Appendix E
Data Validation Reports

Table E-1
Sampling Summary: Data Validation Reports

Apex Laboratory Report Number	Apex Data Validation Number	Vista Laboratory Report Number	Vista Data Validation Number
A9D0674	45378	1900807	45526
A9D0735	45378	1900817	45476
A9E0061	45378	1900951	45600
A9E0168	45378	1901028	45340
A9E0744	45378	1901029	45340
A9E0766	45378	1901246	45719
A9E0838	45378	1901247	45600
A9E0849	45378	1901248	45434
A9E0922	45378	1901249	45631
A9E0927	45378	1901305	45640, 46013
A9F0035	45449	1901384	45631
A9I0305, A9I0309	46182	1903103	46172

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

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

August 26, 2019

SUBJECT: Revised Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on June 25, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

- Updated the QAPP reference.

LDC Project #45378_RV1:

SDG #	Fraction
A9D0674, A9D0735 A9E0061, A9E0168 A9E0744, A9E0766 A9E0838, A9E0849 A9E0922, A9E0927	Polynuclear Aromatic Hydrocarbons, Chlorinated Pesticides, Polychlorinated Biphenyls, Metals, Wet Chemistry

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

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy; 2019
- 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,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

EDD Stage 2B/4 90/10

LDC #45378 (Anchor Environmental-Seattle WA / Port of Portland, T4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PAHs (8270D)		Pest. (8081B)		PCBs (8082A)		TOC (9060A)		Total Solids (PSEP)		Part. Size (D422M)																							
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	W	S
A	A9D0674	06/25/19	07/17/19	1	20	-	-	-	-	0	21	0	21	0	21																						
B	A9D0735	06/25/19	07/17/19	0	5	-	-	-	-	0	5	0	5	0	5																						
C	A9E0061	06/25/19	07/17/19	0	19	-	-	-	-	0	19	0	19	0	21																						
D	A9E0168	06/25/19	07/17/19	0	12	-	-	-	-	0	12	0	12	0	12																						
E	A9E0744	06/25/19	07/17/19	0	9	0	1	0	13	0	9	0	9	0	7																						
E	A9E0744	06/25/19	07/17/19	0	10	0	1	0	4	0	10	0	10	0	10																						
F	A9E0766	06/25/19	07/17/19	0	7	-	-	0	8	0	8	0	8	0	7																						
G	A9E0838	06/25/19	07/17/19	0	8	-	-	0	8	0	8	0	8	0	6																						
H	A9E0849	06/25/19	07/17/19	1	0	1	1	0	3	0	3	0	3	0	3																						
I	A9E0922	06/25/19	07/17/19	0	7	-	-	-	-	0	7	0	7	0	7																						
J	A9E0927	06/25/19	07/17/19	0	4	-	-	0	4	0	4	0	4	0	3																						
Total	J/CR			2	101	1	3	0	40	0	106	0	106	0	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	461

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9D0674

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201904171558	A9D0674-01	Water	04/17/19
T4-PDI2019-SG05-190417	A9D0674-02	Sediment	04/17/19
T4-PDI2019-SG06-190417	A9D0674-03	Sediment	04/17/19
T4-PDI2019-SG08-190415	A9D0674-04	Sediment	04/15/19
T4-PDI2019-SG11-190415	A9D0674-05	Sediment	04/15/19
T4-PDI2019-SG13-190415	A9D0674-06	Sediment	04/15/19
T4-PDI2019-SG15-190416	A9D0674-07	Sediment	04/16/19
T4-PDI2019-SG16-190416	A9D0674-08	Sediment	04/16/19
T4-PDI2019-SG17-190416	A9D0674-12	Sediment	04/16/19
FD-201904151441	A9D0674-13	Sediment	04/15/19
T4-PDI209-SG18-190415	A9D0674-14	Sediment	04/15/19
T4-PDI209-SG51-190417	A9D0674-15	Sediment	04/17/19
T4-PDI209-SG52-190417	A9D0674-16	Sediment	04/17/19
T4-PDI209-SG53-190416	A9D0674-17	Sediment	04/16/19
T4-PDI209-SG54-190416	A9D0674-18	Sediment	04/16/19
T4-PDI209-SG57-190417	A9D0674-19	Sediment	04/17/19
T4-PDI209-SG58-190417	A9D0674-20	Sediment	04/17/19
T4-PDI209-SG59-190417	A9D0674-21	Sediment	04/17/19
FD-201904171301	A9D0674-22	Sediment	04/17/19
T4-PDI2019-SG60-190417	A9D0674-23	Sediment	04/16/19
T4-PDI2019-SG61-190416	A9D0674-24	Sediment	04/16/19
T4-PDI2019-SG05-190417DUP	A9D0674-02DUP	Sediment	04/17/19
T4-PDI209-SG52-190417DUP	A9D0674-16DUP	Sediment	04/17/19
T4-PDI209-SG59-190417MS	A9D0674-21MS	Sediment	04/17/19
T4-PDI209-SG59-190417MSD	A9D0674-21MSD	Sediment	04/17/19
FD-201904171301MS	A9D0674-22MS	Sediment	04/17/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
9041150-BLK1	04/22/19	Naphthalene	0.0509 ng/L	All water samples in SDG A9D0674

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

Sample RB-201904171558 was identified as a rinsate. No contaminants were found.

VII. Surrogates

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

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI209-SG57-190417	2-Fluorobiphenyl Terphenyl-d14	30 (44-115) 40 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI209-SG58-190417	2-Fluorobiphenyl Terphenyl-d14	20 (44-115) 33 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI209-SG59-190417	2-Fluorobiphenyl Terphenyl-d14	43 (44-115) 44 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI2019-SG60-190417	2-Fluorobiphenyl Terphenyl-d14	39 (44-115) 49 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A

Surrogate recoveries (%R) were not within QC limits for several samples. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

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

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.

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
T4-PDI2019-SG05-190417DUP (T4-PDI2019-SG05-190417)	Fluoranthene Pyrene	78 (≤35) 74 (≤35)	J (all detects) J (all detects)	A
T4-PDI209-SG52-190417DUP (T4-PDI209-SG52-190417)	Fluoranthene Pyrene	45 (≤35) 46 (≤35)	J (all detects) J (all detects)	A

IX. Laboratory Control Samples

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

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

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
9041150-LCS/D (All water samples in SDG A9D0674)	Acenaphthene	35 (≤30)	UJ (all non-detects)	P
	Acenaphthylene	33 (≤30)	UJ (all non-detects)	
	1-Methylnaphthalene	43 (≤30)	UJ (all non-detects)	
	2-Methylnaphthalene	45 (≤30)	UJ (all non-detects)	
	Naphthalene	48 (≤30)	UJ (all non-detects)	
	Dibenzofuran	31 (≤30)	UJ (all non-detects)	

X. Field Duplicates

Samples FD-201904151441 and T4-PDI209-SG18-190415 and samples FD-201904171301 and T4-PDI2019-SG60-190417 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI209-SG18-190415	
Anthracene	91.7	64.3	35 (≤50)
Benzo(a)anthracene	364	217	51 (≤50)
Benzo(a)pyrene	425	308	32 (≤50)
Benzo(b)fluoranthene	529	321	49 (≤50)
Benzo(k)fluoranthene	212	119	56 (≤50)
Benzo(g,h,i)perylene	359	227	45 (≤50)
Chrysene	453	233	64 (≤50)
Fluoranthene	750	455	49 (≤50)
Indeno(1,2,3-cd)pyrene	387	202	63 (≤50)
Phenanthrene	404	209	64 (≤50)
Pyrene	831	537	43 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI209-SG18-190415	
Acenaphthene	84.4 U	19.7	Not calculable
Acenaphthylene	84.4 U	19.9	Not calculable
Dibenzo(a,h)anthracene	84.4 U	35.6	Not calculable
Fluorene	84.4 U	33.8	Not calculable
2-Methylnaphthalene	169 U	17.1	Not calculable
Naphthalene	169 U	55.0	Not calculable

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
Anthracene	23.9	14.3 U	Not calculable
Benzo(a)anthracene	81.4	45.9	56 (≤50)
Benzo(a)pyrene	126	65.3	63 (≤50)
Benzo(b)fluoranthene	175	79.1	75 (≤50)
Benzo(k)fluoranthene	67.8	37.7	57 (≤50)
Benzo(g,h,i)perylene	85.6	47.4	57 (≤50)
Chrysene	109	50.1	74 (≤50)
Dibenzo(a,h)anthracene	22.7	14.3 U	Not calculable
Fluoranthene	153	77.8	65 (≤50)
Indeno(1,2,3-cd)pyrene	101	48.4	70 (≤50)
Phenanthrene	55.4	37.6	38 (≤50)
Pyrene	156	76.1	69 (≤50)

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG05-190417 T4-PDI2019-SG06-190417 T4-PDI2019-SG08-190415 T4-PDI2019-SG11-190415 T4-PDI2019-SG13-190415 T4-PDI2019-SG16-190416 T4-PDI2019-SG17-190416 T4-PDI209-SG18-190415 T4-PDI209-SG52-190417 T4-PDI209-SG54-190416 FD-201904171301	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A
T4-PDI2019-SG15-190416 FD-201904151441 T4-PDI209-SG53-190416 T4-PDI2019-SG60-190417 T4-PDI2019-SG61-190416	Chrysene Benzo(a)anthracene Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects)	A
T4-PDI209-SG51-190417 T4-PDI209-SG57-190417 T4-PDI209-SG58-190417 T4-PDI209-SG59-190417	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to surrogate %R, DUP RPD, LCS/D RPD, and peak separation, data were qualified as estimated in twenty samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9D0674

Sample	Compound	Flag	A or P	Reason
T4-PDI209-SG57-190417 T4-PDI209-SG58-190417 T4-PDI209-SG59-190417 T4-PDI2019-SG60-190417	All compounds	J (all detects) UJ (all non-detects)	A	Surrogates (%R)
T4-PDI2019-SG05-190417 T4-PDI209-SG52-190417	Fluoranthene Pyrene	J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
RB-201904171558	Acenaphthene Acenaphthylene 1-Methylnaphthalene 2-Methylnaphthalene Naphthalene Dibenzofuran	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	P	Laboratory control samples (RPD)
T4-PDI2019-SG05-190417 T4-PDI2019-SG06-190417 T4-PDI2019-SG08-190415 T4-PDI2019-SG11-190415 T4-PDI2019-SG13-190415 T4-PDI2019-SG16-190416 T4-PDI2019-SG17-190416 T4-PDI209-SG18-190415 T4-PDI209-SG52-190417 T4-PDI209-SG54-190416 FD-201904171301	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG15-190416 FD-201904151441 T4-PDI209-SG53-190416 T4-PDI2019-SG60-190417 T4-PDI2019-SG61-190416	Chrysene Benzo(a)anthracene Benzo(b)fluoranthene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI209-SG51-190417 T4-PDI209-SG57-190417 T4-PDI209-SG58-190417 T4-PDI209-SG59-190417	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9D0674

No Sample Data Qualified in this SDG

LDC #: 45378A2a

SDG #: A9D0674

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/9/18

Page: 1 of 2

Reviewer: FT

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20, r² 1 ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	SW	
VI.	Field blanks	ND	RB = 1
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates /DUP	A / SW	
IX.	Laboratory control samples	SW	LCS ID
X.	Field duplicates	SW	D = 10, 11 19, 20
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1 1	RB-201904171558	A9D0674-01	Water	04/17/19
2 2	T4-PDI2019-SG05-190417	A9D0674-02	Sediment	04/17/19
3 2	T4-PDI2019-SG06-190417	A9D0674-03	Sediment	04/17/19
4 2	T4-PDI2019-SG08-190415	A9D0674-04	Sediment	04/15/19
5 2	T4-PDI2019-SG11-190415	A9D0674-05	Sediment	04/15/19
6 2	T4-PDI2019-SG13-190415	A9D0674-06	Sediment	04/15/19
7 2	T4-PDI2019-SG15-190416	A9D0674-07	Sediment	04/16/19
8 2	T4-PDI2019-SG16-190416	A9D0674-08	Sediment	04/16/19
9 2	T4-PDI2019-SG17-190416	A9D0674-12	Sediment	04/16/19
10 2	FD-201904151441 D	A9D0674-13	Sediment	04/15/19
11 2	T4-PDI209-SG18-190415 D	A9D0674-14	Sediment	04/15/19
12 2	T4-PDI209-SG51-190417	A9D0674-15	Sediment	04/17/19
13 3	T4-PDI209-SG52-190417	A9D0674-16	Sediment	04/17/19

#1 PAH + TTT, WW, JJ

LDC #: 45378A2a **VALIDATION COMPLETENESS WORKSHEET** Date: 7/9/18
SDG #: A9D0674 Stage 2B Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer: FT
2nd Reviewer:

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

14	T4-PDI209-SG53-190416		A9D0674-17	Sediment	04/16/19
15	T4-PDI209-SG54-190416		A9D0674-18	Sediment	04/16/19
16	T4-PDI209-SG57-190417		A9D0674-19	Sediment	04/17/19
17	T4-PDI209-SG58-190417		A9D0674-20	Sediment	04/17/19
18	T4-PDI209-SG59-190417		A9D0674-21	Sediment	04/17/19
19	FD-201904171301	D1	A9D0674-22	Sediment	04/17/19
20	T4-PDI2019-SG60-190417	D1	A9D0674-23	Sediment	04/16/19
21	T4-PDI2019-SG61-190416		A9D0674-24	Sediment	04/16/19
22	T4-PDI2019-SG05-190417DUP	✓	A9D0674-02DUP	Sediment	04/17/19
23	T4-PDI209-SG52-190417DUP	✓	A9D0674-16DUP	Sediment	04/17/19
24	T4-PDI209-SG59-190417MS	✓	A9D0674-21MS	Sediment	04/17/19
25	T4-PDI209-SG59-190417MSD	✓	A9D0674-21MSD	Sediment	04/17/19
26	FD-201904171301MS		A9D0674-22MS	Sediment	04/17/19
27					
28					
29					

Notes:

-1	9041150 - ~~MB~~ BLK1						
-2	9041271 - ~~MB~~ BLK1						
-3	90503T5 - BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378A2a

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: FT
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: 4/22/19 **Blank analysis date:** 4/23/19
Conc. units: ng/L Associated Samples: all water (ND)

Compound	Blank ID								
	9041150-BLK1								
S	0.0509								

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

Compound	Blank ID								

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

LDC #: 45378A2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	3, 4, 8, 12	surrogate outside limit	( )	no qual ≥5x DL
	13		( )	
			( )	
			( )	
			( )	
			( )	
	16	FBP	30 (44-115)	J/UJ/A all TCL ND + Det
		TPH	40 (54-127)	↓
			( )	
			( )	
	17	↓	20 (↓)	J/UJ/A all TCL ND + Det
			33 (↓)	↓
			( )	
	18	↓	43 (↓)	J/UJ/A all TCL ND + Det
		↓	44 (↓)	↓
			( )	
	20	↓	39 (↓)	J/UJ/A all TCL ND + Det
		↓	49 (↓)	↓
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378A2a

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer:
2nd Reviewer: a

METHOD: GC/MS BNA(EPA SW 846 Method 8270D)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?
Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 35 ?
LEVEL IV ONLY:
Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		2 + 22	Sediment	YY	78 (± 35)	2	Jdet / A Det
				ZZ	74 ↓	↓	↓ ↓
		13 + 23	↓	YY	45 (↓)	13	Jdet / A Det
				ZZ	46 ↓		

Comments:

LDC #: 45378A 2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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

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

Y N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	9041150-lcs/D	GG	( )	( )	35 (30)	all water	J/UJ/P all ND
		DD	( )	( )	33 ( )		
		TTT	( )	( )	43 ( )		
		W	( )	( )	45 ( )		
		S	( )	( )	48 ( )		
		JJ	( )	( )	31 ( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 45378A2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: B
2nd Reviewer: C

METHOD: GCMS PAH (EPA Method 8270D)

Compound	Concentration (ug/Kg)		(≤50)
	10	11	RPD
VV	91.7	64.3	35
CCC	364	217	51
III	425	308	32
GGG	529	321	49
HHH	212	119	56
LLL	359	227	45
DDD	453	233	64
YY	750	455	49
JJJ	387	202	63
UU	404	209	64
ZZ	831	537	43
GG	84.4 U	19.7	NC
DD	84.4 U	19.9	NC
KKK	84.4 U	35.6	NC
NN	84.4 U	33.8	NC
W	169 U	17.1	NC
S	169 U	55.0	NC

LDC#: 45378A2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 2 of 2
Reviewer: 5
2nd Reviewer: 0

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

Compound	Concentration (ug/Kg)		(≤50)
	19	20	RPD
VV	23.9	14.3 U	NC
CCC	81.4	45.9	56
III	126	65.3	63
GGG	175	79.1	75
HHH	67.8	37.7	57
LLL	85.6	47.4	57
DDD	109	50.1	74
KKK	22.7	14.3 U	NC
YY	153	77.8	65
JJJ	101	48.4	70
UU	55.4	37.6	38
ZZ	156	76.1	69

LDC #: 45378A 2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [signature]

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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	2, 3, 4 → 6, 8, 9, 11	GGG, HHH	Peak separation for	J det / Δ all Det
	13, 15, 19		structural isomers is	
			insuffecient for accurate	
			quantification (M-05 qual)	
	6 7, 10, 14, 20, 21	DDD, CCC, GGG	↓	J det / Δ all Det
	12, 16, 17, 18	CCC, GGG, HHH, DDD	↓	J det / Δ all Det

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9D0674

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG05-190417	A9D0674-02	Sediment	04/17/19
T4-PDI2019-SG06-190417	A9D0674-03	Sediment	04/17/19
T4-PDI2019-SG08-190415	A9D0674-04	Sediment	04/15/19
T4-PDI2019-SG11-190415	A9D0674-05	Sediment	04/15/19
T4-PDI2019-SG13-190415	A9D0674-06	Sediment	04/15/19
T4-PDI2019-SG15-190416	A9D0674-07	Sediment	04/16/19
T4-PDI2019-SG16-190416	A9D0674-08	Sediment	04/16/19
T4-PDI2019-SG17-190416	A9D0674-12	Sediment	04/16/19
FD-201904151441	A9D0674-13	Sediment	04/15/19
T4-PDI2019-SG18-190415	A9D0674-14	Sediment	04/15/19
T4-PDI2019-SG51-190417	A9D0674-15	Sediment	04/17/19
T4-PDI2019-SG52-190417	A9D0674-16	Sediment	04/17/19
T4-PDI2019-SG53-190416	A9D0674-17	Sediment	04/16/19
T4-PDI2019-SG54-190416	A9D0674-18	Sediment	04/16/19
T4-PDI2019-SG57-190417	A9D0674-19	Sediment	04/17/19
T4-PDI2019-SG58-190417	A9D0674-20	Sediment	04/17/19
T4-PDI2019-SG59-190417	A9D0674-21	Sediment	04/17/19
FD-201904171301	A9D0674-22	Sediment	04/17/19
T4-PDI2019-SG60-190417	A9D0674-23	Sediment	04/16/19
T4-PDI2019-SG61-190416	A9D0674-24	Sediment	04/16/19
FD-201904171350	A9D0674-25	Sediment	04/17/19
T4-PDI2019-SG05-190417DUP	A9D0674-02DUP	Sediment	04/17/19
T4-PDI209-SG59-190417DUP	A9D0674-21DUP	Sediment	04/17/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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
T4-PDI2019-SG05-190417DUP (T4-PDI2019-SG05-190417 T4-PDI2019-SG06-190417 T4-PDI2019-SG08-190415 T4-PDI2019-SG11-190415 T4-PDI2019-SG13-190415 T4-PDI2019-SG15-190416 T4-PDI2019-SG16-190416 T4-PDI2019-SG17-190416 FD-201904151441 T4-PDI2019-SG18-190415)	Total organic carbon	-	0.047% (≤0.040)	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 FD-201904151441 and T4-PDI2019-SG18-190415 and samples FD-201904171301 and T4-PDI2019-SG60-190417, and samples T4-PDI2019-SG59-190417 and FD-201904171350 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
Total organic carbon	0.59	0.47	23 (≤50)
Total solids	62.4	64.0	3 (≤50)

Analyte	Concentration (%)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
Total organic carbon	2.3	2.3	0 (≤50)
Total solids	37.0	36.7	1 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
Gravel (>2.00 mm)	0.08	0.57	151 (≤50)
4.75 mm	0.01U	0.41	Not calculable
2.00 mm	0.08	0.16	67 (≤50)
Sand (0.063 - 2.00 mm)	82.0	81.2	1 (≤50)
0.85 mm	0.98	0.85	14 (≤50)
0.425 mm	26.2	24.5	7 (≤50)
0.250 mm	42.1	43.6	4 (≤50)
0.150 mm	10.0	9.47	5 (≤50)
0.106 mm	1.36	1.24	9 (≤50)
0.075 mm	0.92	1.04	12 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
0.063 mm	0.46	0.51	10 (≤50)
Silt (0.005 mm < 0.063 mm)	12.3	7.40	50 (≤50)
Clay (<0.005 mm)	5.60	10.8	63 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	T4-PDI2019-SG59-190417	FD-201904171350	
Sand (0.063 - 2.00 mm)	3.97	2.91	31 (≤50)
0.85 mm	0.07	0.03	80 (≤50)
0.425 mm	0.56	0.14	120 (≤50)
0.250 mm	0.67	0.14	131 (≤50)
0.150 mm	0.63	0.23	93 (≤50)
0.106 mm	0.54	0.59	9 (≤50)
0.075 mm	0.89	1.07	18 (≤50)
0.063 mm	0.62	0.71	14 (≤50)
Silt (0.005 mm < 0.063 mm)	65.2	65.7	1 (≤50)
Clay (<0.005 mm)	30.8	31.4	2 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
Sand (0.063 - 2.00 mm)	10.6	10.8	2 (≤50)
0.85 mm	0.21	0.05	123 (≤50)
0.425 mm	1.05	1.00	5 (≤50)
0.250 mm	2.99	2.93	2 (≤50)
0.150 mm	2.32	2.44	5 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
0.106 mm	1.16	1.24	7 (≤50)
0.075 mm	1.70	1.82	7 (≤50)
0.063 mm	1.12	1.30	15 (≤50)
Silt (0.005 mm < 0.063 mm)	58.2	60.5	4 (≤50)
Clay (<0.005 mm)	31.2	28.7	8 (≤50)

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

Due to DUP difference, data were qualified as estimated in ten samples.

No results were rejected in this SDG.

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9D0674

Sample	Analyte	Flag	A or P	Reason
T4-PDI2019-SG05-190417 T4-PDI2019-SG06-190417 T4-PDI2019-SG08-190415 T4-PDI2019-SG11-190415 T4-PDI2019-SG13-190415 T4-PDI2019-SG15-190416 T4-PDI2019-SG16-190416 T4-PDI2019-SG17-190416 FD-201904151441 T4-PDI2019-SG18-190415	Total organic carbon	J (all detects)	A	Duplicate sample analysis (difference)

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9D0674

No Sample Data Qualified in this SDG

LDC #: 45378A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/8/19
SDG #: A9D0674 Stage 2B Page: 1 of 2
Laboratory: Apex Laboratories, LLC Reviewer: ATL
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (ASTM D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	SW	23, 24
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(10,11) (18,22) (19,20)
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	~~RB-201904171558~~	A9D0674-01	Water	04/17/19
2	T4-PDI2019-SG05-190417	A9D0674-02	Sediment	04/17/19
3	T4-PDI2019-SG06-190417	A9D0674-03	Sediment	04/17/19
4	T4-PDI2019-SG08-190415	A9D0674-04	Sediment	04/15/19
5	T4-PDI2019-SG11-190415	A9D0674-05	Sediment	04/15/19
6	T4-PDI2019-SG13-190415	A9D0674-06	Sediment	04/15/19
7	T4-PDI2019-SG15-190416	A9D0674-07	Sediment	04/16/19
8	T4-PDI2019-SG16-190416	A9D0674-08	Sediment	04/16/19
9	T4-PDI2019-SG17-190416	A9D0674-12	Sediment	04/16/19
10	FD-201904151441	A9D0674-13	Sediment	04/15/19
11	T4-P~~DI209~~-SG18-190415 → -PDI2019-	A9D0674-14	Sediment	04/15/19
12	T4-PDI209-SG51-190417	A9D0674-15	Sediment	04/17/19
13	T4-PDI209-SG52-190417	A9D0674-16	Sediment	04/17/19
14	T4-PDI209-SG53-190416	A9D0674-17	Sediment	04/16/19
15	T4-PDI209-SG54-190416	A9D0674-18	Sediment	04/16/19
16	T4-PDI209-SG57-190417	A9D0674-19	Sediment	04/17/19
17	T4-PDI209-SG58-190417	A9D0674-20	Sediment	04/17/19

LDC #: 45378A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/8/19
SDG #: A9D0674 Stage 2B Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer: ATV
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986), Grain Size (D422 Modified)

18	T4-PDI209-SG59-190417	A9D0674-21	Sediment	04/17/19
19	FD-201904171301	A9D0674-22	Sediment	04/17/19
20	T4-PDI2019-SG60-190417	A9D0674-23	Sediment	04/16/19
21	T4-PDI2019-SG61-190416	A9D0674-24	Sediment	04/16/19
22	FD-201904171350	A9D0674-25	Sediment	04/17/19
23	T4-PDI2019-SG05-190417DUP	A9D0674-02DUP	Sediment	04/17/19
24	T4-PDI209-SG59-190417DUP	A9D0674-21DUP	Sediment	04/17/19
25				
26				
27				

Notes:

LDC #: 45378A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: ATL
2nd reviewer:

All circled methods are applicable to each sample.

