal standards (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 21G0176

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 21G0176

No Sample Data Qualified in this SDG

LDC #: 52054Z3b
SDG #: 21G0176
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/22/21
Page: 1 of 1
Reviewer: Q
2nd Reviewer: M

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A/A	RSD ≤ 20% RRV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /DS	A/SW	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples /SRM	A	LCS
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte 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	LDW21-SC529A	21G0176-01	Sediment	07/14/21
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticides

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO. oxy-Chlordane
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP. cis-Nonachlor
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ. trans-Nonachlor
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR. cis-Chlordane
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. p,p'-DDE	SS. trans-Chlordane
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. p,p'-DDD	TT. alpha-Endosulphan
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. p,p'-DDT	UU. beta-Endosulphan
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. o,p'-DDT	VV. Endosulphan Sulphate
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. o,p'-DDE	WW. Mirex
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN. o,p'-DDD	XX. Hexachlorobutadiene

Notes:_____

LDC #: 52054236

VALIDATION FINDINGS WORKSHEET
Internal Standards

Reviewer: Q

METHOD: GC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were all internal standard area counts within -50 to +100% of the ICAL midpoint standard?

(Y) N N/A Were the retention times of the internal standards within +/- 0.05 min seconds of the retention times of the ICAL midpoint standard?

#	Date	Sample ID	Internal Standard	Area (Limits) 70R	RT (Limits)	Qualifications
		1 (dets)	B	44 (50-200)		J (44) A (BB)
			B=Hexabromobiphenyl			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: October 3, 2021

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 21G0176

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW21-SC529A	21G0176-01	Sediment	07/14/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the 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 analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

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 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 21G0176

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

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

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. Target Analyte Quantitation

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 21G0176

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 21G0176

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 21G0176

No Sample Data Qualified in this SDG

LDC #: 52054Z6
SDG #: 21G0176
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 9/29/21
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 Method 9060A), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW21-SC529A	21G0176-01	Sediment	07/14/21
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
All	TS, TOC

VALIDATION FINDINGS WORKSHEET
Laboratory Blank Contamination (PB/ICB/CCB)

Reviewer:CR

METHOD: Inorganics
Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted:% Associated Samples:All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No quals								
TOC		0.02	0.02									