Sample ID	Parameter
‡	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
22	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 grain size
2-21	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS grain size
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
23, 24	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC #: 45378A6

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, Method See cover

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

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water and ≤ 35% for soil samples (≤ 10% for Method 300.0)? If no, see qualification below. A control limit of ±CRDL (±2X CRDL for soil) was used for samples that were ≤5X the CRDL, including when only one of the duplicate sample values were ≤5X the CRDL. If field blanks were used for laboratory duplicates, see overall assessment.

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Analyte	RPD (Limits)	Difference (Limits)	Associated Samples	Qualifications
	04/23/19	23	Soil	TOC		0.047% (≤ 0.040)	2 to 11	JUJ/A (all detect)

Comments:

LDC#: 45378A6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer:

2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	10	11	
TOC	0.59	0.47	23
Total solids	62.4	64.0	3

Analyte	Concentration (%)		RPD (≤50)
	19	20	
TOC	2.3	2.3	0
Total solids	37.0	36.7	1

LDC#: 45378A6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Grain Size	Concentration (% of Total)		RPD (≤50)
	10	11	
Gravel (>2.00 mm)	0.08	0.57	151
4.75 mm	0.01U	0.41	NC
2.00 mm	0.08	0.16	67
Sand (0.063 - 2.00 mm)	82.0	81.2	1
0.85 mm	0.98	0.85	14
0.425 mm	26.2	24.5	7
0.250 mm	42.1	43.6	4
0.150 mm	10.0	9.47	5
0.106 mm	1.36	1.24	9
0.075 mm	0.92	1.04	12
0.063 mm	0.46	0.51	10
Silt (0.005 mm < 0.063 mm)	12.3	7.40	50
Clay (<0.005 mm)	5.60	10.8	63

LDC#: 45378A6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: CV
2nd Reviewer: [illegible]

Inorganics, Method See Cover

Grain Size	Concentration (% of Total)		RPD (≤50)
	18	22	
Sand (0.063 - 2.00 mm)	3.97	2.91	31
0.85 mm	0.07	0.03	80
0.425 mm	0.56	0.14	120
0.250 mm	0.67	0.14	131
0.150 mm	0.63	0.23	93
0.106 mm	0.54	0.59	9
0.075 mm	0.89	1.07	18
0.063 mm	0.62	0.71	14
Silt (0.005 mm < 0.063 mm)	65.2	65.7	1
Clay (<0.005 mm)	30.8	31.4	2

LDC#: 45378A6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: CL
2nd Reviewer: KM

Inorganics, Method See Cover

Grain Size	Concentration (% of Total)		RPD (≤50)
	19	20	
Sand (0.063 - 2.00 mm)	10.6	10.8	2
0.85 mm	0.21	0.05	123
0.425 mm	1.05	1.00	5
0.250 mm	2.99	2.93	2
0.150 mm	2.32	2.44	5
0.106 mm	1.16	1.24	7
0.075 mm	1.70	1.82	7
0.063 mm	1.12	1.30	15
Silt (0.005 mm < 0.063 mm)	58.2	60.5	4
Clay (<0.005 mm)	31.2	28.7	8

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45378A6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9D0735

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG50-190418	A9D0735-01	Sediment	04/18/19
T4-PDI2019-SG56-190418	A9D0735-02	Sediment	04/18/19
T4-PDI2019-SG62-190418	A9D0735-03	Sediment	04/18/19
T4-PDI2019-SG63-190418	A9D0735-04	Sediment	04/18/19
T4-PDI2019-SG64-190418	A9D0735-05	Sediment	04/18/19
T4-PDI2019-SG50-190418DUP	A9D0735-01DUP	Sediment	04/18/19
T4-PDI2019-SG64-190418MS	A9D0735-05MS	Sediment	04/18/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG50-190418	2-Fluorobiphenyl Terphenyl-d14	29 (45-115) 39 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI2019-SG56-190418	2-Fluorobiphenyl Terphenyl-d14	39 (45-115) 41 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI2019-SG62-190418	2-Fluorobiphenyl Terphenyl-d14	39 (45-115) 47 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI2019-SG63-190418	2-Fluorobiphenyl Terphenyl-d14	28 (45-115) 37 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A
T4-PDI2019-SG64-190418	2-Fluorobiphenyl Terphenyl-d14	31 (45-115) 37 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A

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

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

Duplicate (DUP) sample analysis was performed on an associated project sample. Results 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. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG50-190418 T4-PDI2019-SG64-190418	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SG56-190418	Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A
T4-PDI2019-SG62-190418	Benzo(a)anthracene Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects)	A
T4-PDI2019-SG63-190418	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to surrogate %R and peak separation, data were qualified as estimated in five samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9D0735

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG50-190418 T4-PDI2019-SG56-190418 T4-PDI2019-SG62-190418 T4-PDI2019-SG63-190418 T4-PDI2019-SG64-190418	All compounds	J (all detects) UJ (all non-detects)	A	Surrogates (%R)
T4-PDI2019-SG50-190418 T4-PDI2019-SG64-190418	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG56-190418	Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG62-190418	Benzo(a)anthracene Benzo(b)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG63-190418	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9D0735

No Sample Data Qualified in this SDG

LDC #: 45378B2a **VALIDATION COMPLETENESS WORKSHEET** Date: 7/9/19
SDG #: A9D0735 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	%RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates / DUP	A/A	MS only
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG50-190418	A9D0735-01	Sediment	04/18/19
2	T4-PDI2019-SG56-190418	A9D0735-02	Sediment	04/18/19
3	T4-PDI2019-SG62-190418	A9D0735-03	Sediment	04/18/19
4	T4-PDI2019-SG63-190418	A9D0735-04	Sediment	04/18/19
5	T4-PDI2019-SG64-190418	A9D0735-05	Sediment	04/18/19
6	T4-PDI2019-SG50-190418DUP	A9D0735-01DUP	Sediment	04/18/19
7	T4-PDI2019-SG64-190418MS	A9D0735-05MS	Sediment	04/18/19
8				

Notes:

1	9041393-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378B2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: FT
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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	1	FBP	29 (45-115)	~~J/UJ/A~~ ND + Det
		TPH	39 (54-127)	J/UJ/A
			( )	
	2	↓	39 (↓)	↓
			41 (↓)	↓
			( )	
	3	↓	39 (↓)	↓
		↓	47 (↓)	↓
			( )	
	4	↓	28 (↓)	↓
		↓	37 (↓)	↓
			( )	
	5	↓	31 (↓)	↓
		↓	37 (↓)	↓
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378B2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1, 5	CCC, GGG, DDD	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	2	GGG, DDD		
	3	CCC, GGG		
	4	CCC, GGG, HHH, DDD		

Comments: See sample calculation verification worksheet for recalculations

LDC Report# 45378B6_RV1

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9D0735

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG50-190418	A9D0735-01	Sediment	04/18/19
T4-PDI2019-SG56-190418	A9D0735-02	Sediment	04/18/19
T4-PDI2019-SG62-190418	A9D0735-03	Sediment	04/18/19
T4-PDI2019-SG63-190418	A9D0735-04	Sediment	04/18/19
T4-PDI2019-SG64-190418	A9D0735-05	Sediment	04/18/19
T4-PDI2019-SG50-190418DUP	A9D0735-01DUP	Sediment	04/18/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9D0735

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9D0735

No Sample Data Qualified in this SDG

LDC #: 45378B6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9D0735 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~ ASTM), Grain Size (D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG50-190418	A9D0735-01	Sediment	04/18/19
2	T4-PDI2019-SG56-190418	A9D0735-02	Sediment	04/18/19
3	T4-PDI2019-SG62-190418	A9D0735-03	Sediment	04/18/19
4	T4-PDI2019-SG63-190418	A9D0735-04	Sediment	04/18/19
5	T4-PDI2019-SG64-190418	A9D0735-05	Sediment	04/18/19
6	T4-PDI2019-SG50-190418DUP	A9D0735-01DUP	Sediment	04/18/19
7				
8				
9				
10				
11				

Notes:

LDC #: 45378B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-S	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS Grain Size
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC:6	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0061

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG01-190429	A9E0061-01	Sediment	04/29/19
T4-PDI2019-SG02-190429	A9E0061-02	Sediment	04/29/19
T4-PDI2019-SG04-190429	A9E0061-03	Sediment	04/29/19
T4-PDI2019-SG09-190430	A9E0061-04	Sediment	04/30/19
T4-PDI2019-SG10-190430	A9E0061-05	Sediment	04/30/19
T4-PDI2019-SG14-190430	A9E0061-06	Sediment	04/30/19
T4-PDI2019-SG20-190430	A9E0061-07	Sediment	04/30/19
T4-PDI2019-SG27-190429	A9E0061-08	Sediment	04/29/19
T4-PDI2019-SG28-190429	A9E0061-09	Sediment	04/29/19
T4-PDI2019-SG29-190429	A9E0061-10	Sediment	04/29/19
T4-PDI2019-SG30-190429	A9E0061-11	Sediment	04/29/19
T4-PDI2019-SG31-190501	A9E0061-12	Sediment	05/01/19
T4-PDI2019-SG33-190501	A9E0061-13	Sediment	05/01/19
T4-PDI2019-SG36-190501	A9E0061-14	Sediment	05/01/19
T4-PDI2019-SG37-190430	A9E0061-15	Sediment	04/30/19
T4-PDI2019-SG42-190501	A9E0061-16	Sediment	05/01/19
T4-PDI2019-SG43-190501	A9E0061-17	Sediment	05/01/19
FD-201905011017	A9E0061-18	Sediment	05/01/19
T4-PDI2019-SG44-190501	A9E0061-19	Sediment	05/01/19
T4-PDI2019-SG01-190429DUP	A9E0061-01DUP	Sediment	04/29/19
T4-PDI2019-SG27-190429DUP	A9E0061-08DUP	Sediment	04/29/19
T4-PDI2019-SG28-190429MS	A9E0061-09MS	Sediment	04/29/19
T4-PDI2019-SG28-190429MSD	A9E0061-09MSD	Sediment	04/29/19
T4-PDI2019-SG36-190501MS	A9E0061-14MS	Sediment	05/01/19
T4-PDI2019-SG36-190501MSD	A9E0061-14MSD	Sediment	05/01/19
T4-PDI2019-SG44-190501MS	A9E0061-19MS	Sediment	05/01/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG27-190429	2-Fluorobiphenyl Terphenyl-d14	37 (44-115) 45 (54-127)	All compounds	J (all detects) UJ (all non-detects)	A

Surrogate recoveries (%R) were not within QC limits for samples T4-PDI2019-SG10-190430, T4-PDI2019-SG28-190429, and T4-PDI2019-SG30-190429. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

Surrogate recoveries (%R) were not within QC limits for sample T4-PDI2019-SG29-190429. Using professional judgment, no data were qualified when one surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

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

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

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
T4-PDI2019-SG36-190501MS/MSD (T4-PDI2019-SG36-190501)	Acenaphthene	49 (50-150)	47 (50-150)	J (all detects)	A

Percent recoveries (%R) and relative percent differences (RPD) were not within the QC limits for T4-PDI2019-SG28-190429MS/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 with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
T4-PDI2019-SG36-190501MS/MSD (T4-PDI2019-SG36-190501)	Fluoranthene	37 (≤35)	J (all detects)	A

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
T4-PDI2019-SG01-190429DUP (T4-PDI2019-SG01-190429)	Benzo(b)fluoranthene Fluoranthene Pyrene	38 (≤35) 38 (≤35) 37 (≤35)	J (all detects) J (all detects) J (all detects)	A

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 FD-201905011017 and T4-PDI2019-SG44-190501 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
Benzo(a)anthracene	2.88	2.79	3 (≤50)
Benzo(a)pyrene	4.08	3.91	4 (≤50)
Benzo(b)fluoranthene	5.83	5.50	6 (≤50)
Benzo(g,h,i)perylene	3.92	3.51	11 (≤50)
Chrysene	3.40	3.33	2 (≤50)
Fluoranthene	4.14	4.40	6 (≤50)
Indeno(1,2,3-cd)pyrene	3.76	3.50	7 (≤50)
Phenanthrene	2.51	3.18	24 (≤50)
Pyrene	4.97	5.47	10 (≤50)

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG01-190429 T4-PDI2019-SG10-190430 T4-PDI2019-SG27-190429 T4-PDI2019-SG28-190429 T4-PDI2019-SG29-190429 T4-PDI2019-SG36-190501	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A
T4-PDI2019-SG02-190429 T4-PDI2019-SG04-190429 T4-PDI2019-SG09-190430 T4-PDI2019-SG14-190430 T4-PDI2019-SG20-190430 T4-PDI2019-SG33-190501 T4-PDI2019-SG43-190501	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SG30-190429 T4-PDI2019-SG37-190430	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SG31-190501	Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects)	A
FD-201905011017 T4-PDI2019-SG44-190501	Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to surrogate %R, MS/MSD %R and RPD, and peak separation, data were qualified as estimated in eighteen samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0061

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG27-190429	All compounds	J (all detects) UJ (all non-detects)	A	Surrogates (%R)
T4-PDI2019-SG36-190501	Acenaphthene	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
T4-PDI2019-SG36-190501	Fluoranthene	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
T4-PDI2019-SG01-190429	Benzo(b)fluoranthene Fluoranthene Pyrene	J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG01-190429 T4-PDI2019-SG10-190430 T4-PDI2019-SG27-190429 T4-PDI2019-SG28-190429 T4-PDI2019-SG29-190429 T4-PDI2019-SG36-190501	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG02-190429 T4-PDI2019-SG04-190429 T4-PDI2019-SG09-190430 T4-PDI2019-SG14-190430 T4-PDI2019-SG20-190430 T4-PDI2019-SG33-190501 T4-PDI2019-SG43-190501	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG30-190429 T4-PDI2019-SG37-190430	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG31-190501	Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
FD-201905011017 T4-PDI2019-SG44-190501	Benzo(b)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0061

No Sample Data Qualified in this SDG

LDC #: 45378C2a

SDG #: A9E0061

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/9/19

Page: 1 of 2

Reviewer: [illegible]

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A LA	% RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CW ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates /DUP	SW/SW	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D= 18 + 19
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG01-190429	A9E0061-01	Sediment	04/29/19
2	T4-PDI2019-SG02-190429	A9E0061-02	Sediment	04/29/19
3	T4-PDI2019-SG04-190429	A9E0061-03	Sediment	04/29/19
4	T4-PDI2019-SG09-190430	A9E0061-04	Sediment	04/30/19
5	T4-PDI2019-SG10-190430	A9E0061-05	Sediment	04/30/19
6	T4-PDI2019-SG14-190430	A9E0061-06	Sediment	04/30/19
7	T4-PDI2019-SG20-190430	A9E0061-07	Sediment	04/30/19
8 2	T4-PDI2019-SG27-190429	A9E0061-08	Sediment	04/29/19
9	T4-PDI2019-SG28-190429	A9E0061-09	Sediment	04/29/19
10 2	T4-PDI2019-SG29-190429	A9E0061-10	Sediment	04/29/19
11	T4-PDI2019-SG30-190429	A9E0061-11	Sediment	04/29/19
12	T4-PDI2019-SG31-190501	A9E0061-12	Sediment	05/01/19
13	T4-PDI2019-SG33-190501	A9E0061-13	Sediment	05/01/19

LDC #: 45378C2a **VALIDATION COMPLETENESS WORKSHEET** Date: 7/9/19
SDG #: A9E0061 Stage 2B Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer:
2nd Reviewer:

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

14	T4-PDI2019-SG36-190501	A9E0061-14	Sediment	05/01/19
15	T4-PDI2019-SG37-190430	A9E0061-15	Sediment	04/30/19
16	T4-PDI2019-SG42-190501	A9E0061-16	Sediment	05/01/19
17	T4-PDI2019-SG43-190501	A9E0061-17	Sediment	05/01/19
18	FD-201905011017 D	A9E0061-18	Sediment	05/01/19
19	T4-PDI2019-SG44-190501 D	A9E0061-19	Sediment	05/01/19
20	T4-PDI2019-SG01-190429DUP ✓	A9E0061-01DUP	Sediment	04/29/19
21 2	T4-PDI2019-SG27-190429DUP ✓	A9E0061-08DUP	Sediment	04/29/19
22	T4-PDI2019-SG28-190429MS ✓	A9E0061-09MS	Sediment	04/29/19
23	T4-PDI2019-SG28-190429MSD ✓	A9E0061-09MSD	Sediment	04/29/19
24	T4-PDI2019-SG36-190501MS ✓	A9E0061-14MS	Sediment	05/01/19
25	T4-PDI2019-SG36-190501MSD ✓	A9E0061-14MSD	Sediment	05/01/19
26	T4-PDI2019-SG44-190501MS ✓	A9E0061-19MS	Sediment	05/01/19
27				
28				
29				

Notes:

–	9050459-BLK1						
–	9050599-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378 C2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	5, 9, 11	surrogate outside limit	( )	no qual ≥ 5x DL
			( )	
			( )	
	8	FBP	37 (44-115)	~~no qual~~ J/UJ/A ND+Det
		TPH	45 (54-127)	↓
			( )	
			( )	
	10	FBP	38 (44-115)	no qual
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378C2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: FT
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 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
	22 + 23	several	% R outside limit ( )	( )	( )	9	no qual >5X DL
			( )	( )	( )		
			( )	( )			
	24 + 25	GG	49 (50-150)	47 (50-150)	( )	14	J/UJ/A Det
		YY	( )	( )	37 (35)	↓	J det/A Det
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 45378C2a

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Page: 1 of 1
Reviewer: F2
2nd Reviewer: G

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 duplicate sample analyzed for each matrix in this SDG?
Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 35 ?
LEVEL IV ONLY:
Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		1 + 2U	~~GGG~~ sediment	GGG	38 (≤ 35)	#1	Idw/A
				YY	38 ↓	↓	↓
				ZZ	37 ↓	↓	↓

Comments:

LDC#: 45378 C2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: EJ
2nd Reviewer: G

METHOD: GCMS PAH (EPA Method 8270D)

Compound	Concentration (ug/Kg)		(≤50)
	18	19	RPD
CCC	2.88	2.79	3
III	4.08	3.91	4
GGG	5.83	5.50	6
LLL	3.92	3.51	11
DDD	3.40	3.33	2
YY	4.14	4.40	6
JJJ	3.76	3.50	7
UU	2.51	3.18	24
ZZ	4.97	5.47	10

LDC #: 45378C2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1, 5, 8, 9, 10, 14	GGG, HHH	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	2, 3, 4, 6, 7, 13, 17	CCC, GGG, DDD		
	11, 15	CCC, GGG, HHH, DDD		
	12	GGG, DDD		
	18, 19	GGG		

Comments: See sample calculation verification worksheet for recalculations

COMQUA.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0061

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG01-190429	A9E0061-01	Sediment	04/29/19
T4-PDI2019-SG02-190429	A9E0061-02	Sediment	04/29/19
T4-PDI2019-SG04-190429	A9E0061-03	Sediment	04/29/19
T4-PDI2019-SG09-190430	A9E0061-04	Sediment	04/30/19
T4-PDI2019-SG10-190430	A9E0061-05	Sediment	04/30/19
T4-PDI2019-SG14-190430	A9E0061-06	Sediment	04/30/19
T4-PDI2019-SG20-190430	A9E0061-07	Sediment	04/30/19
T4-PDI2019-SG27-190429	A9E0061-08	Sediment	04/29/19
T4-PDI2019-SG28-190429	A9E0061-09	Sediment	04/29/19
T4-PDI2019-SG29-190429	A9E0061-10	Sediment	04/29/19
T4-PDI2019-SG30-190429	A9E0061-11	Sediment	04/29/19
T4-PDI2019-SG31-190501	A9E0061-12	Sediment	05/01/19
T4-PDI2019-SG33-190501	A9E0061-13	Sediment	05/01/19
T4-PDI2019-SG36-190501	A9E0061-14	Sediment	05/01/19
T4-PDI2019-SG37-190430	A9E0061-15	Sediment	04/30/19
T4-PDI2019-SG42-190501	A9E0061-16	Sediment	05/01/19
T4-PDI2019-SG43-190501	A9E0061-17	Sediment	05/01/19
FD-201905011017	A9E0061-18	Sediment	05/01/19
T4-PDI2019-SG44-190501	A9E0061-19	Sediment	05/01/19
T4-PDI2019-SG28-190429-Dup	A9E0061-20	Sediment	04/29/19
T4-PDI2019-SG36-190501-Dup	A9E0061-21	Sediment	05/01/19
T4-PDI2019-SG28-190429DUP	A9E0061-09DUP	Sediment	04/29/19
T4-PDI2019-SG36-190501DUP	A9E0061-14DUP	Sediment	05/01/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 FD-201905011017 and T4-PDI2019-SG44-190501, samples T4-PDI2019-SG28-190429 and T4-PDI2019-SG28-190429-Dup, and samples T4-PDI2019-SG36-190501 and T4-PDI2019-SG36-190501-Dup were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
Total organic carbon	0.11	0.079	33 (≤50)
Total solids	73.9	76.4	3 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
Gravel (>2.00 mm)	2.82	1.51	61 (≤50)
4.75 mm	2.20	0.59	115 (≤50)
2.00 mm	0.62	0.92	39 (≤50)
Sand (0.063-2300 mm)	91.8	94.0	2 (≤50)
0.85 mm	2.01	1.85	8 (≤50)
0.425 mm	21.8	24.0	10 (≤50)
0.250 mm	48.2	50.1	4 (≤50)
0.150 mm	16.2	15.1	7 (≤50)
0.106 mm	2.28	1.96	15 (≤50)
0.075 mm	0.99	0.78	24 (≤50)
0.063 mm	0.32	0.25	25 (≤50)
Silt (0.005 mm < 0.063 mm)	3.40	2.50	31 (≤50)
Clay (<0.005 mm)	1.90	2.00	5 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	T4-PDI2019-SG28-190429	T4-PDI2019-SG28-190429-Dup	
Gravel (< 2.00 mm)	0.02	0.01U	Not calculable
2.00 mm	0.02	0.01U	Not calculable
Sand (0.063-2.00 mm)	22.7	22.3	2 (≤50)
0.85 mm	0.03	0.04	29 (≤50)
0.425 mm	0.45	0.48	6 (≤50)
0.250 mm	2.64	2.48	6 (≤50)
0.150 mm	4.87	4.52	7 (≤50)
0.106 mm	4.33	3.98	8 (≤50)
0.075 mm	6.33	6.74	6 (≤50)
0.063 mm	4.07	4.02	1 (≤50)
Silt (0.005 mm < 0.063 mm)	59.3	60.4	2 (≤50)
Clay (<0.005 mm)	17.9	17.3	3 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	T4-PDI2019-SG36-190501	T4-PDI2019-SG36-190501-Dup	
Gravel (>2.00 mm)	2.15	1.84	16 (≤50)
4.75 mm	0.90	0.59	42 (≤50)
2.00 mm	1.25	1.25	0 (≤50)
Sand (0.063-2.00 mm)	89.1	89.6	1 (≤50)
0.85 mm	1.98	1.83	8 (≤50)
0.425 mm	19.6	19.6	0 (≤50)
0.250 mm	46.7	48.4	4 (≤50)
0.150 mm	16.3	15.1	8 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	T4-PDI2019-SG36-190501	T4-PDI2019-SG36-190501-Dup	
0.106 mm	2.68	2.57	4 (≤50)
0.075 mm	1.40	1.64	16 (≤50)
0.063 mm	0.49	0.52	6 (≤50)
Silt (0.005 mm < 0.063 mm)	6.50	4.70	32 (≤50)
Clay (<0.005 mm)	2.30	3.90	52 (≤50)

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0061

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0061

No Sample Data Qualified in this SDG

LDC #: 45378C6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0061 Stage 2B Page: 1 of 2
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (ASTM D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(18,19) (9,20) (14,21)
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG01-190429	A9E0061-01	Sediment	04/29/19
2	T4-PDI2019-SG02-190429	A9E0061-02	Sediment	04/29/19
3	T4-PDI2019-SG04-190429	A9E0061-03	Sediment	04/29/19
4	T4-PDI2019-SG09-190430	A9E0061-04	Sediment	04/30/19
5	T4-PDI2019-SG10-190430	A9E0061-05	Sediment	04/30/19
6	T4-PDI2019-SG14-190430	A9E0061-06	Sediment	04/30/19
7	T4-PDI2019-SG20-190430	A9E0061-07	Sediment	04/30/19
8	T4-PDI2019-SG27-190429	A9E0061-08	Sediment	04/29/19
9	T4-PDI2019-SG28-190429	A9E0061-09	Sediment	04/29/19
10	T4-PDI2019-SG29-190429	A9E0061-10	Sediment	04/29/19
11	T4-PDI2019-SG30-190429	A9E0061-11	Sediment	04/29/19
12	T4-PDI2019-SG31-190501	A9E0061-12	Sediment	05/01/19
13	T4-PDI2019-SG33-190501	A9E0061-13	Sediment	05/01/19
14	T4-PDI2019-SG36-190501	A9E0061-14	Sediment	05/01/19
15	T4-PDI2019-SG37-190430	A9E0061-15	Sediment	04/30/19
16	T4-PDI2019-SG42-190501	A9E0061-16	Sediment	05/01/19
17	T4-PDI2019-SG43-190501	A9E0061-17	Sediment	05/01/19

LDC #: 45378C6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0061 Stage 2B Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986), Grain Size (D422 Modified)

18	FD-201905011017	A9E0061-18	Sediment	05/01/19
19	T4-PDI2019-SG44-190501	A9E0061-19	Sediment	05/01/19
20	T4-PDI2019-SG28-190429-Dup	A9E0061-20	Sediment	04/29/19
21	T4-PDI2019-SG36-190501-Dup	A9E0061-21	Sediment	05/01/19
22	T4-PDI2019-SG28-190429DUP	A9E0061-09DUP	Sediment	04/29/19
23	T4-PDI2019-SG36-190501DUP	A9E0061-14DUP	Sediment	05/01/19
24				
25				
26				

Notes:

LDC #: US378C6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-19	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS Grain Size
20,21	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 Grain Size
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC-22	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
23	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45378C6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	18	19	
TOC	0.11	0.079	33
Total solids	73.9	76.4	3

Grain Size	Concentration (% of Total)		RPD (≤50)
	18	19	
Gravel (>2.00 mm)	2.82	1.51	61
4.75 mm	2.20	0.59	~~NC~~ 115
2.00 mm	0.62	0.92	39
Sand (0.063 - 2.00 mm)	91.8	94.0	2
0.85 mm	2.01	1.85	8
0.425 mm	21.8	24.0	10
0.250 mm	48.2	50.1	4
0.150 mm	16.2	15.1	7
0.106 mm	2.28	1.96	15
0.075 mm	0.99	0.78	24
0.063 mm	0.32	0.25	25
Silt (0.005 mm < 0.063 mm)	3.40	2.50	31
Clay (<0.005 mm)	1.90	2.00	5

LDC#: 45378C6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Grain Size	Concentration (% of Total)		RPD (≤50)
	9	20	
Gravel (>2.00 mm)	0.02	0.01U	NC
2.00 mm	0.02	0.01U	NC
Sand (0.063 - 2.00 mm)	22.7	22.3	2
0.85 mm	0.03	0.04	29
0.425 mm	0.45	0.48	6
0.250 mm	2.64	2.48	6
0.150 mm	4.87	4.52	7
0.106 mm	4.33	3.98	8
0.075 mm	6.33	6.74	6
0.063 mm	4.07	4.02	1
Silt (0.005 mm < 0.063 mm)	59.3	60.4	2
Clay (<0.005 mm)	17.9	17.3	3

LDC#: 45378C6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

Inorganics, Method See Cover

Grain Size	Concentration (% of Total)		RPD (≤50)
	14	21	
Gravel (>2.00 mm)	2.15	1.84	16
4.75 mm	0.90	0.59	42
2.00 mm	1.25	1.25	0
Sand (0.063 - 2.00 mm)	89.1	89.6	1
0.85 mm	1.98	1.83	8
0.425 mm	19.6	19.6	0
0.250 mm	46.7	48.4	4
0.150 mm	16.3	15.1	8
0.106 mm	2.68	2.57	4
0.075 mm	1.40	1.64	16
0.063 mm	0.49	0.52	6
Silt (0.005 mm < 0.063 mm)	6.50	4.70	32
Clay (<0.005 mm)	2.30	3.90	52

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45378C6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0168

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG32-190502	A9E0168-01	Sediment	05/02/19
T4-PDI2019-SG34-190502	A9E0168-02	Sediment	05/02/19
T4-PDI2019-SG35-190503	A9E0168-03	Sediment	05/03/19
T4-PDI2019-SG45-190503	A9E0168-07	Sediment	05/03/19
T4-PDI2019-SG47-190503	A9E0168-09	Sediment	05/03/19
T4-PDI2019-SG48-190503	A9E0168-10	Sediment	05/03/19
T4-PDI2019-SG49-190503	A9E0168-11	Sediment	05/03/19
T4-PDI2019-SG55-190503	A9E0168-12	Sediment	05/03/19
T4-PDI2019-SG46-190503	A9E0168-13	Sediment	05/03/19
T4-PDI2019-SG66-190502	A9E0168-14	Sediment	05/02/19
T4-PDI2019-SG67-190502	A9E0168-15	Sediment	05/02/19
T4-PDI2019-SG68-190502	A9E0168-19	Sediment	05/02/19
T4-PDI2019-SG49-190503MS	A9E0168-11MS	Sediment	05/03/19
T4-PDI2019-SG49-190503DUP	A9E0168-11DUP	Sediment	05/03/19
T4-PDI2019-SG68-190502MS	A9E0168-19MS	Sediment	05/02/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for samples T4-PDI2019-SG47-190503 and T4-PDI2019-SG49-190503. Using professional judgment, no data were qualified when one surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

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

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

Duplicate (DUP) sample analysis was performed on an associated project sample. Results 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. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG32-190502 T4-PDI2019-SG34-190502	Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects)	A
T4-PDI2019-SG35-190503 T4-PDI2019-SG47-190503 T4-PDI2019-SG49-190503 T4-PDI2019-SG55-190503 T4-PDI2019-SG67-190502 T4-PDI2019-SG68-190502	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SG45-190503 T4-PDI2019-SG48-190503	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects)	A
T4-PDI2019-SG66-190502	Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects)	A

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG46-190503	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to peak separation, data were qualified as estimated in twelve samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0168

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG32-190502 T4-PDI2019-SG34-190502	Benzo(b)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG35-190503 T4-PDI2019-SG47-190503 T4-PDI2019-SG49-190503 T4-PDI2019-SG55-190503 T4-PDI2019-SG67-190502 T4-PDI2019-SG68-190502	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG45-190503 T4-PDI2019-SG48-190503	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG66-190502	Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG46-190503	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0168

No Sample Data Qualified in this SDG

LDC #: 45378D2a

SDG #: A9E0168

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 2

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates /DUP	A / A	A9E0168-19RE1 MS MS only
IX.	Laboratory control samples	A	A9E0061-08RE3 DUP (lcs)
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG32-190502	A9E0168-01	Sediment	05/02/19
2	T4-PDI2019-SG34-190502	A9E0168-02	Sediment	05/02/19
3	T4-PDI2019-SG35-190503	A9E0168-03	Sediment	05/03/19
4	T4-PDI2019-SG45-190503	A9E0168-07	Sediment	05/03/19
5	T4-PDI2019-SG47-190503	A9E0168-09	Sediment	05/03/19
6	T4-PDI2019-SG48-190503	A9E0168-10	Sediment	05/03/19
7	T4-PDI2019-SG49-190503	A9E0168-11	Sediment	05/03/19
8	T4-PDI2019-SG55-190503	A9E0168-12	Sediment	05/03/19
9	T4-PDI2019-SG46-190503	A9E0168-13	Sediment	05/03/19
10	T4-PDI2019-SG66-190502	A9E0168-14	Sediment	05/02/19
11	T4-PDI2019-SG67-190502	A9E0168-15	Sediment	05/02/19
12	T4-PDI2019-SG68-190502	A9E0168-19	Sediment	05/02/19
13	T4-PDI2019-SG49-190503MS	A9E0168-11MS	Sediment	05/03/19

LDC #: 45378D2a **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0168 Stage 2B Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer:
2nd Reviewer:

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

14	T4-PDI2019-SG49-190503DUP	A9E0168-11DUP	Sediment	05/03/19
15	T4-PDI2019-SG68-190502MS	A9E0168-19MS	Sediment	05/02/19
16				
17				
18				

Notes:

1	9050599 - BK1						
1	9050743 - BK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378D2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: FT
2nd Reviewer: C

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	5	FBP	38 (44-115)	no qual
			( )	
	7	↓	43 (↓)	↓
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378D2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: FT
2nd 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 Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1, 2	GGG	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	3, 5, 7, 8, 11, 12	CCC, GGG, DDD		
	4, 6	GGG, HHH		
	10	GGG, DDD		
	9	CCC, GGG, HHH, DDD		

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0168

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG32-190502	A9E0168-01	Sediment	05/02/19
T4-PDI2019-SG34-190502	A9E0168-02	Sediment	05/02/19
T4-PDI2019-SG35-190503	A9E0168-03	Sediment	05/03/19
T4-PDI2019-SG45-190503	A9E0168-07	Sediment	05/03/19
T4-PDI2019-SG47-190503	A9E0168-09	Sediment	05/03/19
T4-PDI2019-SG48-190503	A9E0168-10	Sediment	05/03/19
T4-PDI2019-SG49-190503	A9E0168-11	Sediment	05/03/19
T4-PDI2019-SG55-190503	A9E0168-12	Sediment	05/03/19
T4-PDI2019-SG46-190503	A9E0168-13	Sediment	05/03/19
T4-PDI2019-SG66-190502	A9E0168-14	Sediment	05/02/19
T4-PDI2019-SG67-190502	A9E0168-15	Sediment	05/02/19
T4-PDI2019-SG68-190502	A9E0168-19	Sediment	05/02/19
T4-PDI2019-SG32-190502DUP	A9E0168-01DUP	Sediment	05/02/19
T4-PDI2019-SG49-190503DUP	A9E0168-11DUP	Sediment	05/03/19
T4-PDI2019-SG66-190502DUP	A9E0168-14DUP	Sediment	05/02/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0168

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0168

No Sample Data Qualified in this SDG

LDC #: 45378D6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0168 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG32-190502	A9E0168-01	Sediment	05/02/19
2	T4-PDI2019-SG34-190502	A9E0168-02	Sediment	05/02/19
3	T4-PDI2019-SG35-190503	A9E0168-03	Sediment	05/03/19
4	T4-PDI2019-SG45-190503	A9E0168-07	Sediment	05/03/19
5	T4-PDI2019-SG47-190503	A9E0168-09	Sediment	05/03/19
6	T4-PDI2019-SG48-190503	A9E0168-10	Sediment	05/03/19
7	T4-PDI2019-SG49-190503	A9E0168-11	Sediment	05/03/19
8	T4-PDI2019-SG55-190503	A9E0168-12	Sediment	05/03/19
9	T4-PDI2019-SG46-190503	A9E0168-13	Sediment	05/03/19
10	T4-PDI2019-SG66-190502	A9E0168-14	Sediment	05/02/19
11	T4-PDI2019-SG67-190502	A9E0168-15	Sediment	05/02/19
12	T4-PDI2019-SG68-190502	A9E0168-19	Sediment	05/02/19
13	T4-PDI2019-SG32-190502DUP	A9E0168-01DUP	Sediment	05/02/19
14	T4-PDI2019-SG49-190503DUP	A9E0168-11DUP	Sediment	05/03/19
15	T4-PDI2019-SG66-190502DUP	A9E0168-14DUP	Sediment	05/02/19
16				
17				

LDC #: 45378B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-12	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS Grain Size
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC 13	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
14	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
15	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0744

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC03-190521- 01-03**	A9E0744-01**	Sediment	05/21/19
T4-PDI2019-SC03-190521- 03-05**	A9E0744-02**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 01-03**	A9E0744-06**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 03-05**	A9E0744-07**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 05-07**	A9E0744-08**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 07-8.3**	A9E0744-09**	Sediment	05/21/19
FD-201905211556	A9E0744-10	Sediment	05/21/19
T4-PDI2019-SC13-190521-01-03**	A9E0744-11**	Sediment	05/21/19
T4-PDI2019-SC13-190521-03-05**	A9E0744-12**	Sediment	05/21/19
T4-PDI2019-SC13-190521-05-07**	A9E0744-13**	Sediment	05/21/19
T4-PDI2019-SC13-190521-07-09**	A9E0744-14**	Sediment	05/21/19
T4-PDI2019-SC13-190521-09-11.1	A9E0744-15	Sediment	05/21/19
FD-201905211730	A9E0744-16	Sediment	05/21/19
T4-PDI2019-SC19-190521-01-03	A9E0744-17	Sediment	05/21/19
T4-PDI2019-SC19-190521-03-05	A9E0744-18	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07	A9E0744-19	Sediment	05/21/19
T4-PDI2019-SC19-190521-07-09	A9E0744-20	Sediment	05/21/19
T4-PDI2019-SC19-190521-09-11	A9E0744-21	Sediment	05/21/19
T4-PDI2019-SC19-190521-11-11.8	A9E0744-22	Sediment	05/21/19
T4-PDI2019-SC03-190521- 01-03DUP	A9E0744-01DUP	Sediment	05/21/19
T4-PDI2019-SC13-190521-01-03MS	A9E0744-11MS	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07MS	A9E0744-19MS	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07MSD	A9E0744-19MSD	Sediment	05/21/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

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

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 T4-PDI2019-SC13-190521-01-03MS. No data were qualified for MS/MSD samples analyzed greater than or equal to a 5X dilution were within QC limits. Relative percent differences (RPD) were within QC limits.

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
T4-PDI2019-SC03-190521- 01-03DUP (T4-PDI2019-SC03-190521- 01-03**)	Fluoranthene Phenanthrene Pyrene	80 (≤35) 78 (≤35) 81 (≤35)	J (all detects) J (all detects) J (all detects)	A

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 FD-201905211556 and T4-PDI2019-SC13-190521-07-09** and samples FD-201905211730 and T4-PDI2019-SC19-190521-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905211730	T4-PDI2019-SC19-190521-01-03	
Acenaphthene	169	19.1	159 (≤50)
Anthracene	160	32.7	132 (≤50)
Benzo(a)anthracene	1000	170	142 (≤50)
Benzo(a)pyrene	1300	249	136 (≤50)
Benzo(b)fluoranthene	1610	298	138 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905211730	T4-PDI2019-SC19-190521-01-03	
Benzo(k)fluoranthene	706	99.3	151 (≤50)
Benzo(g,h,i)perylene	899	167	137 (≤50)
Chrysene	1200	194	144 (≤50)
Dibenzo(a,h)anthracene	189	29.2	146 (≤50)
Fluoranthene	1630	313	136 (≤50)
Indeno(1,2,3-cd)pyrene	1010	167	143 (≤50)
Phenanthrene	850	147	141 (≤50)
Pyrene	1690	333	134 (≤50)
Fluorene	77.0U	13.1	Not calculable
Naphthalene	155U	18.6	Not calculable

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SC03-190521- 01-03**	Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects)	A
T4-PDI2019-SC03-190521- 03-05** T4-PDI2019-SC12-190521- 01-03** T4-PDI2019-SC12-190521- 03-05** T4-PDI2019-SC12-190521- 05-07** T4-PDI2019-SC13-190521-01-03** T4-PDI2019-SC13-190521-03-05** T4-PDI2019-SC19-190521-01-03	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A
FD-201905211730	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects) J (all detects)	A

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SC19-190521-09-11	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and peak separation, data were qualified as estimated in ten samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0744

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC03-190521- 01-03**	Fluoranthene Phenanthrene Pyrene	J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SC03-190521- 01-03**	Benzo(b)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC03-190521- 03-05** T4-PDI2019-SC12-190521- 01-03** T4-PDI2019-SC12-190521- 03-05** T4-PDI2019-SC12-190521- 05-07** T4-PDI2019-SC13-190521-01-03** T4-PDI2019-SC13-190521-03-05** T4-PDI2019-SC19-190521-01-03	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
FD-201905211730	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC19-190521-09-11	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0744

No Sample Data Qualified in this SDG

LDC #: 45378E2a

SDG #: A9E0744

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 7/10/19

Page: 1 of 2

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	% RPD ≤ 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 MMP	SW/SW	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	*D = 7, 11 D = 13, 14
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation
XIII.	Target compound identification	A	Not reviewed for Level III validation
XIV.	System performance	A	Not reviewed for Level III validation
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:

**Indicates samples underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC03-190521- 01-03**	A9E0744-01**	Sediment	05/21/19
2	T4-PDI2019-SC03-190521- 03-05**	A9E0744-02**	Sediment	05/21/19
3	T4-PDI2019-SC12-190521- 01-03**	A9E0744-06**	Sediment	05/21/19
4	T4-PDI2019-SC12-190521- 03-05**	A9E0744-07**	Sediment	05/21/19
5	T4-PDI2019-SC12-190521- 05-07**	A9E0744-08**	Sediment	05/21/19
6	T4-PDI2019-SC12-190521- 07-8.3**	A9E0744-09**	Sediment	05/21/19
7	FD-201905211556 D	A9E0744-10	Sediment	05/21/19
8	T4-PDI2019-SC13-190521-01-03**	A9E0744-11**	Sediment	05/21/19
9	T4-PDI2019-SC13-190521-03-05**	A9E0744-12**	Sediment	05/21/19
10	T4-PDI2019-SC13-190521-05-07**	A9E0744-13**	Sediment	05/21/19
11	T4-PDI2019-SC13-190521-07-09** D	A9E0744-14**	Sediment	05/21/19
12	T4-PDI2019-SC13-190521-09-11.1	A9E0744-15	Sediment	05/21/19
13	FD-201905211730 D	A9E0744-16	Sediment	05/21/19

LDC #: 45378E2a **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0744 Stage 2B/4 Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

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

14	T4-PDI2019-SC19-190521-01-03 D1	A9E0744-17	Sediment	05/21/19
15	T4-PDI2019-SC19-190521-03-05	A9E0744-18	Sediment	05/21/19
16	T4-PDI2019-SC19-190521-05-07	A9E0744-19	Sediment	05/21/19
17	T4-PDI2019-SC19-190521-07-09	A9E0744-20	Sediment	05/21/19
18	T4-PDI2019-SC19-190521-09-11	A9E0744-21	Sediment	05/21/19
19	T4-PDI2019-SC19-190521-11-11.8	A9E0744-22	Sediment	05/21/19
20	T4-PDI2019-SC03-190521- 01-03DUP	A9E0744-01DUP	Sediment	05/21/19
21	T4-PDI2019-SC13-190521-01-03MS	A9E0744-11MS	Sediment	05/21/19
22	T4-PDI2019-SC19-190521-05-07MS	A9E0744-19MS	Sediment	05/21/19
23	T4-PDI2019-SC19-190521-05-07MSD	A9E0744-19MSD	Sediment	05/21/19
24				
25				
26				

Notes:

	9051333						

LDC #: 45378Eda

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [illegible]

Method: Semivolatiles (EPA SW 846 Method 8270D)

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

LDC #: 45378E2a

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378E2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: FT
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 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
	21	%R outside limit	( )	( )	( )	8	no qual 2 5xDL
			( )	( )	( )		
			( )	( )			
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 45378E2a

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

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

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

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?
Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ ≤35?

LEVEL IV ONLY:
Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		1 & 20	sediment	YY	80 (≤35)	1	Jdet /A
				UU	78	↓	↓
				ZZ	81	↓	↓

Comments:

LDC#: 45378E2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: E2
2nd Reviewer: [illegible]

METHOD: GCMS PAH (EPA Method 8270D)

Compound	Concentration (ug/Kg)		(≤50)
	13	14	RPD
GG	169	19.1	159
VV	160	32.7	132
CCC	1000	170	142
III	1300	249	136
GGG	1610	298	138
HHH	706	99.3	151
LLL	899	167	137
DDD	1200	194	144
KKK	189	29.2	146
YY	1630	313	136
JJJ	1010	167	143
UU	850	147	141
ZZ	1690	333	134
NN	77.0U	13.1	NC
S	155U	18.6	NC

LDC #: 45378E2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1	GGG	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	2, 3, 4, 5, 8, 9, 14	GGG, HHH		
	13	CCC, GGG, HHH, DDD		
	18	CCC, GGG, DDD		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 45378E2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: a

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

RRF = (Ax)(Cis)/(Ais)(Cx)
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

Where:
Ax = Area of compound
Cx = Concentration of compound
S = Standard deviation of the RRFs
X = Mean of the RRFs
Ais = Area of associated internal standard
Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 500ng/ml std)	Recalculated (RRF 500ng/ml std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL GCMS 10 A9D1505	4/12/2019	S	1.147102	1.147102	1.035252	1.035252	10.717520	10.717520
			GG	1.407188	1.407188	1.286670	1.286670	10.971540	10.971540
			UU	1.177029	1.177029	1.085248	1.085248	12.232740	12.232740
			DDD	1.096461	1.096461	1.058934	1.058934	2.949131	2.949131
			LLL	1.174822	1.174822	1.081412	1.081412	8.424744	8.424744

LDC #: 45378E2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: FT
2nd Reviewer: a

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

RRF = (Ax)(Cis)/(Ais)(Cx)
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

Where:
Ax = Area of compound
Cx = Concentration of compound
S = Standard deviation of the RRFs
X = Mean of the RRFs
Ais = Area of associated internal standard
Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 500ng/ml std)	Recalculated (RRF 500ng/ml std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL GCMS 5 A9A3103	1/30/2019	S	1.100540	1.100540	1.066921	1.066921	5.537751	5.537751
			GG	1.381346	1.381346	1.320947	1.320947	5.949628	5.949628
			UU	1.161203	1.161203	1.097729	1.097729	11.424400	11.424400
			DDD	1.107315	1.107315	1.074697	1.074697	1.516659	1.516659
			III	1.016943	1.016943	0.959388	0.959388	12.802630	12.802630

LDC #: 45378 Eda

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: FT
2nd Reviewer: a

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
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 (Internal Standard)		Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	CCV GCMS5 1308	5/31/19	S	(1st IS)	1.066921	1.070284	1.070284	0.3	0.3
			GG	(2nd IS)	1.320947	1.349099	1.349099	2.1	2.1
			UU	(3rd IS)	1.097729	1.13924	1.13924	3.8	3.8
			DDD	(4th IS)	1.074697	1.11168	1.11168	3.4	3.4
			III	(5th IS)	0.9593879	1.107319	1.107319	15.4	15.4
				(6th IS)					
2	CCV GCMS10 1027	5/29/19	S	(1st IS)	1.035252	1.079938	1.079938	4.3	4.3
			GG	(2nd IS)	1.28667	1.316117	1.316117	2.3	2.3
			UU	(3rd IS)	1.085248	1.114187	1.114187	2.7	2.7
			DDD	(4th IS)	1.058934	1.131419	1.131419	6.8	6.8
			~~III~~ LLL	(5th IS)	~~0.9699381~~	1.133153	1.133153	4.8	4.8
				(6th IS)	1.081412				
3				(1st IS)					
				(2nd IS)					
				(3rd IS)					
				(4th IS)					
				(5th IS)					
				(6th IS)					

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 #: 45378Eda

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: FT
2nd reviewer: [illegible]

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1 40X

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	2500	42.11	67	67	0
2-Fluorobiphenyl	↓	31.83	51	51	↓
Terphenyl-d14		47.60	76	76	
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 #: 45378 Ed2

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: FT
2nd Reviewer: [illegible]

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: 22 + 23

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene	757	751	~~568~~ ND	568	597	75	75	79	79	5	5
Pentachlorophenol											
Pyrene	↓	751	ND	642	669	85	85	89	89	4	4

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 #: 45378 Edr

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: [illegible]

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

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

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: 9051333-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										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene	533	NA	434	NA	81	81				
Pentachlorophenol										
Pyrene	533	NA	505	NA	95	95	NA			

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 #: 45378E2a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: FT
2nd reviewer:

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

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

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

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, S:

Conc. = $\frac{(62023)(2000.0)(\cancel{12}\ 2)(40)}{(675973)(1.035252)(15.04)(0.6889)}$

= 1368.65 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	#1	S	1370	1368.65	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Chlorinated Pesticides

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0744

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC03-190521- 01-03**	A9E0744-01**	Sediment	05/21/19
T4-PDI2019-SC03-190521- 03-05	A9E0744-02	Sediment	05/21/19
T4-PDI2019-SC03-190521- 01-03DUP	A9E0744-01DUP	Sediment	05/21/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition 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% for all compounds.

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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/Duplicate Sample Analysis

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

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

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Stage 4 validation.

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

Sample	Compound	RPD	Flag	A or P
T4-PDI2019-SC03-190521- 01-03**	2,4'-DDD	45	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to RPDs between two columns, data were qualified as estimated in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Chlorinated Pesticides - Data Qualification Summary - SDG A9E0744

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC03-190521- 01-03**	2,4'-DDD	J (all detects)	A	Compound quantitation (RPD between two columns)

Port of Portland, T4
Chlorinated Pesticides - Laboratory Blank Data Qualification Summary - SDG A9E0744

No Sample Data Qualified in this SDG

LDC #: 45378E3a

SDG #: A9E0744

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 7/10/19

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: GC Chlorinated Pesticides (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	~~A~~ A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	~~A~~ A	% RSD / 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 /DUP	~~A~~ A	A9E0849-02 RE3 MS MS only
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	SW	Not reviewed for Level III validation
XII.	Target compound identification	A	Not reviewed for Level III validation
XIII.	System Performance	A	Not reviewed for Level III 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:

**Indicates samples underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC03-190521- 01-03**	A9E0744-01**	Sediment	05/21/19
2	T4-PDI2019-SC03-190521- 03-05	A9E0744-02	Sediment	05/21/19
3	T4-PDI2019-SC03-190521- 01-03DUP	A9E0744-01DUP	Sediment	05/21/19
4	~~T4-PDI2019-SC03-190521- 03-05MS~~	~~A9E0744-02MS~~	~~Sediment~~	~~05/21/19~~
5				
6				
7				
8				
9				
10				

Notes:

-	9060523						

LDC #:_____

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [illegible]

Method: Pesticides (EPA SW 846 Method 8081)

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 #:_____

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [illegible]

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 in this SDG?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
IX. Laboratory control samples				
Was an LCS analyzed per extraction batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?				
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?				
Were relative percent difference (RPD) of the results between two columns ≤ 40%?				
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?				
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.				

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #:_____

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

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

METHOD: __ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	% RPD Bet 2 col ≤40 Findings	Qualifications
	1	cc	45%	Idet A

Comments: See sample calculation verification worksheet for recalculations

COMQUA_r1.wpd

LDC #: 45378E3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GC X HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below 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 10 ng/ml	Recalculated 10 ng/ml	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	5/13/2019	Gamma BHC Col1	180488.9	180488.9	189744.0	189744.0	5.266619	5.266619
	A9E1407		4,4-DDD	132537.4	132537.4	142303.1	142303.1	5.354852	5.354852
			Gamma BHC Col2	318154.8	318154.8	346720.0	346720.0	8.823249	8.823249
			4,4-DDD	210005.9	210005.9	236251.4	236251.4	9.065080	9.065080

LDC #: 45378E3a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

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

METHOD: GC Pesticides (EPA SW 846 Method 8081)

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
ccv	6/4/19	gamma BHC col1	50.0	50.4	50.418	0.8	0.8
1121		4'4-DDD ↓	↓	49.8	49.776	0.4	0.4
		↓ col2		51.2	51.228	2.5	2.5
				50.1	50.103	0.2	0.2

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 #: 45378E3a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 6 of 1
Reviewer: FT
2nd reviewer: ✓

METHOD: GC Pesticides (EPA SW 846 Method 8081)

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: #2

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene	col 2	50	33.635	67	67	0
Tetrachloro-m-xylene						
Decachlorobiphenyl	col 2	50	45.665	91	91	0
Decachlorobiphenyl						

Sample ID:

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

Sample ID:

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

Sample ID:

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

Notes:

LDC #: 45378E3a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

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

METHOD: GC Pesticides (EPA SW 846 Method 8081A)

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: 9060523 - LCS

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	50.0	NA	45.1	NA	90	90				
4,4'-DDT	↓	↓	64.7	↓	129	129	NA			

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 #: 45378E3a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: GC

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

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

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, 4,4'-DDD

Conc. = $\frac{1675638 \quad (10)}{236251.4 \quad (10.81)(0.6066)}$

=

= 10.81

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	#1	4,4'-DDD	10.8	10.81	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0744

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC12-190521- 01-03**	A9E0744-06**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 03-05**	A9E0744-07**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 05-07**	A9E0744-08**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 07-8.3**	A9E0744-09**	Sediment	05/21/19
FD-201905211556	A9E0744-10	Sediment	05/21/19
T4-PDI2019-SC13-190521-01-03	A9E0744-11	Sediment	05/21/19
T4-PDI2019-SC13-190521-03-05	A9E0744-12	Sediment	05/21/19
T4-PDI2019-SC13-190521-05-07	A9E0744-13	Sediment	05/21/19
T4-PDI2019-SC13-190521-07-09	A9E0744-14	Sediment	05/21/19
T4-PDI2019-SC13-190521-09-11.1	A9E0744-15	Sediment	05/21/19
FD-201905211730	A9E0744-16	Sediment	05/21/19
T4-PDI2019-SC19-190521-01-03	A9E0744-17	Sediment	05/21/19
T4-PDI2019-SC19-190521-03-05	A9E0744-18	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07	A9E0744-19	Sediment	05/21/19
T4-PDI2019-SC19-190521-07-09	A9E0744-20	Sediment	05/21/19
T4-PDI2019-SC19-190521-09-11	A9E0744-21	Sediment	05/21/19
T4-PDI2019-SC19-190521-11-11.8	A9E0744-22	Sediment	05/21/19
T4-PDI2019-SC12-190521- 01-03DUP	A9E0744-06DUP	Sediment	05/21/19
T4-PDI2019-SC12-190521- 01-03DUP	A9E0744-06DUP	Sediment	05/21/19
T4-PDI2019-SC13-190521-03-05MS	A9E0744-12MS	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07MS	A9E0744-19MS	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07MSD	A9E0744-19MSD	Sediment	05/21/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

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

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

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.

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

IX. Field Duplicates

Samples FD-201905211730 and T4-PDI2019-SC19-190521-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	FD-201905211730	T4-PDI2019-SC19-190521-01-03	
Aroclor-1254	3.04	3.26	7 (≤50)

X. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SC12-190521- 01-03** T4-PDI2019-SC12-190521- 03-05** T4-PDI2019-SC12-190521- 05-07** T4-PDI2019-SC13-190521-01-03	Aroclor-1254 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects)	A
T4-PDI2019-SC13-190521-03-05	Aroclor-1242 Aroclor-1254 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SC13-190521-09-11.1	Aroclor-1254	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to matrix interference, data were qualified as estimated in six samples. No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls - Data Qualification Summary - SDG A9E0744

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC12-190521- 01-03** T4-PDI2019-SC12-190521- 03-05** T4-PDI2019-SC12-190521- 05-07** T4-PDI2019-SC13-190521-01-03	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (Matrix interference)
T4-PDI2019-SC13-190521-03-05	Aroclor-1242 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (matrix interference)
T4-PDI2019-SC13-190521-09-11.1	Aroclor-1254	J (all detects)	A	Compound quantitation (matrix interference)

Port of Portland, T4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG A9E0744

No Sample Data Qualified in this SDG

LDC #: 45378E3b

SDG #: A9E0744

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 7/11/19

Page: 1 of 2

Reviewer: [illegible]

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	% RSD / ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates / DUP	~~A~~ / A	~~A9E0744-06 DUP~~
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	*D = 5, 9 11, 12
X.	Compound quantitation/RL/LOQ/LODs	SW	Not reviewed for Level III validation
XI.	Target compound identification	A	Not reviewed for Level III validation
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:

**Indicates samples underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1 2	T4-PDI2019-SC12-190521- 01-03**	A9E0744-06**	Sediment	05/21/19
2	T4-PDI2019-SC12-190521- 03-05**	A9E0744-07**	Sediment	05/21/19
3	T4-PDI2019-SC12-190521- 05-07**	A9E0744-08**	Sediment	05/21/19
4	T4-PDI2019-SC12-190521- 07-8.3**	A9E0744-09**	Sediment	05/21/19
5	FD-201905211556 D	A9E0744-10	Sediment	05/21/19
6 2	T4-PDI2019-SC13-190521-01-03	A9E0744-11	Sediment	05/21/19
7 2	T4-PDI2019-SC13-190521-03-05	A9E0744-12	Sediment	05/21/19
8	T4-PDI2019-SC13-190521-05-07	A9E0744-13	Sediment	05/21/19
9	T4-PDI2019-SC13-190521-07-09 D	A9E0744-14	Sediment	05/21/19
10	T4-PDI2019-SC13-190521-09-11.1	A9E0744-15	Sediment	05/21/19
11	FD-201905211730 D1	A9E0744-16	Sediment	05/21/19
12	T4-PDI2019-SC19-190521-01-03 D1	A9E0744-17	Sediment	05/21/19
13	T4-PDI2019-SC19-190521-03-05	A9E0744-18	Sediment	05/21/19
14	T4-PDI2019-SC19-190521-05-07	A9E0744-19	Sediment	05/21/19
15	T4-PDI2019-SC19-190521-07-09	A9E0744-20	Sediment	05/21/19
16	T4-PDI2019-SC19-190521-09-11	A9E0744-21	Sediment	05/21/19
17	T4-PDI2019-SC19-190521-11-11.8	A9E0744-22	Sediment	05/21/19

No 2nd column Confirmation Performed

LDC #: 45378E3b

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

SDG #: A9E0744

Laboratory: Apex Laboratories, LLC

Date: 7/11/19

Page: 2 of 2

Reviewer: FJ

2nd Reviewer:

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

18 1	T4-PDI2019-SC12-190521- 01-03DUP	A9E0744-06DUP	Sediment	05/21/19
19 2	T4-PDI2019-SC12-190521- 01-03~~TRP~~ REX DUP	A9E0744-06~~TRP~~ REX DUP	Sediment	05/21/19
20	T4-PDI2019-SC13-190521-03-05MS	A9E0744-12MS	Sediment	05/21/19
21	T4-PDI2019-SC19-190521-05-07MS	A9E0744-19MS	Sediment	05/21/19
22	T4-PDI2019-SC19-190521-05-07MSD	A9E0744-19MSD	Sediment	05/21/19
23				
24				
25				

Notes:

1	9051305-BLK1						
2	9060503-BLK1						

LDC #: 45378E3b

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

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?		✓		
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?	✓			

LDC #: 45378E3b

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

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

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

Notes:_____

LDC #: 45378E36

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: FT
2nd reviewer: C

METHOD: ✓ **GC** __ **HPLC**

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/kg)		%RPD Limit (≤ 50 %)	Qualification (Parent only)
	~~8~~ 11	~~8~~ 12		
AA	3.04	3.26	7	

Compound	Concentration ( )		%RPD Limit (≤_____%)	Qualification (Parent only)

Compound	Concentration ( )		%RPD Limit (≤_____%))	Qualification (Parent only)

LDC #: 45378E36

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

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

METHOD: ✓ GC __ HPLC

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

Level IV/D Only

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

Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	Findings	Qualifications
	1, 2, 3, 6	AA, BB	Result estimated due to the presence of multiple PCB aroclors or matric interference (P-10 qual)	J det / A
	7	Y, AA, BB		
	10	AA		

Comments: See sample calculation verification worksheet for recalculations

LDC #: K5378E3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: a

METHOD: GC X HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below 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 200 ng/ml	Recalculated 200 ng/ml	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/2019	PCB 1260-1 Rear col	1.299E+04	1.299E+04	1.326E+04	1.326E+04	9.39	9.39
	A9A3104	A9E1302							

LDC #: Y5378E36

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GC X HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below 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 200 ng/ml	Recalculated 200 ng/ml	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	1/30/2019	PCB 1260-1 Front col	5.256E+03	5.256E+03	5.490E+03	5.490E+03	7.83	7.83
	A9A3104								

LDC #: Y5378E36

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

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

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	CCV 1631 A9A3104	5/30/19	Aroclor 1260 (F)	500	486	486	2.8	2.8
2	CCV ~~1304~~ 2006 A9A3104	5/30/19 20.	↓	500	502	502	0.3	0.3
3	CCV 2042 A9E1302	5/13/19	↓	500	543	543	8.6	8.6
4	CCV 0749 A9E1302	5/13/19	↓	500	537	537	7.5	7.5

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 #: 45378E36

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: FT
2nd reviewer: a

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: # 2

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
DCB	Front Col	250	189.904	76	76	0

Sample ID: _____

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

	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	2-Bromonaphthalene
C`	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin	AA	Chloro-octadecane
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 45378E36

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

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

MS = Matrix spike
MSD = Matrix spike duplicate

MS/MSD samples: 21 + 22

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)											
Phorate (8141A)											
Malathion (8141A)											
Formaldehyde (8315A)											
Aroclor 1260	356	355	ND ~~283~~	283	291	80	80	82	82	3	3

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 #: 45378E35

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: a

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

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 9051305-LCS

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)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										
Aroclor 1260	250	NA	191	NA	76	76	NA			

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 #: 45378E36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: A
2nd reviewer: C

METHOD: GC

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

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

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, PCB 1260

Conc. = $\frac{21.538\ (2)}{(10.59)(0.6014)}$

= 6.76 ug/kg

2/10.59 %S = 60.14

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	#1	PCB 1260	6.76	6.76	
	1260-4 =	$\frac{619648}{2.766 \times 10^4}$ = 22.4023			
	1260-4 = 22.4023				
	-5 = 21.723				
	-6 = 20.491				
	21.538				

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0744

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC03-190521- 01-03**	A9E0744-01**	Sediment	05/21/19
T4-PDI2019-SC03-190521- 03-05**	A9E0744-02**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 01-03**	A9E0744-06**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 03-05**	A9E0744-07**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 05-07**	A9E0744-08**	Sediment	05/21/19
T4-PDI2019-SC12-190521- 07-8.3**	A9E0744-09**	Sediment	05/21/19
FD-201905211556	A9E0744-10	Sediment	05/21/19
T4-PDI2019-SC13-190521-01-03**	A9E0744-11**	Sediment	05/21/19
T4-PDI2019-SC13-190521-03-05**	A9E0744-12**	Sediment	05/21/19
T4-PDI2019-SC13-190521-05-07**	A9E0744-13**	Sediment	05/21/19
T4-PDI2019-SC13-190521-07-09**	A9E0744-14**	Sediment	05/21/19
T4-PDI2019-SC13-190521-09-11.1	A9E0744-15	Sediment	05/21/19
FD-201905211730	A9E0744-16	Sediment	05/21/19
T4-PDI2019-SC19-190521-01-03	A9E0744-17	Sediment	05/21/19
T4-PDI2019-SC19-190521-03-05	A9E0744-18	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07	A9E0744-19	Sediment	05/21/19
T4-PDI2019-SC19-190521-07-09	A9E0744-20	Sediment	05/21/19
T4-PDI2019-SC19-190521-09-11	A9E0744-21	Sediment	05/21/19
T4-PDI2019-SC19-190521-11-11.8	A9E0744-22	Sediment	05/21/19
T4-PDI2019-SC03-190521- 01-03DUP	A9E0744-01DUP	Sediment	05/21/19
T4-PDI2019-SC12-190521- 07-8.3DUP	A9E0744-09DUP	Sediment	05/21/19
T4-PDI2019-SC19-190521-03-05DUP	A9E0744-18DUP	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07DUP	A9E0744-19DUP	Sediment	05/21/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. 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 not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 FD-201905211556 and T4-PDI2019-SC13-190521-07-09** and samples FD-201905211730 and T4-PDI2019-SC19-190521-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201905211556	T4-PDI2019-SC13-190521-07-09**	
Total organic carbon	0.14	0.042	108 (≤50)
Total solids	70.0	70.2	0 (≤50)

Analyte	Concentration (%)		RPD (Limits)
	FD-201905211730	T4-PDI2019-SC19-190521-01-03	
Total organic carbon	0.47	0.50	6 (≤50)
Total solids	67.7	69.1	2 (≤50)

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0744

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0744

No Sample Data Qualified in this SDG

LDC #: 45378E6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0744 Stage 2B/4 Page: 1 of 2
Laboratory: Apex Laboratories, LLC Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (ASTM D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(9,11) (13,14)
X.	Sample result verification	A	Not reviewed for Level III validation
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:

**Indicates samples underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC03-190521- 01-03**	A9E0744-01**	Sediment	05/21/19
2	T4-PDI2019-SC03-190521- 03-05**	A9E0744-02**	Sediment	05/21/19
3	T4-PDI2019-SC12-190521- 01-03**	A9E0744-06**	Sediment	05/21/19
4	T4-PDI2019-SC12-190521- 03-05**	A9E0744-07**	Sediment	05/21/19
5	T4-PDI2019-SC12-190521- 05-07**	A9E0744-08**	Sediment	05/21/19
6	T4-PDI2019-SC12-190521- 07-8.3**	A9E0744-09**	Sediment	05/21/19
7	FD-201905211556	A9E0744-10	Sediment	05/21/19
8	T4-PDI2019-SC13-190521-01-03**	A9E0744-11**	Sediment	05/21/19
9	T4-PDI2019-SC13-190521-03-05**	A9E0744-12**	Sediment	05/21/19
10	T4-PDI2019-SC13-190521-05-07**	A9E0744-13**	Sediment	05/21/19
11	T4-PDI2019-SC13-190521-07-09**	A9E0744-14**	Sediment	05/21/19
12	T4-PDI2019-SC13-190521-09-11.1	A9E0744-15	Sediment	05/21/19
13	FD-201905211730	A9E0744-16	Sediment	05/21/19
14	T4-PDI2019-SC19-190521-01-03	A9E0744-17	Sediment	05/21/19
15	T4-PDI2019-SC19-190521-03-05	A9E0744-18	Sediment	05/21/19
16	T4-PDI2019-SC19-190521-05-07	A9E0744-19	Sediment	05/21/19
17	T4-PDI2019-SC19-190521-07-09	A9E0744-20	Sediment	05/21/19

LDC #: 45378E6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0744 Stage 2B/4 Page: 2 of 2
Laboratory: Apex Laboratories, LLC Reviewer:
2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986), Grain Size (D422 Modified)

18	T4-PDI2019-SC19-190521-09-11	A9E0744-21	Sediment	05/21/19
19	T4-PDI2019-SC19-190521-11-11.8	A9E0744-22	Sediment	05/21/19
20	T4-PDI2019-SC03-190521- 01-03DUP	A9E0744-01DUP	Sediment	05/21/19
21	T4-PDI2019-SC12-190521- 07-8.3DUP	A9E0744-09DUP	Sediment	05/21/19
22	T4-PDI2019-SC19-190521-03-05DUP	A9E0744-18DUP	Sediment	05/21/19
23	T4-PDI2019-SC19-190521-05-07DUP	A9E0744-19DUP	Sediment	05/21/19
24				
25				
26				

Notes:

LDC #: 45378E6

VALIDATION FINDINGS CHECKLIST

Reviewer: OR
2nd Reviewer: RK

Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			✓	
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓	✓	
Were the performance evaluation (PE) samples within the acceptance limits?				

LDC #: US378E6

VALIDATION FINDINGS CHECKLIST

Reviewer: a
2nd Reviewer: KM

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions ~~and dry weight fa~~ctors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 45378 E6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-19	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
1-6,7-12,14-19	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 Grain Size
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC:20	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
21	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
22	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
23	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45378E6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	7	11	
TOC	0.14	0.042	108
Total solids	70.0	70.2	0

Analyte	Concentration (%)		RPD (≤50)
	13	14	
TOC	0.47	0.50	6
Total solids	67.7	69.1	2

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45378E6.wpd

LDC #: 45378E6

Validatin Findings Worksheet
Initial and Continuing Calibration Calculation Verification

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

Method: Inorganics, Method see cover

The correlation coefficient (r) for the calibration of TOC was recalculated. Calibration date: 2/2/18

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. (ugC)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial Calibration	TOC	s1	0	1.38	0.995	NA	Y
		s2	20.0	15.60			
		s3	50.0	46.83			
		s4	100	129.37			
		s5	200	283.50			
		s6	300	352.23			
		s7	400	403.87			
		s8	500	438.70			
		s9	600	475.50			
		s10	700	504.23			
		s11	800	533.07			
Calibration verification		ICV	10000	10428	104	—	
Calibration verification		CCV	10000	10317	103	—	
Calibration verification							

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

LDC #: 45378E6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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

METHOD: Inorganics, Method see cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

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

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	TOC	10025	10000	100	100	Y
N	Matrix spike sample		(SSR-SR)				
21 ~~20~~	Duplicate sample	TS	83.6	82.1	2	2	Y

Comments:

TOTCLC.6

LDC #: 45378E6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: CL
2nd reviewer: KM

METHOD: Inorganics, Method see cover

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

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for TOC reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{\text{Average}}{10000}$

Recalculation: $\frac{14770.58 + 17926.43 + 1719.10}{3\,(10000)} = 1.69\%$

#	Sample ID	Analyte	Reported Concentration (%)	Calculated Concentration (%)	Acceptable (Y/N)
	1	TOC	1.7	1.7	Y
	2		2.0	2.0	
	3		1.4	1.4	
	4		2.0	2.0	
	5		0.88	0.88	
	6		0.028	0.028	
	8	TS	58.0	58.0	
	9		67.2	67.2	
	10		72.9	72.9	
	11	Gravel	0.01	0.01	

Note:

RECALC.6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0766

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905220947	A9E0766-01	Sediment	05/22/19
T4-PDI2019-SC18-190522-01-03	A9E0766-02	Sediment	05/22/19
T4-PDI2019-SC18-190522-03-05	A9E0766-03	Sediment	05/22/19
T4-PDI2019-SC18-190522-05-07	A9E0766-04	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09	A9E0766-05	Sediment	05/22/19
T4-PDI2019-SC18-190522-09-11	A9E0766-06	Sediment	05/22/19
T4-PDI2019-SC18-190522-11-13	A9E0766-07	Sediment	05/22/19
T4-PDI2019-SC18-190522-01-03DUP	A9E0766-02DUP	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09MS	A9E0766-05MS	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09MSD	A9E0766-05MSD	Sediment	05/22/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample FD-201905220947. Using professional judgment, no data were qualified when one surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

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

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 QC limits. No data were qualified since there were no associated samples in this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results 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 FD-201905220947 and T4-PDI2019-SC18-190522-05-07 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. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0766

No Sample Data Qualified in this SDG

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0766

No Sample Data Qualified in this SDG

LDC #: 45378F2a

SDG #: A9E0766

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 1

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	% RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	%R, %RPD No Assoc sample
VII.	Surrogate spikes	SW	A9E0744-19RE2 MS/D
VIII.	Matrix spike/Matrix spike duplicates	SW/SW	A9E0744-01DUP A9E0744-11 MS
IX.	Laboratory control samples	A	LCS A9E0838-02MS/D
X.	Field duplicates	ND	D = 1,4 A9E0838-15 MS/D
XI.	Internal standards	A	A9E0927-05 MS/D
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905220947 D	A9E0766-01	Sediment	05/22/19
2	T4-PDI2019-SC18-190522-01-03	A9E0766-02	Sediment	05/22/19
3	T4-PDI2019-SC18-190522-03-05	A9E0766-03	Sediment	05/22/19
4	T4-PDI2019-SC18-190522-05-07 D	A9E0766-04	Sediment	05/22/19
5	T4-PDI2019-SC18-190522-07-09	A9E0766-05	Sediment	05/22/19
6	T4-PDI2019-SC18-190522-09-11	A9E0766-06	Sediment	05/22/19
7	T4-PDI2019-SC18-190522-11-13	A9E0766-07	Sediment	05/22/19
8	T4-PDI2019-SC18-190522-01-03DUP	A9E0766-02DUP	Sediment	05/22/19
9	T4-PDI2019-SC18-190522-07-09MS	A9E0766-05MS	Sediment	05/22/19
10	T4-PDI2019-SC18-190522-07-09MSD	A9E0766-05MSD	Sediment	05/22/19
11				
12	905133			
13	9060602			

LDC #: 45378F2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: FT
2nd Reviewer: [signature]

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	1	TPH	53 (54-127)	no qual
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0766

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905220947	A9E0766-01	Sediment	05/22/19
T4-PDI2019-SC18-190522-01-03	A9E0766-02	Sediment	05/22/19
T4-PDI2019-SC18-190522-03-05	A9E0766-03	Sediment	05/22/19
T4-PDI2019-SC18-190522-05-07	A9E0766-04	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09	A9E0766-05	Sediment	05/22/19
T4-PDI2019-SC18-190522-09-11	A9E0766-06	Sediment	05/22/19
T4-PDI2019-SC18-190522-11-13	A9E0766-07	Sediment	05/22/19
T4-PDI2019-SC67-190522-01-03	A9E0766-16	Sediment	05/22/19
T4-PDI2019-SC18-190522-01-03DUP	A9E0766-02DUP	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09MS	A9E0766-05MS	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09MSD	A9E0766-05MSD	Sediment	05/22/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

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

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

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.

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

IX. Field Duplicates

Samples FD-201905220947 and T4-PDI2019-SC18-190522-05-07 were identified as field duplicates. No results were detected in any of the samples.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Port of Portland, T4
Polychlorinated Biphenyls - Data Qualification Summary - SDG A9E0766

No Sample Data Qualified in this SDG

Port of Portland, T4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG A9E0766

No Sample Data Qualified in this SDG

LDC #: 45378F3b
SDG #: A9E0766
Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 7/10/19
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 / A	
II.	Initial calibration/ICV	A / A	% RSD / ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates / DUP	A / ~~BOTH~~ A	A9E0744-06DUP A9E0744-19MS1D
VIII.	Laboratory control samples	A	LCS A9E0838-02RE1 MS1D
IX.	Field duplicates	ND	D = 1,4 A9E0838-15RE1 MS1D
X.	Compound quantitation/RL/LOQ/LODs	N	A9E0927-05RE MS1D
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905220947 D	A9E0766-01	Sediment	05/22/19
2	T4-PDI2019-SC18-190522-01-03	A9E0766-02	Sediment	05/22/19
3	T4-PDI2019-SC18-190522-03-05	A9E0766-03	Sediment	05/22/19
4	T4-PDI2019-SC18-190522-05-07 D	A9E0766-04	Sediment	05/22/19
5	T4-PDI2019-SC18-190522-07-09	A9E0766-05	Sediment	05/22/19
6	T4-PDI2019-SC18-190522-09-11	A9E0766-06	Sediment	05/22/19
7	T4-PDI2019-SC18-190522-11-13	A9E0766-07	Sediment	05/22/19
8	T4-PDI2019-SC67-190522-01-03	A9E0766-16	Sediment	05/22/19
9	T4-PDI2019-SC18-190522-01-03DUP	A9E0766-02DUP	Sediment	05/22/19
10	T4-PDI2019-SC18-190522-07-09MS	A9E0766-05MS	Sediment	05/22/19
11	T4-PDI2019-SC18-190522-07-09MSD	A9E0766-05MSD	Sediment	05/22/19
12				

Notes:

1	9051305						
2	9060524						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0766

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905220947	A9E0766-01	Sediment	05/22/19
T4-PDI2019-SC18-190522-01-03	A9E0766-02	Sediment	05/22/19
T4-PDI2019-SC18-190522-03-05	A9E0766-03	Sediment	05/22/19
T4-PDI2019-SC18-190522-05-07	A9E0766-04	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09	A9E0766-05	Sediment	05/22/19
T4-PDI2019-SC18-190522-09-11	A9E0766-06	Sediment	05/22/19
T4-PDI2019-SC18-190522-11-13	A9E0766-07	Sediment	05/22/19
T4-PDI2019-SC67-190522-01-03	A9E0766-16	Sediment	05/22/19
T4-PDI2019-SC18-190522-07-09DUP	A9E0766-05DUP	Sediment	05/22/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 FD-201905220947 and T4-PDI2019-SC18-190522-05-07 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201905220947	T4-PDI2019-SC18-190522-05-07	
Total organic carbon	0.053	0.051	4 (≤50)

Analyte	Concentration (%)		RPD (Limits)
	FD-201905220947	T4-PDI2019-SC18-190522-05-07	
Total solids	72.3	76.0	5 (≤50)

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0766

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0766

No Sample Data Qualified in this SDG

LDC #: 45378F6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19

SDG #: A9E0766 Stage 2B Page: 1 of 1

Laboratory: Apex Laboratories, LLC Reviewer:

2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (ASTM D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	
IX.	Field duplicates	SW	(1,4)
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905220947	A9E0766-01	Sediment	05/22/19
2	T4-PDI2019-SC18-190522-01-03	A9E0766-02	Sediment	05/22/19
3	T4-PDI2019-SC18-190522-03-05	A9E0766-03	Sediment	05/22/19
4	T4-PDI2019-SC18-190522-05-07	A9E0766-04	Sediment	05/22/19
5	T4-PDI2019-SC18-190522-07-09	A9E0766-05	Sediment	05/22/19
6	T4-PDI2019-SC18-190522-09-11	A9E0766-06	Sediment	05/22/19
7	T4-PDI2019-SC18-190522-11-13	A9E0766-07	Sediment	05/22/19
8	T4-PDI2019-SC67-190522-01-03	A9E0766-16	Sediment	05/22/19
9	T4-PDI2019-SC18-190522-07-09DUP	A9E0766-05DUP	Sediment	05/22/19
10				
11				
12				
13				
14				

Notes:

LDC #: 45328F6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: KK

All circled methods are applicable to each sample.

Sample ID	Parameter
1-8	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
2-8	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 GS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC-9	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45378F6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Page: 1 of 1
Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	1	4	
TOC	0.053	0.051	4
Total solids	72.3	76.0	5

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45378F6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0838

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241445	A9E0838-01	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03	A9E0838-02	Sediment	05/24/19
T4-PDI2019-SC27-190524-03-05	A9E0838-03	Sediment	05/24/19
T4-PDI2019-SC27-190524-05-07	A9E0838-04	Sediment	05/24/19
FD-201905241300	A9E0838-13	Sediment	05/24/19
T4-PDI2019-SC30-190524-01-03	A9E0838-14	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05	A9E0838-15	Sediment	05/24/19
T4-PDI2019-SC30-190524-05-07	A9E0838-16	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03MS	A9E0838-02MS	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03MSD	A9E0838-02MSD	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05MS	A9E0838-15MS	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05MSD	A9E0838-15MSD	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

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

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 T4-PDI2019-SC27-190524-01-03MS/MSD. No data were qualified for MS/MSD samples analyzed greater than or equal to a 5X dilution 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 FD-201905241445 and T4-PDI2019-SC27-190524-05-07 and samples FD-201905241300 and T4-PDI2019-SC30-190524-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905241445	T4-PDI2019-SC27-190524-05-07	
Benzo(a)anthracene	295	366	21 (≤50)
Benzo(a)pyrene	327	461	34 (≤50)
Benzo(b)fluoranthene	471	634	30 (≤50)
Benzo(k)fluoranthene	188	187	1 (≤50)
Benzo(g,h,i)perylene	238	348	38 (≤50)
Chrysene	337	453	29 (≤50)
Fluoranthene	520	664	24 (≤50)
Indeno(1,2,3-cd)pyrene	273	347	24 (≤50)
Phenanthrene	253	355	34 (≤50)
Pyrene	495	586	17 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905241445	T4-PDI2019-SC27-190524-05-07	
Dibenzo(a,h)anthracene	87.7U	77.3	Not calculable
Acenaphthene	87.7U	73.7	Not calculable
Anthracene	87.7U	57.3	Not calculable
Fluorene	87.7U	53.8	Not calculable

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905241300	T4-PDI2019-SC30-190524-01-03	
Acenaphthene	394	200	65 (≤50)
Anthracene	358	181	66 (≤50)
Benzo(a)anthracene	2630	1400	61 (≤50)
Benzo(a)pyrene	3880	2060	61 (≤50)
Benzo(b)fluoranthene	4670	2570	58 (≤50)
Benzo(k)fluoranthene	1860	1020	58 (≤50)
Benzo(g,h,i)perylene	2420	1330	58 (≤50)
Chrysene	2890	1650	55 (≤50)
Dibenzo(a,h)anthracene	512	288	56 (≤50)
Fluoranthene	3960	2030	64 (≤50)
Fluorene	188	92.1U	Not calculable
Indeno(1,2,3-cd)pyrene	2580	1470	55 (≤50)
Phenanthrene	1800	953	62 (≤50)
Pyrene	3800	1980	63 (≤50)

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
FD-201905241445	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SC27-190524-01-03 T4-PDI2019-SC30-190524-03-05	Benzo(a)anthracene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SC27-190524-03-05 T4-PDI2019-SC27-190524-05-07 FD-201905241300 T4-PDI2019-SC30-190524-01-03	Benzo(b)fluoranthene Dibenzo(a,h)anthracene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects)	A
T4-PDI2019-SC30-190524-05-07	Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to peak separation, data were qualified as estimated in eight samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0838

Sample	Compound	Flag	A or P	Reason
FD-201905241445	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC27-190524-01-03 T4-PDI2019-SC30-190524-03-05	Benzo(a)anthracene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC27-190524-03-05 T4-PDI2019-SC27-190524-05-07 FD-201905241300 T4-PDI2019-SC30-190524-01-03	Benzo(b)fluoranthene Dibenzo(a,h)anthracene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC30-190524-05-07	Benzo(b)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0838

No Sample Data Qualified in this SDG

LDC #: 45378G2a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

SDG #: A9E0838

Laboratory: Apex Laboratories, LLC

Date: 7/10/19

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: GC/MS ~~Semivolatile~~s (EPA SW 846 Method 8270D)
PAH

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A /A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	%RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	A	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates /DMP	SW/A	A9E0766-02RE2DUP A9E0766-05RE2MS/D
IX.	Laboratory control samples	A	LCS A9E0927-05MS/P
X.	Field duplicates	SW	D= 1,4 ~~3~~,5 (%R, No Ass. sample)
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905241445 D	A9E0838-01	Sediment	05/24/19
2	T4-PDI2019-SC27-190524-01-03	A9E0838-02	Sediment	05/24/19
3	T4-PDI2019-SC27-190524-03-05	A9E0838-03	Sediment	05/24/19
4	T4-PDI2019-SC27-190524-05-07 D	A9E0838-04	Sediment	05/24/19
5	FD-201905241300 D1	A9E0838-13	Sediment	05/24/19
6	T4-PDI2019-SC30-190524-01-03 D1	A9E0838-14	Sediment	05/24/19
7	T4-PDI2019-SC30-190524-03-05	A9E0838-15	Sediment	05/24/19
8	T4-PDI2019-SC30-190524-05-07	A9E0838-16	Sediment	05/24/19
9	T4-PDI2019-SC27-190524-01-03MS	A9E0838-02MS	Sediment	05/24/19
10	T4-PDI2019-SC27-190524-01-03MSD	A9E0838-02MSD	Sediment	05/24/19
11	T4-PDI2019-SC30-190524-03-05MS	A9E0838-15MS	Sediment	05/24/19
12	T4-PDI2019-SC30-190524-03-05MSD	A9E0838-15MSD	Sediment	05/24/19
13	9060602-BLK1			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378G2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: FT

2nd Reviewer: [signature]

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	2, 7, 5	surrogate outside	limit ( )	no qual ≥5x DL
			( )	
			( )	
			( )	
	4		( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378G2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: FT
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 Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

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

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

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	9 + 10	%R + %RSD (outside limit)			( )	2	no qual ≥5x DL
			( )	( )	( )		
			( )	( )			
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 45378G2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 6 of 1
Reviewer:
2nd Reviewer:

METHOD: GCMS PAH (EPA Method 8270D)

Compound	Concentration (ug/Kg)		(≤50)
	1	4	RPD
CCC	295	366	21
III	327	461	34
GGG	471	634	30
HHH	188	187	1
LLL	238	348	38
DDD	337	453	29
YY	520	664	24
JJJ	273	347	24
UU	253	355	34
ZZ	495	586	17
KKK	87.7U	77.3	NC
GG	87.7U	73.7	NC
VV	87.7U	57.3	NC
NN	87.7U	53.8	NC

LDC#: 45378G2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

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

Compound	Concentration (ug/Kg)		(≤50)
	5	6	RPD
GG	394	200	65
VV	358	181	66
CCC	2630	1400	61
III	3880	2060	61
GGG	4670	2570	58
HHH	1860	1020	58
LLL	2420	1330	58
DDD	2890	1650	55
KKK	512	288	56
YY	3960	2030	64
NN	188	92.1U	NC
JJJ	2580	1470	55
UU	1800	953	62
ZZ	3800	1980	63

LDC #: 45378G2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1	CCC, GGG, DDD	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	2, 7	CCC, GGG, KKK, DDD		
	3, 4, 5, 6	GGG, KKK		
	8	GGG		

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0838

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241445	A9E0838-01	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03	A9E0838-02	Sediment	05/24/19
T4-PDI2019-SC27-190524-03-05	A9E0838-03	Sediment	05/24/19
T4-PDI2019-SC27-190524-05-07	A9E0838-04	Sediment	05/24/19
FD-201905241300	A9E0838-13	Sediment	05/24/19
T4-PDI2019-SC30-190524-01-03	A9E0838-14	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05	A9E0838-15	Sediment	05/24/19
T4-PDI2019-SC30-190524-05-07	A9E0838-16	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03MS	A9E0838-02MS	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03MSD	A9E0838-02MSD	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05MS	A9E0838-15MS	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05MSD	A9E0838-15MSD	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

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

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

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.

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

IX. Field Duplicates

Samples FD-201905241445 and T4-PDI2019-SC27-190524-05-07 and samples T4-PDI2019-SC30-190524-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	FD-201905241445	T4-PDI2019-SC27-190524-05-07	
Aroclor-1242	9.32	7.69	19 (≤50)
Aroclor-1254	32.5	26.7	20 (≤50)
Aroclor-1260	24.4	19.3	23 (≤50)

Compound	Concentration (ug/Kg)		RPD
	FD-201905241300	T4-PDI2019-SC30-190524-01-03	
Aroclor-1254	7.61	7.38	3 (≤50)
Aroclor-1260	6.75	5.65	18 (≤50)

X. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
FD-201905241445 T4-PDI2019-SC27-190524-05-07	Aroclor-1242 Aroclor-1254 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SC27-190524-03-05 FD-201905241300 T4-PDI2019-SC30-190524-01-03 T4-PDI2019-SC30-190524-05-07	Aroclor-1254	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects)	A
T4-PDI2019-SC30-190524-03-05	Aroclor-1254 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to matrix interference, data were qualified as estimated in seven samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls - Data Qualification Summary - SDG A9E0838

Sample	Compound	Flag	A or P	Reason
FD-201905241445 T4-PDI2019-SC27-190524-05-07	Aroclor-1242 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (matrix interference)
T4-PDI2019-SC27-190524-03-05 FD-201905241300 T4-PDI2019-SC30-190524-01-03 T4-PDI2019-SC30-190524-05-07	Aroclor-1254	J (all detects)	A	Compound quantitation (matrix interference)
T4-PDI2019-SC30-190524-03-05	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (matrix interference)

Port of Portland, T4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG A9E0838

No Sample Data Qualified in this SDG

LDC #: 45378G3b

SDG #: A9E0838

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	%RSD / ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	A9E0766-05RE1 MS/D
VII.	Matrix spike/Matrix spike duplicates / DUP	A / A	A9E0766-02RE1 DUP; A9E0838-02RE1 MSD; A9E0838-15RE1 MS/D
VIII.	Laboratory control samples	A	
IX.	Field duplicates	SW	D = 1, 4 5, 6; A9E0927-05RE1 MS/D
X.	Compound quantitation/RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID		Lab ID	Matrix	Date
1 †	FD-201905241445	D	A9E0838-01	Sediment	05/24/19
2 †	T4-PDI2019-SC27-190524-01-03		A9E0838-02	Sediment	05/24/19
3 †	T4-PDI2019-SC27-190524-03-05		A9E0838-03	Sediment	05/24/19
4 †	T4-PDI2019-SC27-190524-05-07	D	A9E0838-04	Sediment	05/24/19
5 †	FD-201905241300	D1	A9E0838-13	Sediment	05/24/19
6 †	T4-PDI2019-SC30-190524-01-03	D1	A9E0838-14	Sediment	05/24/19
7 †	T4-PDI2019-SC30-190524-03-05		A9E0838-15	Sediment	05/24/19
8 †	T4-PDI2019-SC30-190524-05-07		A9E0838-16	Sediment	05/24/19
9	T4-PDI2019-SC27-190524-01-03MS		A9E0838-02MS	Sediment	05/24/19
10	T4-PDI2019-SC27-190524-01-03MSD		A9E0838-02MSD	Sediment	05/24/19
11	T4-PDI2019-SC30-190524-03-05MS		A9E0838-15MS	Sediment	05/24/19
12	T4-PDI2019-SC30-190524-03-05MSD		A9E0838-15MSD	Sediment	05/24/19
13					
14					

Notes:

	9060524-BLK1						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 45378G3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: ✓ GC __ HPLC

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/kg)		%RPD Limit (≤ 50 %)	Qualification (Parent only)
	1	4		
Y	9.32	7.69	19	
AA	32.5	26.7	20	
BB	24.4	19.3	23	

Compound	Concentration (ug/kg)		%RPD Limit (≤ 50 %)	Qualification (Parent only)
	5	6		
AA	7.61	7.38	3	
BB	6.75	5.65	18	

Compound	Concentration ( )		%RPD Limit (≤ %))	Qualification (Parent only)

LDC #: 45378G3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: FT
2nd Reviewer:

METHOD: ✓ GC __ HPLC

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

Level IV/D Only

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

Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	Findings	Qualifications
	1, 4	Y, AA, BB	Result estimated due to the presence of multiple PCB Aroclors or matrix interference (P-10 qual)	Jdu /Δ
	3, 5, 6, ~~7~~ 8	AA		
	7	AA, BB		

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0838

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241445	A9E0838-01	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03	A9E0838-02	Sediment	05/24/19
T4-PDI2019-SC27-190524-03-05	A9E0838-03	Sediment	05/24/19
T4-PDI2019-SC27-190524-05-07	A9E0838-04	Sediment	05/24/19
FD-201905241300	A9E0838-13	Sediment	05/24/19
T4-PDI2019-SC30-190524-01-03	A9E0838-14	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05	A9E0838-15	Sediment	05/24/19
T4-PDI2019-SC30-190524-05-07	A9E0838-16	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03DUP	A9E0838-02DUP	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05DUP	A9E0838-15DUP	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 FD-201905241300 and T4-PDI2019-SC30-190524-01-03 and samples FD-201905241445 and T4-PDI2019-SC27-190524-05-07 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201905241300	T4-PDI2019-SC30-190524-01-03	
Total organic carbon	1.7	1.7	0 (≤50)
Total solids	52.6	55.3	5 (≤50)

Analyte	Concentration (%)		RPD (Limits)
	FD-201905241445	T4-PDI2019-SC27-190524-05-07	
Total organic carbon	2.0	2.2	10 (≤50)
Total solids	57.5	56.1	2 (≤50)

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0838

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0838

No Sample Data Qualified in this SDG

LDC #: 45378G6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/6/19
SDG #: A9E0838 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (ASTM D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(5,6) (1,4)
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905241445	A9E0838-01	Sediment	05/24/19
2	T4-PDI2019-SC27-190524-01-03	A9E0838-02	Sediment	05/24/19
3	T4-PDI2019-SC27-190524-03-05	A9E0838-03	Sediment	05/24/19
4	T4-PDI2019-SC27-190524-05-07	A9E0838-04	Sediment	05/24/19
5	FD-201905241300	A9E0838-13	Sediment	05/24/19
6	T4-PDI2019-SC30-190524-01-03	A9E0838-14	Sediment	05/24/19
7	T4-PDI2019-SC30-190524-03-05	A9E0838-15	Sediment	05/24/19
8	T4-PDI2019-SC30-190524-05-07	A9E0838-16	Sediment	05/24/19
9	T4-PDI2019-SC27-190524-01-03DUP	A9E0838-02DUP	Sediment	05/24/19
10	T4-PDI2019-SC30-190524-03-05DUP	A9E0838-15DUP	Sediment	05/24/19
11				
12				
13				
14				

Notes:

LDC #: MS378866

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-8	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
2-4, 68	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 GS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC-9	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
10	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45378G6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	5	6	
TOC	1.7	1.7	0
Total solids	52.6	55.3	5

Analyte	Concentration (%)		RPD (≤50)
	1	4	
TOC	2.0	2.2	10
Total solids	57.5	56.1	2

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45378G6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0849

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905231817	A9E0849-01	Water	05/23/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D in Selected Ion Monitoring (SIM) mode

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

Sample RB-201905231817 was identified as a rinsate blank. No contaminants were found.

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

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

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0849

No Sample Data Qualified in this SDG

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0849

No Sample Data Qualified in this SDG

LDC #: 45378H2a

SDG #: A9E0849

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/9/19

Page: 1 of 1

Reviewer: EJ

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20 ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	RB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	QC Sample
IX.	Laboratory control samples	A	LCS / D
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	RB-201905231817	A9E0849-01	Water	05/23/19
2				
3				
4				
5				
6				
7				
8				

Notes:

	9051400-BLK 2						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Chlorinated Pesticides

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0849

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905231817	A9E0849-01	Water	05/23/19
T4-PDI2019-SC32-190523-01-03	A9E0849-02	Sediment	05/23/19
T4-PDI2019-SC32-190523-01-03MS	A9E0849-02MS	Sediment	05/23/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

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

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
06/07/19	CCV	Col 2	gamma-BHC	22.4	All water samples in SDG A9E0849	NA	-

V. Laboratory Blanks

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

VI. Field Blanks

Sample RB-201905231817 was identified as a rinsate blank. No contaminants were found.

VII. Surrogates

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

VIII. Matrix Spike/Duplicate Sample Analysis

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

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

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIII. Overall Assessment of Data

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

Port of Portland, T4
Chlorinated Pesticides - Data Qualification Summary - SDG A9E0849

No Sample Data Qualified in this SDG

Port of Portland, T4
Chlorinated Pesticides - Laboratory Blank Data Qualification Summary - SDG A9E0849

No Sample Data Qualified in this SDG

LDC #: 45378H3a

SDG #: A9E0849

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: GC Chlorinated Pesticides (EPA SW846 Method 8081B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A/A	% RSD ≤ 20, r² ICV ≤ 20
IV.	Continuing calibration	SW	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	RB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates /DUP	~~A~~ A	A9E0744-01RE3DUP MS only
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Compound quantitation/RL/LOQ/LODs	N	
XII.	Target compound identification	N	
XIII.	System Performance	N	
XIV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1 1	RB-201905231817	A9E0849-01	Water	05/23/19
2 2	T4-PDI2019-SC32-190523-01-03	A9E0849-02	Sediment	05/23/19
3 1	~~RB-201905231817MS~~ #2 MS	~~A9E0849-01MS~~ -02 MS	~~Water~~ Sediment	05/23/19
4				
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8				

Notes:

1	9051398-						
2	9060523						

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 45378H3a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of continuing calibration calculation was performed? ___%D or ___%R
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 / %R validation criteria of ≤20.0% / 80-120%?
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 ≤ 20.0)	RT (limit)	Associated Samples	Qualifications
+	6/7/19 1349	CCV	col. 2	D	22.4		all water	Jdet /A ND

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0849

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC32-190523-01-03	A9E0849-02	Sediment	05/23/19
T4-PDI2019-SC43-190523-01-03	A9E0849-08	Sediment	05/23/19
T4-PDI2019-SC43-190523-03-05	A9E0849-09	Sediment	05/23/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

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

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

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.

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SC43-190523-01-03	Aroclor-1254 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to matrix interference, data were qualified as estimated in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls - Data Qualification Summary - SDG A9E0849

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC43-190523-01-03	Aroclor-1254 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (matrix interference)

Port of Portland, T4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG A9E0849

No Sample Data Qualified in this SDG

LDC #: 45378H3b

SDG #: A9E0849

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 1

Reviewer: EJ

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	% RSD ≤ 20 ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	A9E0838-15RE1 MS/D
VI.	Surrogate spikes	A	A9E0838-02RE1 MS/D
VII.	Matrix spike/Matrix spike duplicates /DUP	A	~~05~~ A9E0766-05RE1 MS/D
VIII.	Laboratory control samples	A	LCS A9E0927-05RE1 MS/D
IX.	Field duplicates	N	A9E0766-02RE1 DUP
X.	Compound quantitation/RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC32-190523-01-03	A9E0849-02	Sediment	05/23/19
2	T4-PDI2019-SC43-190523-01-03	A9E0849-08	Sediment	05/23/19
3	T4-PDI2019-SC43-190523-03-05	A9E0849-09	Sediment	05/23/19
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12				

Notes:

	9060524-BLK						

no 2nd column confirmation performed

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 45378H3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

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

METHOD: ✓ GC __ HPLC

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

Level IV/D Only

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

Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	Findings	Qualifications
	2	AA, BB	Result estimated due to the presence of multiple PCB Aroclors or matrix interference (P-10 qual)	J all /A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0849

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC32-190523-01-03	A9E0849-02	Sediment	05/23/19
T4-PDI2019-SC43-190523-01-03	A9E0849-08	Sediment	05/23/19
T4-PDI2019-SC43-190523-03-05	A9E0849-09	Sediment	05/23/19
T4-PDI2019-SC32-190523-01-03DUP	A9E0849-02DUP	Sediment	05/23/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

VII. Duplicate Sample Analysis

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0849

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0849

No Sample Data Qualified in this SDG

LDC #: 45378H6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0849 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~ ASTM), Grain Size (D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC32-190523-01-03	A9E0849-02	Sediment	05/23/19
2	T4-PDI2019-SC43-190523-01-03	A9E0849-08	Sediment	05/23/19
3	T4-PDI2019-SC43-190523-03-05	A9E0849-09	Sediment	05/23/19
4	T4-PDI2019-SC32-190523-01-03DUP	A9E0849-02DUP	Sediment	05/23/19
5				
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14				

Notes:

LDC #: 45378H6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-3	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS GS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC-4	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0922

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG22-190529	A9E0922-09	Sediment	05/29/19
T4-PDI2019-SG23-190529	A9E0922-10	Sediment	05/29/19
T4-PDI2019-SG24-190529	A9E0922-11	Sediment	05/29/19
T4-PDI2019-SG25-190529	A9E0922-12	Sediment	05/29/19
T4-PDI2019-SG40-190529	A9E0922-13	Sediment	05/28/19
FD-201905281308	A9E0922-14	Sediment	05/28/19
T4-PDI2019-SG41-190528	A9E0922-15	Sediment	05/28/19
T4-PDI2019-SG24-190528DUP	A9E0922-11DUP	Sediment	05/29/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for samples T4-PDI2019-SG22-190529 and T4-PDI2019-SG25-190529. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

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

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

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
T4-PDI2019-SG24-190528DUP (T4-PDI2019-SG24-190529)	Anthracene	51 (≤35)	J (all detects)	A
	Chrysene	63 (≤35)	J (all detects)	
	Fluoranthene	100 (≤35)	J (all detects)	
	Phenanthrene	96 (≤35)	J (all detects)	
	Pyrene	85 (≤35)	J (all detects)	

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 FD-201905281308 and T4-PDI2019-SG41-190528 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
Acenaphthene	76.9	167	74 (≤50)
Acenaphthylene	7.17U	2.41	Not calculable
Anthracene	29.5	21.9	30 (≤50)
Benzo(a)anthracene	241	19.1	171 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
Benzo(a)pyrene	143	20.5	150 (≤50)
Benzo(b)fluoranthene	214	32.6	147 (≤50)
Benzo(k)fluoranthene	98.9	9.59	165 (≤50)
Benzo(g,h,i)perylene	32.0	7.53	124 (≤50)
Chrysene	210	15.7	172 (≤50)
Dibenzo(a,h)anthracene	12.7	2.07	144 (≤50)
Fluoranthene	140	92.4	41 (≤50)
Fluorene	28.9	82.9	97 (≤50)
Indeno(1,2,3-cd)pyrene	49.2	10.1	132 (≤50)
2-Methylnaphthalene	21.6	68.7	104 (≤50)
Naphthalene	47.5	166	111 (≤50)
Phenanthrene	99.8	285	96 (≤50)
Pyrene	137	77.9	55 (≤50)

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG22-190529 T4-PDI2019-SG23-190529 T4-PDI2019-SG24-190529 FD-201905281308	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG25-190529	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects) J (all detects) J (all detects)	A
T4-PDI2019-SG41-190528	Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and peak separation, data were qualified as estimated in six samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0922

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG24-190529	Anthracene Chrysene Fluoranthene Phenanthrene Pyrene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG22-190529 T4-PDI2019-SG23-190529 T4-PDI2019-SG24-190529 FD-201905281308	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG25-190529	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SG41-190528	Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0922

No Sample Data Qualified in this SDG

LDC #: 45378I2a

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

SDG #: A9E0922

Page: 1 of 1

Laboratory: Apex Laboratories, LLC

Reviewer:

2nd Reviewer:

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	SW	A9E0766-02RE2 DUP A9E0766-05RE2 MS/D
IX.	Laboratory control samples	A	LCS A9E0927-05 MS/D
X.	Field duplicates	SW	D = 6, 7 A9E0838-02 MS/D
XI.	Internal standards	A	A9E038-15 MS/D
XII.	Compound quantitation RL/LOQ/LODs	SW	LCS %R, %RPD no Asso sample
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG22-190528 9	A9E0922-09	Sediment	05/29/19
2	T4-PDI2019-SG23-190528 9	A9E0922-10	Sediment	05/29/19
3	T4-PDI2019-SG24-190528 9	A9E0922-11	Sediment	05/29/19
4	T4-PDI2019-SG25-190528 9	A9E0922-12	Sediment	05/29/19
5	T4-PDI2019-SG40-190528 OK don't change	A9E0922-13	Sediment	05/28/19
6	FD-201905281308 D	A9E0922-14	Sediment	05/28/19
7	T4-PDI2019-SG41-190528 D	A9E0922-15	Sediment	05/28/19
8	T4-PDI2019-SG24-190528DUP	A9E0922-11DUP	Sediment	05/29/19
9				
10				

Notes:

	9060602-BLK						
	9060718-BLK						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378I2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [signature]

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	1, 4	Surrogate outside	limit ( )	no qual > 5X DL
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378 I2a

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

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

METHOD: GC/MS BNA(EPA SW 846 Method 8270D)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?
Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 35 ?
LEVEL IV ONLY:
Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		3 + 8	Sediment	VV	51 (≤ 35)	3	Jdet /A all Det
				DDD	63 ↓	↓	↓
				YY	100 ↓	↓	↓
				UU	96 ↓	↓	↓
				ZZ	85 ↓	↓	↓

Comments:

LDC#: 45378 I2a **VALIDATION FINDINGS WORKSHEET**
Field Duplicates

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GCMS PAH (EPA Method 8270D)

Compound	Concentration (ug/Kg)		(≤50)
	6	7	RPD
GG	76.9	167	74
DD	7.17U	2.41	NC
VV	29.5	21.9	30
CCC	241	19.1	171
III	143	20.5	150
GGG	214	32.6	147
HHH	98.9	9.59	165
LLL	32.0	7.53	124
DDD	210	15.7	172
KKK	12.7	2.07	144
YY	140	92.4	41
NN	28.9	82.9	97
JJJ	49.2	10.1	132
W	21.6	68.7	104
S	47.5	166	111
UU	99.8	285	96
ZZ	137	77.9	55

LDC #: 45378J2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1, 2, 3, 6	GGG, HHH	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	4	CCC, GGG, HHH, DDD	↓	↓
	7	GGG, HHH, DDD	↓	↓

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0922

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG22-190528	A9E0922-09	Sediment	05/29/19
T4-PDI2019-SG23-190528	A9E0922-10	Sediment	05/29/19
T4-PDI2019-SG24-190528	A9E0922-11	Sediment	05/29/19
T4-PDI2019-SG25-190528	A9E0922-12	Sediment	05/29/19
T4-PDI2019-SG40-190528	A9E0922-13	Sediment	05/28/19
FD-201905281308	A9E0922-14	Sediment	05/28/19
T4-PDI2019-SG41-190528	A9E0922-15	Sediment	05/28/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 FD-201905281308 and T4-PDI2019-SG41-190528 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
Total organic carbon	0.13	0.11	17 (≤50)

Analyte	Concentration (%)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
Total solids	70.8	69.7	2 (≤50)

Grain Size	Concentration (% of Total)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
Gravel (>2.00 mm)	2.44	4.08	50 (≤50)
4.75 mm	1.83	3.59	65 (≤50)
2.00 mm	0.61	0.49	22 (≤50)
Sand (0.063-2.00 mm)	83.8	78.8	6 (≤50)
0.85 mm	1.95	2.06	5 (≤50)
0.425 mm	24.9	24.1	3 (≤50)
0.250 mm	40.4	37.0	9 (≤50)
0.150 mm	10.7	9.78	9 (≤50)
0.106 mm	2.74	2.71	1 (≤50)
0.075 mm	2.09	2.14	2 (≤50)
0.063 mm	0.96	1.02	6 (≤50)
Silt (0.005 mm < 0.063 mm)	8.60	11.5	29 (≤50)
Clay (0.005 mm)	5.20	5.60	7 (≤50)

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0922

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0922

No Sample Data Qualified in this SDG

LDC #: 45378I6

SDG #: A9E0922

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/6/19

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986), Grain Size (D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	DUP (A9E0849)
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(6,7)
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG22-190528	A9E0922-09	Sediment	05/29/19
2	T4-PDI2019-SG23-190528	A9E0922-10	Sediment	05/29/19
3	T4-PDI2019-SG24-190528	A9E0922-11	Sediment	05/29/19
4	T4-PDI2019-SG25-190528	A9E0922-12	Sediment	05/29/19
5	T4-PDI2019-SG40-190528	A9E0922-13	Sediment	05/28/19
6	FD-201905281308	A9E0922-14	Sediment	05/28/19
7	T4-PDI2019-SG41-190528	A9E0922-15	Sediment	05/28/19
8				
9				
10				
11				
12				
13				
14				

Notes:

LDC #: 45378I6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-7	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS GS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45378I6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer:
2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	6	7	
TOC	0.13	0.11	17
Total solids	70.8	69.7	2

Grain Size	Concentration (% of Total)		RPD (≤50)
	6	7	
Gravel (>2.00 mm)	2.44	4.08	50
4.75 mm	1.83	3.59	~~NC~~ 65
2.00 mm	0.61	0.49	22
Sand (0.063 - 2.00 mm)	83.8	78.8	6
0.85 mm	1.95	2.06	5
0.425 mm	24.9	24.1	3
0.250 mm	40.4	37.0	9
0.150 mm	10.7	9.78	9
0.106 mm	2.74	2.71	1
0.075 mm	2.09	2.14	2
0.063 mm	0.96	1.02	6
Silt (0.005 mm < 0.063 mm)	8.60	11.5	29
Clay (<0.005 mm)	5.20	5.60	7

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0927

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241641	A9E0927-02	Sediment	05/24/19
T4-PDI2019-SC29-190524-01-03	A9E0927-03	Sediment	05/24/19
T4-PDI2019-SC29-190524-03-05	A9E0927-04	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07	A9E0927-05	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07MS	A9E0927-05MS	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07MSD	A9E0927-05MSD	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

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

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

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 T4-PDI2019-SC29-190524-05-07MS/MSD. No data were qualified for MS/MSD samples analyzed greater than or equal to a 5X dilution were within QC limits. Relative percent differences (RPD) were within QC limits.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results 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 FD-201905241641 and T4-PDI2019-SC29-190524-03-05 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905241641	T4-PDI2019-SC29-190524-03-05	
Acenaphthene	228	348	42 (≤50)
Anthracene	259	338	26 (≤50)
Benzo(a)anthracene	1700	2190	25 (≤50)
Benzo(a)pyrene	2190	2960	30 (≤50)
Benzo(b)fluoranthene	2690	3530	27 (≤50)
Benzo(k)fluoranthene	839	1340	46 (≤50)
Benzo(g,h,i)perylene	1670	2080	22 (≤50)
Chrysene	1720	2260	27 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905241641	T4-PDI2019-SC29-190524-03-05	
Dibenzo(a,h)anthracene	348	449	25 (≤50)
Fluoranthene	2350	3100	28 (≤50)
Indeno(1,2,3-cd)pyrene	1590	134	169 (≤50)
Phenanthrene	1080	1420	27 (≤50)
Pyrene	2290	3000	27 (≤50)

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
FD-201905241641 T4-PDI2019-SC29-190524-03-05	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A
T4-PDI2019-SC29-190524-01-03	Benzo(b)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects)	A
T4-PDI2019-SC29-190524-05-07	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	Peak separation for structural isomers is insufficient for accurate quantification	J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to peak separation, data were qualified as estimated in four samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9E0927

Sample	Compound	Flag	A or P	Reason
FD-201905241641 T4-PDI2019-SC29-190524-03-05	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC29-190524-01-03	Benzo(b)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)
T4-PDI2019-SC29-190524-05-07	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9E0927

No Sample Data Qualified in this SDG

LDC #: 45378J2a

SDG #: A9E0927

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 1

Reviewer: D

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20, r² ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	(%R/%RPD NO ASSOC. Sample)
VIII.	Matrix spike/Matrix spike duplicates	SW / A	A9E0766.02RE2 DUP A9E0766-05RE2 MS/MSD
IX.	Laboratory control samples	A	LCS A9E0838-02 MS/MSD
X.	Field duplicates	SW	D = 1 + 3 A9E838-15 MS/MSD
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID		Lab ID	Matrix	Date
1	FD-201905241641	D	A9E0927-02	Sediment	05/24/19
2	T4-PDI2019-SC29-190524-01-03		A9E0927-03	Sediment	05/24/19
3	T4-PDI2019-SC29-190524-03-05	D	A9E0927-04	Sediment	05/24/19
4	T4-PDI2019-SC29-190524-05-07		A9E0927-05	Sediment	05/24/19
5	T4-PDI2019-SC29-190524-05-07MS		A9E0927-05MS	Sediment	05/24/19
6	T4-PDI2019-SC29-190524-05-07MSD		A9E0927-05MSD	Sediment	05/24/19
7					
8					

Notes:

	9060602-BLK1						

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 45378J2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: FT
2nd Reviewer: [signature]

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

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	1, 2, 4	surrogates outside limit	( )	no qual ≥ 5x DL
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45378J2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: FT
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 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
	5 & 6	% R	outside limit	( )	( )	4	no qual ≥ 5x PL
			( )	( )	( )		
			( )	( )			
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 45378J2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: GCMS PAH (EPA Method 8270D)

Compound	Concentration (ug/Kg)		(≤50)
	1	3	RPD
GG	228	348	42
VV	259	338	26
CCC	1700	2190	25
III	2190	2960	30
GGG	2690	3530	27
HHH	839	1340	46
LLL	1670	2080	22
DDD	1720	2260	27
KKK	348	449	25
YY	2350	3100	28
JJJ	1590	134	169
UU	1080	1420	27
ZZ	2290	3000	27

LDC #: 45378J2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	1, 3	GGG, HHH	Peak separation for structural isomers is insuffecient for accurate quantificattion (M-05 qual)	J det/A
	2	GGG		
	4	~~AA~~ DD, GGG, DDD		

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0927

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241641	A9E0927-02	Sediment	05/24/19
T4-PDI2019-SC29-190524-01-03	A9E0927-03	Sediment	05/24/19
T4-PDI2019-SC29-190524-03-05	A9E0927-04	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07	A9E0927-05	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07MS	A9E0927-05MS	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07MSD	A9E0927-05MSD	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

IV. Laboratory Blanks

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

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

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

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

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.

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

IX. Field Duplicates

Samples FD-201905241641 and T4-PDI2019-SC29-190524-03-05 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD
	FD-201905241641	T4-PDI2019-SC29-190524-03-05	
Aroclor-1242	3.75U	4.30	Not calculable
Aroclor-1254	7.96	9.02	12
Aroclor-1260	6.77	6.43	5

X. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
FD-201905241641 T4-PDI2019-SC29-190524-03-05	Aroclor-1254	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects)	A
T4-PDI2019-SC29-190524-05-07	Aroclor-1242 Aroclor-1254 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to matrix interference, data were qualified as estimated in three samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls - Data Qualification Summary - SDG A9E0927

Sample	Compound	Flag	A or P	Reason
FD-201905241641 T4-PDI2019-SC29-190524-03-05	Aroclor-1254	J (all detects)	A	Compound quantitation (Matrix interference)
T4-PDI2019-SC29-190524-05-07	Aroclor-1242 Aroclor-1254 Aroclor-1260	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (matrix interference)

Port of Portland, T4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG A9E0927

No Sample Data Qualified in this SDG

LDC #: 45378J3b

SDG #: A9E0927

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/10/19

Page: 1 of 1

Reviewer: FT

2nd Reviewer: O

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	% RSD ≤ 20 ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates /DUP	A	A9E0766-02RE1DUP A9E0766-05RE1MS/D
VIII.	Laboratory control samples	A	LCS A9E0838-02RE1MS/D
IX.	Field duplicates	SW	D = 1,3 A9E0838-15RE1MS/D
X.	Compound quantitation/RL/LOQ/LODs	N	A9E0927-05RE1 MS/D
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905241641 D	A9E0927-02	Sediment	05/24/19
2	T4-PDI2019-SC29-190524-01-03	A9E0927-03	Sediment	05/24/19
3	T4-PDI2019-SC29-190524-03-05 D	A9E0927-04	Sediment	05/24/19
4	T4-PDI2019-SC29-190524-05-07	A9E0927-05	Sediment	05/24/19
5	T4-PDI2019-SC29-190524-05-07MS	A9E0927-05MS	Sediment	05/24/19
6	T4-PDI2019-SC29-190524-05-07MSD	A9E0927-05MSD	Sediment	05/24/19
7				
8				
9				
10				
11				
12				

Notes:

	9060524						

no 2nd column confirmation performed

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 45378J3b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: ✓ **GC** __ **HPLC**

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/kg)		%RPD Limit (≤ %)	Qualification (Parent only)
	1	3		
Y	3.754	4.30	NC	
AA	7.96	9.02	12	
BB	6.77	6.43	5	

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

Compound	Concentration ( )		%RPD Limit (≤ %))	Qualification (Parent only)

LDC #: 45378J3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: FT
2nd Reviewer: S

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	Findings	Qualifications
	1, 3	AA	Result estimated due to the presence of multiple PCB aroclors or matric interference (P-10 qual)	Jdet /A
	4	Y, AA, BB	↓	Jdet /A

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9E0927

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241641	A9E0927-02	Sediment	05/24/19
T4-PDI2019-SC29-190524-01-03	A9E0927-03	Sediment	05/24/19
T4-PDI2019-SC29-190524-03-05	A9E0927-04	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07	A9E0927-05	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07DUP	A9E0927-05DUP	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

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

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

Laboratory blanks were not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 FD-201905241641 and T4-PDI2019-SC29-190524-03-05 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (%)		RPD (Limits)
	FD-201905241641	T4-PDI2019-SC29-190524-03-05	
Total organic carbon	2.3	2.5	8 (≤50)

Analyte	Concentration (%)		RPD (Limits)
	FD-201905241641	T4-PDI2019-SC29-190524-03-05	
Total solids	52.6	52.7	0 (≤50)

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9E0927

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9E0927

No Sample Data Qualified in this SDG

LDC #: 45378J6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/10/19
SDG #: A9E0927 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP ~~1986~~), Grain Size (ASTM D422 Modified)

The samples listed below were reviewed for 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	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(1,3)
X.	Sample result verification	N	
XI	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	FD-201905241641	A9E0927-02	Sediment	05/24/19
2	T4-PDI2019-SC29-190524-01-03	A9E0927-03	Sediment	05/24/19
3	T4-PDI2019-SC29-190524-03-05	A9E0927-04	Sediment	05/24/19
4	T4-PDI2019-SC29-190524-05-07	A9E0927-05	Sediment	05/24/19
5	T4-PDI2019-SC29-190524-05-07DUP	A9E0927-05DUP	Sediment	05/24/19
6				
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12				
13				
14				

Notes:

LDC #: 45378J6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: VK

All circled methods are applicable to each sample.

Sample ID	Parameter
1-4	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
2-4	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 GrainSize
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC:S	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45378J6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

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

Inorganics, Method See Cover

Analyte	Concentration (%)		RPD (≤50)
	1	3	
TOC	2.3	2.5	8
Total solids	52.6	52.7	0

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45378J6.wpd

LDC #: 45378

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 7/16/19

2nd Reviewer: CG

The LDC job number listed above was entered by FM

Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	Y		
Ib.	- All samples present/match report?	Y		
Ic.	- All reported analytes present?	Y		
Id.	- 10% or 100% verification of EDD?	Y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	—		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	—		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	—		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

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

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

September 9, 2019

SUBJECT: Revised Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed is the revised validation report for the fraction listed below. This SDG was received on July 3, 2019. Attachment 1 is a summary of the samples that were reviewed for analysis.

- Updated the QAPP reference

LDC Project #45434_RV1:

SDG #	Fraction
1901248	Polychlorinated Dioxins/Dibenzofurans

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

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy; March 2019
- USEPA, National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016

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

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

534 pages-ADV

Attachment 1

EDD Stage 2B/4 90/10

LDC #45434 (Anchor Environmental-Seattle WA / Port of Portland, T4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Dioxins (1613B)																																	
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	W	S
A	1901248	07/03/19	07/25/19	0	3																																
A	1901248	07/03/19	07/25/19	0	1																																
Total	T/CR			0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Port of Portland - T4\45434ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901248

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241641	1901248-01	Sediment	05/24/19
T4-PDI2019-SC29-190524-01-03**	1901248-02**	Sediment	05/24/19
T4-PDI2019-SC29-190524-03-05	1901248-03	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07	1901248-04	Sediment	05/24/19
T4-PDI2019-SC29-190524-05-07DUP	1901248-04DUP	Sediment	05/24/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

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

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

III. Initial Calibration and Initial Calibration Verification

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

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

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

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for unlabeled compounds and less than or equal to 30.0% for labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria with the following exceptions:

Date	Standard ID	Compound	Ion Abundance Ratio (Limits)	Associated Samples	Affected Compounds	Flag	A or P
06/25/19	190625D1	13C-1,2,3,4,7,8-HxCDD	1.44 (1.051.43)	T4-PDI2019-SC29-190524-01-03** T4-PDI2019-SC29-190524-05-07	1,2,3,4,7,8-HxCDD Total HxCDD	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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/Duplicate Sample Analysis

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

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Affected Compounds	Flag	A or P
T4-PDI2019-SC29-190524-05-07DUP (T4-PDI2019-SC29-190524-05-07)	1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDD OCDD OCDF	187 (≤35) 179 (≤35) 185 (≤35) 183 (≤35)	1,2,3,6,7,8-HxCDD Total HxCDD 1,2,3,4,6,7,8-HpCDD OCDD OCDF Total HpCDD	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201905241641 and T4-PDI2019-SC29-190524-03-05 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (pg/g)		RPD (Limits)
	FD-201905241641	T4-PDI2019-SC29-190524-03-05	
1,2,3,4,7,8-HxCDD	0.354	0.205U	Not calculable
1,2,3,6,7,8-HxCDD	1.65	1.85	11 (≤50)
1,2,3,7,8,9-HxCDD	0.527	0.759	36 (≤50)
1,2,3,4,6,7,8-HpCDD	44.2	37.4	17 (≤50)
OCDD	352	573	48 (≤50)
2,3,7,8-TCDF	0.181U	0.376	Not calculable
2,3,4,7,8-PeCDF	0.341	0.409	18 (≤50)
1,2,3,4,7,8-HxCDF	0.775	1.26	48 (≤50)
1,2,3,6,7,8-HxCDF	0.303	0.425	34 (≤50)
2,3,4,6,7,8-HxCDF	0.243*	0.322	28 (≤50)
1,2,3,7,8,9-HxCDF	0.183	0.355	64 (≤50)
1,2,3,4,6,7,8-HpCDF	4.04	4.07	1 (≤50)
1,2,3,4,7,8,9-HpCDF	0.365	0.341	7 (≤50)
OCDF	11.7	8.54	31 (≤50)
Total PeCDD	0.176U	0.884	Not calculable
Total HxCDD	13.6	11.6	16 (≤50)
Total HpCDD	116	83.7	32 (≤50)
Total TCDF	0.181U	1.06	Not calculable
Total PeCDF	2.47	2.77	11 (≤50)
Total HxCDF	7.89	9.26	16 (≤50)
Total HpCDF	15.0	13.7	9 (≤50)

X. Labeled Compounds

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

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 191248	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to continuing calibration ion abundance ratio, DUP RPD, and results reported as EMPC, data were qualified as estimated in four samples.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901248

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC29-190524-01-03** T4-PDI2019-SC29-190524-05-07	1,2,3,4,7,8-HxCDD Total HxCDD	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P	Continuing calibration (ion abundance ratio)
T4-PDI2019-SC29-190524-05-07	1,2,3,6,7,8-HxCDD Total HxCDD 1,2,3,4,6,7,8-HpCDD OCDD OCDF Total HpCDD	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
FD-201905241641 T4-PDI2019-SC29-190524-01-03** T4-PDI2019-SC29-190524-03-05 T4-PDI2019-SC29-190524-05-07	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901248

No Sample Data Qualified in this SDG

LDC #: 45434A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/18/19
SDG #: 1901248 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: SL
2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20/35 ICV ≤ QC limits
IV.	Continuing calibration	SW	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N / SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 1+3
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation.
XII.	Target compound identification		Not reviewed for Stage 2B validation.
XIII.	System performance	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:

** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	FD-201905241641	1901248-01	Sediment	05/24/19
2	T4-PDI2019-SC29-190524-01-03**	1901248-02**	Sediment	05/24/19
3	T4-PDI2019-SC29-190524-03-05	1901248-03	Sediment	05/24/19
4	T4-PDI2019-SC29-190524-05-07	1901248-04	Sediment	05/24/19
5	T4-PDI2019-SC29-190524-05-07DUP	1901248-04DUP	Sediment	05/24/19
6				
7				
8				
9				

Notes:

LDC #: 45434A21

VALIDATION FINDINGS CHECKLIST

Reviewer: N
2nd Reviewer: O

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

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

LDC #: 45434321

VALIDATION FINDINGS CHECKLIST

Reviewer: N
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compounds within ~~the 25-150%~~ method criteria?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria? N	~~✓~~	✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?			✓	
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 45431A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer:
2nd Reviewer:

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

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

#	Date	Standard ID	Compound	conc (ng/mL) Finding %D	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	6/25/19	190625D1	13C-C		1.44 (1.05-1.43)	2,4,~~1~~5 (~~ND~~/ND) MB	J/UJ/P (+T)

LDC #: 45434A21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: R
2nd Reviewer: [illegible]

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

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

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 50?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		5	Sed	D	187 (≤35)	4 (dup)	~~No qual, ≤ RL~~ J dets/A (+T)
				F	179		J dets/A (+ U)
				G	185		
				Q	183		

LDC#:45434A21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: A
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCDD/PCDF (EPA SW 846 Method 8290)

Compound	Concentration (pg/g) 1	Concentration (pg/g) 3	RPD (≤50)	
C	0.354	0.205U	NC	
D	1.65	1.85	~~200~~ 11	
E	0.527	0.759	~~200~~ 36	
F	44.2	37.4	17	
G	352	573	~~200~~ 48	
H	0.181U	0.376	NC	
J	0.341	0.409*	18	
K	0.775	1.26	48	
L	0.303	0.425	34	
M	0.243*	0.322	28	
N	0.183	0.355	64	
O	4.04	4.07	1	
P	0.365	0.341	7	
Q	11.7	8.54	31	
S	0.176U	0.884*	NC	
T	13.6	11.6	16	
U	116	83.7	32	
V	0.181U	1.06	NC	
W	2.47	2.77*	11	
X	7.89*	9.26*	16	
Y	15.0	13.7	9	

*EMPC

LDC #: 45434A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

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

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

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

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		~~1,3,4~~	All compounds reported as estimated		~~U/A (Individual)~~
		All	maximum possible concentration (EMPC)		Jdets/A (Total)

Comments: See sample calculation verification worksheet for recalculations No QL for Totals

LDC #: 45434A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: R
2nd Reviewer: [illegible]

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

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10/50/100 std)	Recalculated RRF (10/50/100 std)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.87	0.87	5.57	5.43
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.86	0.87	6.57	6.70
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.86	0.86	8.35	8.10
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.99	0.98	10.09	10.06
			OCDF (^{13}C-OCDF)	0.94	0.94	0.97	0.97	12.29	12.28
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

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

LDC #: 45434A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

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

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190625D1	6/25/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	9.43	9.40		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	x ~~0.89~~ 0.90	12.7	x ~~13~~ 12.8		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	54.2	54.2		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	47.3	47.3		
			OCDF (^{13}C-OCDF)	0.94	101	101		
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

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

LDC #: 45434A21

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer: 2
2nd Reviewer: 2

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

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: OPR

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		OPR Percent Recovery		OPRD Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
2,3,7,8-TCDD	40.0		57.0		143	143				
1,2,3,7,8-PeCDD	200		223		112	112				
1,2,3,4,7,8-HxCDD	↓		209		105	105				
1,2,3,4,7,8,9-HpCDF	↓		184		92.2	92				
OCDF	400		417		104	104				

LDC #: 45434A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: R
2nd reviewer: C

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

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

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

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

Example:

Sample I.D. 2, E:

Conc. = $\frac{(1.90e4)(200)(1)}{(3.52e6)(0.96)(9.61)(0.523)}$

= 2.24 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	2	E	2.22	2.24	–

LDC #: 45434

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 7/24/19
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	Y		
Ib.	- All samples present/match report?	Y		
Ic.	- All reported analytes present?	Y		
Id.	- 10% or 100% verification of EDD?	Y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	Y		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	—		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

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

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

September 9, 2019

SUBJECT: Revised Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the revised validation reports for the fractions listed below. This SDG was received on July 5, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

- Updated the QAPP reference

LDC Project #45449_RV1:

SDG #	Fraction
A9F0035	Semivolatiles, Wet Chemistry

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

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- 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,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

41 pages-ADV

Attachment 1

EDD Stage 2B/4 90/10

LDC #45449 (Anchor Environmental-Seattle WA / Port of Portland, T4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	SVOA (8270D)		TOC (9060A)		Total Solids (PSEP)		Part. Size (D422M)																											
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	W	S
A	A9F0035	07/05/19	07/26/19	1	2	0	2	0	2	0	3																										
A	A9F0035	07/05/19	07/26/19	0	1	0	1	0	1	0	1																										
Total	J/CR			1	3	0	3	0	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Port of Portland - T4\45449ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Semivolatiles

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9F0035

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905301712	A9F0035-01	Water	05/30/19
T4-PDI2019-SG21-190531	A9F0035-14	Sediment	05/31/19
T4-PDI2019-SG26-190530	A9F0035-15	Sediment	05/30/19
T4-PDI2019-SG38-190531**	A9F0035-16**	Sediment	05/31/19
T4-PDI2019-SG38-190531MS	A9F0035-16MS	Sediment	05/31/19
T4-PDI2019-SG38-190531MSD	A9F0035-16MSD	Sediment	05/31/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 8270D

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

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

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

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

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

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

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

V. Laboratory Blanks

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

VI. Field Blanks

Sample RB-201905301712 was identified as a rinsate blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample T4-PDI2019-SG26-190530. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

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

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
9060576-LCS/D (All water samples in SDG A9F0035)	1-Methylnaphthalene 2-Methylnaphthalene	32 (≤30) 32 (≤30)	UJ (all non-detects) UJ (all non-detects)	P

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

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

XII. Compound Quantitation

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

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SG21-190531 T4-PDI2019-SG26-190530	Benzo(b)fluoranthene Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to LCS/LCSD RPD and peak separation, data were qualified as estimated in three samples.

No results were rejected in this SDG.

Port of Portland, T4
Semivolatiles – Data Qualification Summary – SDG A9F0035

Sample	Compound	Flag	A or P	Reason
RB-201905301712	1-Methylnaphthalene 2-Methylnaphthalene	UJ (all non-detects) UJ (all non-detects)	P	Laboratory control samples (RPD)
T4-PDI2019-SG21-190531 T4-PDI2019-SG26-190530	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Semivolatiles – Laboratory Blank Data Qualification Summary – SDG A9F0035

No Sample Data Qualified in this SDG

LDC #: 45449A2a

SDG #: A9F0035

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 7/19/19

Page: 1 of 1

Reviewer: EJ

2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A A	% RSD ≤ 20, 12 ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 30
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	RB = 1
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XIII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIV.	System performance	A	Not reviewed for Stage 2B validation
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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1 1	RB-201905301712	A9F0035-01	Water	05/30/19
2 2	T4-PDI2019-SG21-190531	A9F0035-14	Sediment	05/31/19
3	T4-PDI2019-SG26-190530	A9F0035-15	Sediment	05/30/19
4	T4-PDI2019-SG38-190531**	A9F0035-16**	Sediment	05/31/19
5	T4-PDI2019-SG38-190531MS	A9F0035-16MS	Sediment	05/31/19
6	T4-PDI2019-SG38-190531MSD	A9F0035-16MSD	Sediment	05/31/19
7				
8				

Notes:

1	9060576						
2	9060718						

LDC #: 45449 A2a

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [signature]

Method: Semivolatiles (EPA SW 846 Method 8270D)

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

LDC #: 45449 A2a

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [illegible]

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

LDC #: Y5419A2a

VALIDATION FINDINGS WORKSHEET

Surrogate Recovery

Reviewer: FT

2nd Reviewer: [signature]

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	3	surrogates outside	limit ( )	no qual > 5x DL
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

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

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

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

Y N N/A Was a LCS required?

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

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	9060576-lcs/P	TTT	( )	( )	32 (30)	all water	J/UJ/P ND
		W	( )	( )	32 (30)	↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 45449A 2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	2, 3, 6	GGG, HHH	Peak separation for structural isomers is insufficient for accurate quantification	Jdw /A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

RRF = (Ax)(Cis)/(Ais)(Cx)
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

Where:
Ax = Area of compound
Cx = Concentration of compound
S = Standard deviation of the RRFs
X = Mean of the RRFs
Ais = Area of associated internal standard
Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 500ng/ml std)	Recalculated (RRF 500ng/ml std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL GCMS 10 A9D1505	4/12/2019	S	1.147102	1.147102	1.035252	1.035252	10.717520	10.717520
			GG	1.407188	1.407188	1.286670	1.286670	10.971540	10.971540
			UU	1.177029	1.177029	1.085248	1.085248	12.232740	12.232740
			DDD	1.096461	1.096461	1.058934	1.058934	2.949131	2.949131
			LLL	1.174822	1.174822	1.081412	1.081412	8.424744	8.424744

LDC #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

RRF = (Ax)(Cis)/(Ais)(Cx)
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

Where:
Ax = Area of compound
Cx = Concentration of compound
S = Standard deviation of the RRFs
X = Mean of the RRFs
Ais = Area of associated internal standard
Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 500ng/ml std)	Recalculated (RRF 500ng/ml std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL GCMS 5 A9A3103	1/30/2019	S	1.100540	1.100540	1.066921	1.066921	5.537751	5.537751
			GG	1.381346	1.381346	1.320947	1.320947	5.949628	5.949628
			UU	1.161203	1.161203	1.097729	1.097729	11.424400	11.424400
			DDD	1.107315	1.107315	1.074697	1.074697	1.516659	1.516659
			III	1.016943	1.016943	0.959388	0.959388	12.802630	12.802630

LDC #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: FT
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
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 (Internal Standard)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	CCV-10 0842	6/10/19	S (1st IS)	1.035252	1.069168	1.069168	3.3	3.3
			GG (2nd IS)	1.286670	1.335202	1.335202	3.8	3.8
			NN (3rd IS)	1.085248	1.1507	1.1507	6.0	6.0
			DDD (4th IS)	1.058934	1.120038	1.120038	5.8	5.8
			LLL (5th IS)	1.081412	1.175749	1.175749	8.7	8.7
			(6th IS)					
2			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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 #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: FT
2nd reviewer:

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 4

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	2500	1652.03	66	66	0
2-Fluorobiphenyl	↓	1616.49	65	65	↓
Terphenyl-d14		2255.43	90	90	
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 #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: FT
2nd Reviewer:

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: 5 + 6

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene	724	718	24.9	500	527	66	66	70	70	5	5
Pentachlorophenol											
Pyrene	724	718	19.9	701	692	94	94	94	94	1	1

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 #: 45449A2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: [illegible]

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

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

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: 9060718 - LCS

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										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene	533	NA	464	NA	87	87				
Pentachlorophenol										
Pyrene	533	↓	524	↓	98	98	NA			

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 #: 45449A2a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: FT
2nd reviewer:

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

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

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

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 4, GG:

$$\text{Conc.} = \frac{(46546)(2000)(2)}{(525137)(1.286670)(15.19)(0.7297)}$$

= 24.86 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	4	GG	24.9	24.86	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9F0035

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG21-190531	A9F0035-14	Sediment	05/31/19
T4-PDI2019-SG26-190530	A9F0035-15	Sediment	05/30/19
T4-PDI2019-SG38-190531**	A9F0035-16**	Sediment	05/31/19
T4-PDI2019-SG38-190531-DUP	A9F0035-17	Sediment	05/31/19
T4-PDI2019-SG38-190531DUP	A9F0035-16DUP	Sediment	05/31/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP) 1986
Grain Size by American Society for Testing and Material (ASTM) Method D422 Modified

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. 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 not required by the methods.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) analyses were not required by the methods.

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 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Grain Size	Concentration (%)		RPD (Limits)
	T4-PDI2019-SG38-190531**	T4-PDI2019-SG38-190531-DUP	
Gravel (>2.00 mm)	0.12	0.28	80 (≤50)

Grain Size	Concentration (%)		RPD (Limits)
	T4-PDI2019-SG38-190531**	T4-PDI2019-SG38-190531-DUP	
4.75 mm	0.01U	0.11	Not calculable
2.00 mm	0.12	0.17	34 (≤50)
Sand (0.063 - 2.00 mm)	98.1	97.2	1 (≤50)
0.85 mm	0.49	0.37	28 (≤50)
0.425 mm	17.2	14.7	16 (≤50)
0.250 mm	61.5	63.7	4 (≤50)
0.150 mm	17.7	16.9	5 (≤50)
0.106 mm	0.81	0.96	17 (≤50)
0.075 mm	0.30	0.40	29 (≤50)
0.063 mm	0.11	0.16	37 (≤50)
Silt (0.005 mm < 0.063 mm)	1.70	1.90	11 (≤50)
Clay (<0.005 mm)	0.10	0.60	143 (≤50)

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9F0035

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9F0035

No Sample Data Qualified in this SDG

LDC #: 45449A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/24/19
SDG #: A9F0035 Stage 2B/4 Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986), Grain Size (D422 Modified)

The samples listed below were reviewed for 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	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	not required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(3,4)
X.	Sample result verification	A	Not reviewed for Stage 2B validation
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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG21-190531	A9F0035-14	Sediment	05/31/19
2	T4-PDI2019-SG26-190530	A9F0035-15	Sediment	05/30/19
3	T4-PDI2019-SG38-190531**	A9F0035-16**	Sediment	05/31/19
4	T4-PDI2019-SG38-190531-DUP	A9F0035-17	Sediment	05/31/19
5	T4-PDI2019-SG38-190531DUP	A9F0035-16DUP	Sediment	05/31/19
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes:

LDC #: 45149A6

VALIDATION FINDINGS CHECKLIST

Reviewer: OR
2nd Reviewer: RW

Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			✓	
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓	✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 45449A6

VALIDATION FINDINGS CHECKLIST

Reviewer: a
2nd Reviewer: aw

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓	✓	
Target analytes were detected in the field blanks.				

LDC #: 45449A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-3	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
1-4	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 Grain Size
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
1-5	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC#: 45449A6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

Inorganics, Method See Cover

Grain Size	Concentration (% of Total)		RPD (≤50)
	3	4	
Gravel (>2.00 mm)	0.12	0.28	80
4.75 mm	0.01U	0.11	NC
2.00 mm	0.12	0.17	34
Sand (0.063 - 2.00 mm)	98.1	97.2	1
0.85 mm	0.49	0.37	28
0.425 mm	17.2	14.7	16
0.250 mm	61.5	63.7	4
0.150 mm	17.7	16.9	5
0.106 mm	0.81	0.96	17
0.075 mm	0.30	0.40	29
0.063 mm	0.11	0.16	37
Silt (0.005 mm < 0.063 mm)	1.70	1.90	11
Clay (<0.005 mm)	0.10	0.60	143

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\45449A6.wpd

LDC #: 45449A6

Validatin Findings Worksheet
Initial and Continuing Calibration Calculation Verification

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

Method: Inorganics, Method _____

The correlation coefficient (r) for the calibration of TOC was recalculated.Calibration date: —

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. (ugC)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial Calibration	TOC	s1	0	1.38	*0.995*	NA	Y
		s2	20.0	15.60			
		s3	50.0	46.83			
		s4	100	129.37			
		s5	200	283.50			
		s6	300	352.23			
		s7	400	403.87			
		s8	500	438.70			
		s9	600	475.50			
		s10	700	504.23			
		s11	800	533.07			
Calibration verification	CCV	CCV	10000	10296	103	—	✓
Calibration verification							
Calibration verification							

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

LDC #: 45449A6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: a
2nd Reviewer: aa

METHOD: Inorganics, Method see cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

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

Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

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

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	TOC	9800	10000	98	98	Y
N	Matrix spike sample		(SSR-SR)				
S	Duplicate sample	TS	73.1	73.0	0.2	0.2	Y

Comments:

TOTCLC.6

LDC #: 45449A6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Inorganics, Method see cover

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

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for TS reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{\text{Dry-Tare}}{\text{Wet-Tare}} \times 100$

Recalculation: $\frac{30.0493g - 1.3899g}{40.6634g - 1.3899g} \times 100 = 72.97\%$

#	Sample ID	Analyte	Reported Concentration (%)	Calculated Concentration (%)	Acceptable (Y/N)
	3	TOC	0.038	0.038	Y
		TS	73.0	73.0	↓
		Gravel	0.12	0.12	↓

Note:

LDC #: 45449

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 7/26/19
Page: 1 of 1
2nd Reviewer: CG

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	Y	↓	
Ib.	- All samples present/match report?	Y	↓	
Ic.	- All reported analytes present?	Y	↓	
Id.	- 10% or 100% verification of EDD?	Y	↓	
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y	↓	
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	—	↓	
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y	↓	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y	↓	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y	↓	
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—	↓	
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	—	↓	
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—	↓	
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y	↓	
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—	↓	
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N	↓	

Notes: *see discrepancy sheet

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

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

September 9, 2019

SUBJECT: Revised Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the revised validation reports for the fractions listed below. This SDG was received on July 10, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

- Updated the QAPP reference

LDC Project #45476_RV1:

SDG #	Fraction
1900817	Polychlorinated Dioxins/Dibenzofurans, Polychlorinated Biphenyls as Congeners

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

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

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

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

EDD **Stage 2B 90/10**

LDC #45476 (Anchor Environmental-Seattle WA / Port of Portland, T4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PCBs (1668C)		Dioxins (1613B)																															
Matrix:	Water/Soil			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	W	S
A	1900817	07/10/19	07/31/19	0	4	0	4																														
A	1900817	07/10/19	07/31/19	0	1	0	1																														
Total	T/CR			0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1900817

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG50-190418	1900817-01	Sediment	04/18/19
T4-PDI2019-SG56-190418	1900817-02	Sediment	04/18/19
T4-PDI2019-SG62-190418**	1900817-03**	Sediment	04/18/19
T4-PDI2019-SG63-190418	1900817-04	Sediment	04/18/19
T4-PDI2019-SG64-190418	1900817-05	Sediment	04/18/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

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

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

III. Initial Calibration and Initial Calibration Verification

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

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

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

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

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

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1900817	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Sample	Compound	Flag	A or P
T4-PDI2019-SG50-190418 T4-PDI2019-SG63-190418	All compounds flagged "P" due to polychlorinated diphenyl ether (PcDPE) interference.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to results reported as EMPC and PcDPE interference, data were qualified as estimated in five samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1900817

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG50-190418 T4-PDI2019-SG56-190418 T4-PDI2019-SG62-190418** T4-PDI2019-SG63-190418 T4-PDI2019-SG64-190418	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)
T4-PDI2019-SG50-190418 T4-PDI2019-SG63-190418	All compounds flagged "P" due to polychlorinated diphenyl ether (PcDPE) interference.	J (all detects)	A	Compound quantitation (PcDPE interference)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1900817

No Sample Data Qualified in this SDG

LDC #: 45476A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/31/19
SDG #: 1900817 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: M
2nd Reviewer: C

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20/35 ICV ≤ QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation All - EMPC - J dupe/A
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG50-190418	1900817-01	Sediment	04/18/19
2	T4-PDI2019-SG56-190418	1900817-02	Sediment	04/18/19
3	T4-PDI2019-SG62-190418**	1900817-03**	Sediment	04/18/19
4	T4-PDI2019-SG63-190418	1900817-04	Sediment	04/18/19
5	T4-PDI2019-SG64-190418	1900817-05	Sediment	04/18/19
6				
7				
8				
9				
10				

Notes:

LDC #: 45476A21

VALIDATION FINDINGS CHECKLIST

Reviewer: A
2nd Reviewer: [illegible]

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

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

LDC #: 45476A21

VALIDATION FINDINGS CHECKLIST

Reviewer: M
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compounds within the 25-150% criteria?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?			✓	
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 47476A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

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

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

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

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All results flagged "EMPC"		Jdets/A
		1,4	All results flagged "P" *		Jdets/A
			* The lab indicated that reported conc may include contribution from polychlorinated diphenyl ether (PCDPE)		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 45476A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer:
2nd Reviewer:

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

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10/50/100 std)	Recalculated RRF (10/50/100 std)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.87	0.87	5.57	5.43
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.86	0.87	6.57	6.70
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.86	0.86	8.35	8.10
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.99	0.98	10.09	10.06
			OCDF (^{13}C-OCDF)	0.94	0.94	0.97	0.97	12.29	12.28
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

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

LDC #: 45476A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: M
2nd Reviewer: —

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

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190607A	6/7/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	9.28	9.31		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	11.2	11.2		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	53.1	53.1		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	48.5	48.3		
			OCDF (^{13}C-OCDF)	0.94	99.9	100		
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

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

LDC #: 45476A21

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer:
2nd Reviewer:

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

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9E0217-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		OPR Percent Recovery		OPRD Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
2,3,7,8-TCDD	40.0		41.2		103					
1,2,3,7,8-PeCDD	200		204		102					
1,2,3,4,7,8-HxCDD	↓		208		104					
1,2,3,4,7,8,9-HpCDF	↓		213		106					
OCDF	400		392		98.0					

LDC #: 45476A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: M
2nd reviewer: G

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

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

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

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

Example:

Sample I.D. 3, D:

Conc. = $\frac{(2.71e4)(2000)(\quad)}{(6.57e6)(0.93)(13.0)(0.387)}$

= 1.76 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	3	D	1.76	1.76	–

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1900817

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG50-190418	1900817-01	Sediment	04/18/19
T4-PDI2019-SG56-190418	1900817-02	Sediment	04/18/19
T4-PDI2019-SG62-190418**	1900817-03**	Sediment	04/18/19
T4-PDI2019-SG63-190418	1900817-04	Sediment	04/18/19
T4-PDI2019-SG64-190418	1900817-05	Sediment	04/18/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

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

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all congeners. The chromatographic resolution between the congeners PCB-23 and PCB-34 and congeners PCB-182 and PCB-187 was resolved with a valley of less than or equal to 40%.

The static resolving power was less than or equal to 10,000 (10% valley definition) at m/z 330.9792 and greater than or equal to 8000 throughout the mass range.

III. Initial Calibration and Initial Calibration Verification

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

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

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF within QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
B9F0064-BLK1	06/07/19	PCB-1	0.000872 ug/Kg	All samples in SDG 1900817

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
T4-PDI2019-SG63-190418	PCB-1	0.00247 ug/Kg	0.00247U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

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

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1900817	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to results reported as EMPC, data were qualified as estimated in five samples.

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

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 1900817

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG50-190418 T4-PDI2019-SG56-190418 T4-PDI2019-SG62-190418** T4-PDI2019-SG63-190418 T4-PDI2019-SG64-190418	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 1900817

Sample	Compound	Modified Final Concentration	A or P
T4-PDI2019-SG63-190418	PCB-1	0.00247U ug/Kg	A

LDC #: 45476A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/31/19
SDG #: 1900817 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20 ICV ≤ QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation All - EMPC - J det's/A
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG50-190418	1900817-01	Sediment	04/18/19
2	T4-PDI2019-SG56-190418	1900817-02	Sediment	04/18/19
3	T4-PDI2019-SG62-190418**	1900817-03**	Sediment	04/18/19
4	T4-PDI2019-SG63-190418	1900817-04	Sediment	04/18/19
5	T4-PDI2019-SG64-190418	1900817-05	Sediment	04/18/19
6				
7				
8				
9				
10				

Notes:

LDC #: 45476A31

VALIDATION FINDINGS CHECKLIST

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

Method: HRGC/HRMS Polychlorinated Biphenyls (EPA Method 1668C)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 330.9792 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution (valley) between PCB 23 and PCB 34 and between PCB 182 and PCB 187 ≤ 40% ?	✓			
Is the static resolving power ≥10,000 at m/z 330.9792 and ≥ 8000 throughout the mass range?	✓			
Was the mass resolution adequately checked with PFK?	✓			
III. Initial calibration/Initial calibration verification				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤20% for unlabeled and labeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
Were all initial calibration verification (ICV) percent differences (%D) within QC limits for unlabeled and labeled compounds?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all percent differences (%D) ≤25% for unlabeled and percent recoveries (%R) for labeled compounds within 50-145%?	✓			
Did all routine calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
V. Laboratory Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the blanks validation findings worksheet.	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. 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				

LDC #: 45476A31

VALIDATION FINDINGS CHECKLIST

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

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

LDC #: 45476A31

VALIDATION FINDINGS WORKSHEET
Blanks

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

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated? If yes, please see qualification below.

Blank extraction date: 6/7/19 **Blank analysis date:** 6/10/19
Conc. units: ug/kg **Associated samples:** All

Compound	Blank ID	Sample Identification								
	B9F0064-BLK1	4								
PCB-1	2000872		0.0025 U							
			0.00247 cf							

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

Compound	Blank ID	Sample Identification								

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

LDC #: 45476A31

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

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

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of compound, A_{is} = Area of associated internal standard
average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, C_{is} = Concentration of internal standard
%RSD = 100 * (S/X) — S = Standard deviation of the RRFs, X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported %RSD	Recalculated %RSD
1	ICAL	2/8/18	PCB 77 (^{13}C-PCB 77)	1.082	1.083	1.00	0.99	8.00	7.93
			PCB 105 (^{13}C-PCB 105)	1.123	1.123	1.06	1.06	5.02	5.03
			PCB 167 (^{13}C-PCB 167)	1.020	1.018	0.95	0.95	5.21	5.43
			PCB 189 (^{13}C-PCB 189)	1.451	1.458	1.35	1.35	7.03	7.04
2			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						
3			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						

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 #: 45476A31

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

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

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

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

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

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

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc ~~RRF~~ (CC)	Recalculated Conc ~~RRF~~ (CC)	Reported %D	Recalculated %D
1	190610E1S	6/10/19	PCB 77 (^{13}C-PCB 77)	1.082	47.3	47.2		
			PCB 105 (^{13}C-PCB 105)	1.123	45.7	45.8		
			PCB 167 (^{13}C-PCB 167)	1.020	46.9	46.9		
			PCB 189 (^{13}C-PCB 189)	1.457	45.0	45.1		
2			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					
3			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					
4			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					

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

LDC #: 45476A31

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

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

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F0064-BS1

Compound	Spike Added (pg/g)		Spiked Sample Concentration (pg/g)		OPR Percent Recovery		OPR D Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
PCB 15	1.00		0.954		95.4	95.4				
PCB 77	↓		0.968		96.8	96.8				
PCB 169	↓		0.947		94.7	94.7				
PCB 206	↓		0.977		97.7	97.7				

LDC #: 45476A31

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

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

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

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

Example:

Sample I.D. 3, PCB-15:

Conc. = $\frac{(3.426)(10)(\quad)}{(1.468)(1.055)(13.0)(0.387)}$

= 0.0441 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	3		0.0444	0.0441	–

LDC #: 45416

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 8/2/19
Page: 1 of 1
2nd Reviewer: SG

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	y		
Ib.	- All samples present/match report?	y		
Ic.	- All reported analytes present?	y		
Id.	- 10% or 100% verification of EDD?	y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	y		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	—		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	y		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	y		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

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

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

September 9, 2019

SUBJECT: Revised Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the revised validation reports for the fractions listed below. This SDG was received on July 16, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

- Updated the QAPP reference

LDC Project #45526_RV1:

SDG #	Fraction
1900807	Polychlorinated Dioxins/Dibenzofurans, Polychlorinated Biphenyls as Congeners

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

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

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

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

EDD Stage 2B 90/10

LDC #45526 (Anchor Environmental-Seattle WA / Port of Portland, T4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PCBs (1668C)		Dioxins (1613B)																																	
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	W	S	W	S
A	1900807	07/16/19	08/06/19	1	18	1	12																																
A	1900807	07/16/19	08/06/19	0	2	0	2																																
Total	J/CR			1	20	1	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1900807

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201904171558	1900807-01	Water	04/17/19
T4-PDI2019-SG08-190415	1900807-04	Sediment	04/15/19
T4-PDI2019-SG13-190415	1900807-06	Sediment	04/15/19
FD-201904151441	1900807-10	Sediment	04/15/19
T4-PDI2019-SG18-190415	1900807-11	Sediment	04/15/19
T4-PDI2019-SG51-190417	1900807-12	Sediment	04/17/19
T4-PDI2019-SG52-190417	1900807-13	Sediment	04/17/19
T4-PDI2019-SG53-190416	1900807-14	Sediment	04/16/19
T4-PDI2019-SG54-190416	1900807-15	Sediment	04/16/19
T4-PDI2019-SG57-190417	1900807-16	Sediment	04/17/19
T4-PDI2019-SG58-190417**	1900807-17**	Sediment	04/17/19
T4-PDI2019-SG59-190417**	1900807-18**	Sediment	04/17/19
FD-201904171301	1900807-19	Sediment	04/17/19
T4-PDI2019-SG60-190417	1900807-20	Sediment	04/17/19
T4-PDI2019-SG61-190416	1900807-21	Sediment	04/16/19
T4-PDI2019-SG59-190417DUP	1900807-18DUP	Sediment	04/17/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

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

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

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

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

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

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

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

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

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

I. Sample Receipt and Technical Holding Times

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

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

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

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

III. Initial Calibration and Initial Calibration Verification

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

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

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

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

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

VI. Field Blanks

Sample RB-201904171558 was identified as a rinsate blank. No contaminants were found.

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

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

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

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG59-190417DUP (T4-PDI2019-SG59-190417**)	1,2,3,7,8,9-HxCDD	-	14.9 ng/Kg (≤9.86)	1,2,3,7,8,9-HxCDD	J (all detects)	A
	2,3,4,7,8-PeCDF	-	10.3 ng/Kg (≤9.86)	2,3,4,7,8-PeCDF	J (all detects)	
	1,2,3,6,7,8-HxCDD	108 (≤35)	-	1,2,3,6,7,8-HxCDD	J (all detects)	
	1,2,3,4,6,7,8-HpCDD	137 (≤35)	-	1,2,3,4,6,7,8-HpCDD	J (all detects)	
	OCDD	130 (≤35)	-	OCDD	J (all detects)	
	1,2,3,4,7,8-HxCDF	86.4 (≤35)	-	1,2,3,4,7,8-HxCDF	J (all detects)	
	1,2,3,4,6,7,8-HpCDF	87.1 (≤35)	-	1,2,3,4,6,7,8-HpCDF	J (all detects)	
	1,2,3,4,7,8,9-HpCDF	88.1 (≤35)	-	1,2,3,4,7,8,9-HpCDF	J (all detects)	
	OCDF	83.4 (≤35)	-	OCDF	J (all detects)	
				Total HxCDD	J (all detects)	
				Total HpCDD	J (all detects)	
				Total TCDF	J (all detects)	
				Total HxCDF	J (all detects)	
				Total HpCDF	J (all detects)	

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201904151441 and T4-PDI2019-SG18-190415 and samples FD-201904171301 and T4-PDI2019-SG60-190417 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
1,2,3,7,8-PeCDD	0.315U	0.305	Not calculable

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
1,2,3,4,7,8-HxCDD	0.667	0.551	19 (≤50)
1,2,3,6,7,8-HxCDD	2.62	2.22	17 (≤50)
1,2,3,7,8,9-HxCDD	1.54	0.894	53 (≤50)
1,2,3,4,6,7,8-HpCDD	65.9	48.6	30 (≤50)
OCDD	563	565	0 (≤50)
2,3,7,8-TCDF	0.463	0.390	17 (≤50)
1,2,3,7,8-PeCDF	0.499	0.505	1 (≤50)
2,3,4,7,8-PeCDF	0.675	0.352	63 (≤50)
1,2,3,4,7,8-HxCDF	1.77	1.78	1 (≤50)
1,2,3,6,7,8-HxCDF	0.557	0.686	21 (≤50)
2,3,4,6,7,8-HxCDF	0.729	0.611	18 (≤50)
1,2,3,4,6,7,8-HpCDF	17.5	8.96	65 (≤50)
1,2,3,4,7,8,9-HpCDF	1.23	0.847	37 (≤50)
OCDF	54.6	26.8	68 (≤50)
Total TCDD	0.850	0.801	6 (≤50)
Total PeCDD	1.55	1.37	12 (≤50)
Total HxCDD	19.9	15.9	22 (≤50)
Total HpCDD	156	130	18 (≤50)
Total TCDF	1.97	1.23	46 (≤50)
Total PeCDF	5.24	4.74	10 (≤50)
Total HxCDF	19.2	15.0	25 (≤50)
Total HpCDF	60.9	26.6	78 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
1,2,3,7,8-PeCDD	1.24	0.188U	Not calculable
1,2,3,4,7,8-HxCDD	3.36	0.492U	Not calculable
1,2,3,6,7,8-HxCDD	29.2	3.57	156 (≤50)
1,2,3,7,8,9-HxCDD	7.62	1.10	150 (≤50)
1,2,3,4,6,7,8-HpCDD	1550	204	153 (≤50)
OCDD	20600	2350	159 (≤50)
2,3,7,8-TCDF	1.21	0.179U	Not calculable
1,2,3,7,8-PeCDF	2.61	0.348U	Not calculable
2,3,4,7,8-PeCDF	4.82	0.757	146 (≤50)
1,2,3,4,7,8-HxCDF	36.1	3.10	168 (≤50)
1,2,3,6,7,8-HxCDF	7.87	0.623	171 (≤50)
2,3,4,6,7,8-HxCDF	7.76	0.816	162 (≤50)
1,2,3,7,8,9-HxCDF	4.69	0.503	161 (≤50)
1,2,3,4,6,7,8-HpCDF	264	28.4	161 (≤50)
1,2,3,4,7,8,9-HpCDF	19.2	2.23	158 (≤50)
OCDF	1820	181	164 (≤50)
Total TCDD	3.08	0.276	167 (≤50)
Total PeCDD	11.5	0.393	187 (≤50)
Total HxCDD	269	40.0	148 (≤50)
Total HpCDD	4170	580	151 (≤50)
Total TCDF	3.83	0.179U	Not calculable
Total PeCDF	60.6	5.47	167 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
Total HxCDF	306	30.8	163 (≤50)
Total HpCDF	1340	142	162 (≤50)

X. Labeled Compounds

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

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
T4-PDI2019-SG08-190415 T4-PDI2019-SG13-190415 FD-201904151441 T4-PDI2019-SG18-190415 T4-PDI2019-SG51-190417 T4-PDI2019-SG52-190417 T4-PDI2019-SG53-190416 T4-PDI2019-SG54-190416 T4-PDI2019-SG57-190417 T4-PDI2019-SG58-190417** T4-PDI2019-SG59-190417** FD-201904171301 T4-PDI2019-SG60-190417 T4-PDI2019-SG61-190416	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Sample	Compound	Finding	Criteria	Flag	A or P
T4-PDI2019-SG59-190417** FD-201904171301	OCDD	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	P

For samples T4-PDI2019-SG13-190415, FD-201904151441, T4-PDI2019-SG18-190415, T4-PDI2019-SG59-190417**, and T4-PDI2019-SG61-190416, 2nd column confirmation was not performed for 2,3,7,8-TCDF by the laboratory since the results were either less than the reporting limit or EMPC.

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and difference, results reported as EMPC, and results exceeding calibration range, data were qualified as estimated in fourteen samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1900807

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG59-190417**	1,2,3,7,8,9-HxCDD 2,3,4,7,8-PeCDF	J (all detects) J (all detects)	A	Duplicate sample analysis (difference)
T4-PDI2019-SG59-190417**	1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDD OCDD 1,2,3,4,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF OCDF Total HxCDD Total HpCDD Total TCDF Total HxCDF Total HpCDF	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG08-190415 T4-PDI2019-SG13-190415 FD-201904151441 T4-PDI2019-SG18-190415 T4-PDI2019-SG51-190417 T4-PDI2019-SG52-190417 T4-PDI2019-SG53-190416 T4-PDI2019-SG54-190416 T4-PDI2019-SG57-190417 T4-PDI2019-SG58-190417** T4-PDI2019-SG59-190417** FD-201904171301 T4-PDI2019-SG60-190417 T4-PDI2019-SG61-190416	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)
T4-PDI2019-SG59-190417** FD-201904171301	OCDD	J (all detects)	P	Compound quantitation (exceeded range)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1900807

No Sample Data Qualified in this SDG

LDC #: 45526A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/5/19
SDG #: 1900807 Stage 2B/4 Page: 1 of 2
Laboratory: Vista Analytical Laboratory Reviewer: [illegible]
2nd Reviewer: [illegible]

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

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20/35 IV ≤ QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	RB = 1
VII.	Matrix spike/Matrix spike duplicates /DUP	N/SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 4+5, 13+14
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	RB-201904171558	1900807-01	Water	04/17/19
2	T4-PDI2019-SG08-190415	1900807-04	Sediment	04/15/19
3	T4-PDI2019-SG13-190415	1900807-06	Sediment	04/15/19
4	FD-201904151441	1900807-10	Sediment	04/15/19
5	T4-PDI2019-SG18-190415	1900807-11	Sediment	04/15/19
6	T4-PDI2019-SG51-190417	1900807-12	Sediment	04/17/19
7	T4-PDI2019-SG52-190417	1900807-13	Sediment	04/17/19
8	T4-PDI2019-SG53-190416	1900807-14	Sediment	04/16/19
9	T4-PDI2019-SG54-190416	1900807-15	Sediment	04/16/19
10	T4-PDI2019-SG57-190417	1900807-16	Sediment	04/17/19
11	T4-PDI2019-SG58-190417**	1900807-17**	Sediment	04/17/19
12	T4-PDI2019-SG59-190417**	1900807-18**	Sediment	04/17/19
13	FD-201904171301	1900807-19	Sediment	04/17/19
14	T4-PDI2019-SG60-190417	1900807-20	Sediment	04/17/19

LDC #: 45526A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/5/19
SDG #: 1900807 Stage 2B/4 Page: 2 of 2
Laboratory: Vista Analytical Laboratory Reviewer: 9
2nd Reviewer:

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

15	T4-PDI2019-SG61-190416	1900807-21	Sediment	04/16/19
16	T4-PDI2019-SG59-190417DUP	1900807-18DUP	Sediment	04/17/19
17				
18				
19				

Notes:

	B9D0246						
	B9E0111						

LDC #: 45526A21

VALIDATION FINDINGS CHECKLIST

Reviewer: 9
2nd Reviewer: [illegible]

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

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

LDC #: 45526A21

VALIDATION FINDINGS CHECKLIST

Reviewer: AL
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compounds within the 25-150% criteria?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?		✓		
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

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

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

Notes:_____

LDC #: 45526A21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Page: 6 of 1
Reviewer:
2nd Reviewer:

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

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 35?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		16	Sd	Su	unbracketed for RPD	12 (dets)	J dets/A + (S,T,U,V-Y)
					Difference		
				E	14.9 (≤9.86)		
				J	10.3		

Sample ID: Duplicate **EPA Method 1613B**

Source Client ID: T4-PDI2019-SG59-190417
Source LabNumber: 1900807-18
Matrix: Solid

Duplicate Lab Sample: B9E0111-DUP1

≤35

Analyte		Dup Conc. (ng/Kg)	Source Conc.	RPD	RPD Limits
2,3,7,8-TCDD		ND	ND	NA	25
1,2,3,7,8-PeCDD	B	2.15	0.911	**81.1** *	25
1,2,3,4,7,8-HxCDD	C	8.86	2.84	**103** *	25
1,2,3,6,7,8-HxCDD	D	74.5	22.3	**108**	25
1,2,3,7,8,9-HxCDD	E	20.8	5.95	**111** diff out	25
1,2,3,4,6,7,8-HpCDD	F	6970	1310	**137**	25
OCDD	G	65000	13900	**130**	25
2,3,7,8-TCDF	H	2.41	0.889	**92.0** *	25
1,2,3,7,8-PeCDF	I	5.67	1.77	**105** *	25
2,3,4,7,8-PeCDF	J	16.1	5.76	**94.7** diff out	25
1,2,3,4,7,8-HxCDF	K	63.5	25.2	**86.4**	25
1,2,3,6,7,8-HxCDF	L	13.2	5.05	**89.0** *	25
2,3,4,6,7,8-HxCDF	M	15.1	5.91	**87.4** *	25
1,2,3,7,8,9-HxCDF	N	4.59	2.64	**54.1** *	25
1,2,3,4,6,7,8-HpCDF	O	511	201	**87.1**	25
1,2,3,4,7,8,9-HpCDF	P	38.3	14.9	**88.1**	25
OCDF	Q	3290	1350	**83.4**	25

	Labeled Standard	Dup %R	Source %R	LCL-UCL
IS	13C-2,3,7,8-TCDD	80.5	92.7	25 - 164
	13C-1,2,3,7,8-PeCDD	81.5	95.8	25 - 181
	13C-1,2,3,4,7,8-HxCDD	74.6	79.9	32 - 141
	13C-1,2,3,6,7,8-HxCDD	70.8	79.6	28 - 130
	13C-1,2,3,7,8,9-HxCDD	73.7	78.7	32 - 141
	13C-1,2,3,4,6,7,8-HpCDD	99.1	84.6	23 - 140
	13C-OCDD	94.7	85.7	17 - 157
	13C-2,3,7,8-TCDF	81.3	82.7	24 - 169
	13C-1,2,3,7,8-PeCDF	79.9	90.0	24 - 185
	13C-2,3,4,7,8-PeCDF	79.8	84.3	21 - 178
	13C-1,2,3,4,7,8-HxCDF	75.7	90.3	26 - 152
	13C-1,2,3,6,7,8-HxCDF	77.1	89.2	26 - 123
	13C-2,3,4,6,7,8-HxCDF	78.8	89.2	28 - 136
	13C-1,2,3,7,8,9-HxCDF	81.8	86.2	29 - 147
	13C-1,2,3,4,6,7,8-HpCDF	97.0	90.3	28 - 143
	13C-1,2,3,4,7,8,9-HpCDF	104	99.2	26 - 138
	13C-OCDF	97.1	87.4	17 - 157
CRS	37Cl-2,3,7,8-TCDD	90.3	88.8	35 - 197

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.

* No qual; difference in

LDC#:45526A21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA SW 846 Method 8290)

Compound	Concentration (ng/Kg) 4	Concentration (ng/Kg) 5	RPD (≤50)	
B	0.315U	0.305*	NC	
C	0.667	0.551	19	
D	2.62	2.22	17	
E	1.54	0.894	53	
F	65.9	48.6	30	
G	563	565	0	
H	0.463*	0.390*	17	
I	0.499	0.505	1	
J	0.675	0.352*	63	
K	1.77	1.78	1	
L	0.557	0.686	21	
M	0.729	0.611	18	
O	17.5	8.96	65	
P	1.23	0.847	37	
Q	54.6	26.8	68	
R	0.850*	0.801	6	
S	1.55*	1.37*	12	
T	19.9	15.9*	22	
U	156	130	18	
V	1.97*	1.23*	46	
W	5.24*	4.74*	10	
X	19.2	15.0	25	
Y	60.9	26.6	78	

*EMPC

LDC#:45526A21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: M
2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA SW 846 Method 8290)

Compound	Concentration (ng/Kg)		RPD (≤50)	
	13	14		
B	1.24	0.188U	NC	
C	3.36	0.492U	NC	
D	29.2	3.57	156	
E	7.62	1.10	150	
F	1550	204	153	
G	20600	2350	159	
H	1.21	0.179U	NC	
I	2.61	0.348U	NC	
J	4.82	0.757	146	
K	36.1	3.10	168	
L	7.87	0.623*	171	
M	7.76	0.816	162	
N	4.69	0.503	161	
O	264	28.4	161	
P	19.2	2.23	158	
Q	1820	181	164	
R	3.08	0.276*	167	
S	11.5*	0.393*	187	
T	269	40.0	148	
U	4170	580	151	
V	3.83*	0.179U	NC	
W	60.6*	5.47	167	
X	306	30.8*	163	
Y	1340	142	162	

LDC #: 45526A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		2-10, 11-15	All compounds reported as estimated		Jdets/A
			maximum possible concentration (EMPC)		
		12, 13	G > calib range		Jdets/P
		3-5, 12, 15	H not confirmed		text
			when < QL or EMPC		

Comments: See sample calculation verification worksheet for recalculations lower (lab SOP) H value b/w 2 columns reported

LDC #: 45526A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10/50/100 std)	Recalculated RRF (10/50/100 std)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.87	0.87	5.57	5.43
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.86	0.87	6.57	6.70
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.86	0.86	8.35	8.10
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.99	0.98	10.09	10.06
			OCDF (^{13}C-OCDF)	0.94	0.94	0.97	0.97	12.29	12.28
2	ICAL	5/30/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.9476	0.9483	0.87	0.87	9.58	9.65
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45526A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: M
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190520D19	5/20/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	9.74	9.79		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	11.5	11.6		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	50.7	50.8		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	47.7	47.6		
			OCDF (^{13}C-OCDF)	0.94	94.4	94.4		
2	190520D28I	5/21/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	↓	10.5	10.5		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)		10.5	10.5		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)		52.7	52.7		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)		50.6	50.5		
			OCDF (^{13}C-OCDF)		107	107		
3	190617D10	6/17/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.9476	9.9	9.9		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45526A21

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9E0111-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		OPR Percent Recovery		OPRD Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	40.0		52.2		131	131				
1,2,3,7,8-PeCDD	200		237		119	119				
1,2,3,4,7,8-HxCDD			235		117	118				
1,2,3,4,7,8,9-HpCDF			209		104	105				
OCDF	400		428		107	107				

LDC #: 45526A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 11, F:

Conc. = $\frac{(1.526)(2000)(\quad)}{(6.126)(0.99)(15.82)(0.326)}$

= 97.3 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	11	F	97.8	97.3	–

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1900807

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201904171558	1900807-01	Water	04/17/19
T4-PDI2019-SG05-190417	1900807-02	Sediment	04/17/19
T4-PDI2019-SG06-190417	1900807-03	Sediment	04/17/19
T4-PDI2019-SG08-190415	1900807-04	Sediment	04/15/19
T4-PDI2019-SG11-190415	1900807-05	Sediment	04/15/19
T4-PDI2019-SG13-190415	1900807-06	Sediment	04/15/19
T4-PDI2019-SG15-190416	1900807-07	Sediment	04/16/19
T4-PDI2019-SG16-190416	1900807-08	Sediment	04/16/19
T4-PDI2019-SG17-190416	1900807-09	Sediment	04/16/19
FD-201904151441	1900807-10	Sediment	04/15/19
T4-PDI2019-SG18-190415	1900807-11	Sediment	04/15/19
T4-PDI2019-SG51-190417	1900807-12	Sediment	04/17/19
T4-PDI2019-SG52-190417	1900807-13	Sediment	04/17/19
T4-PDI2019-SG53-190416	1900807-14	Sediment	04/16/19
T4-PDI2019-SG54-190416	1900807-15	Sediment	04/16/19
T4-PDI2019-SG57-190417	1900807-16	Sediment	04/17/19
T4-PDI2019-SG58-190417**	1900807-17**	Sediment	04/17/19
T4-PDI2019-SG59-190417**	1900807-18**	Sediment	04/17/19
FD-201904171301	1900807-19	Sediment	04/17/19
T4-PDI2019-SG60-190417	1900807-20	Sediment	04/17/19
T4-PDI2019-SG61-190416	1900807-21	Sediment	04/16/19
T4-PDI2019-SG59-190417DUP	1900807-18DUP	Sediment	04/17/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all congeners. The chromatographic resolution between the congeners PCB-23 and PCB-34 and congeners PCB-182 and PCB-187 was resolved with a valley of less than or equal to 40%.

The static resolving power was less than or equal to 10,000 (10% valley definition) at m/z 330.9792 and greater than or equal to 8000 throughout the mass range.

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF within QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
B9E0099-BLK1	05/15/19	PCB-1 PCB-11 PCB-16/32 PCB-18 PCB-28 PCB-31 PCB-41/64/71/72 PCB-42/59 PCB-43/49 PCB-44 PCB-47 PCB-51 PCB-52/69 PCB-61/70 PCB-68 PCB-110 PCB-138/163/164 PCB-139/149 PCB-153 PCB-194 PCB-208 PCB-209	0.356 pg/L 4.91 pg/L 1.06 pg/L 0.642 pg/L 0.957 pg/L 0.726 pg/L 0.638 pg/L 0.278 pg/L 0.597 pg/L 0.686 pg/L 4.91 pg/L 0.759 pg/L 0.743 pg/L 0.480 pg/L 0.710 pg/L 0.670 pg/L 0.491 pg/L 0.497 pg/L 0.364 pg/L 0.546 pg/L 0.218 pg/L 0.379 pg/L	All water samples in SDG 1900807
B9F0009-BLK1	06/03/19	PCB-1 PCB-16/32 PCB-47 PCB-153 PCB-193	0.000880 ug/Kg 0.000580 ug/Kg 0.00102 ug/Kg 0.00132 ug/Kg 0.000545 ug/Kg	All soil samples in SDG 1900807

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
RB-201904171558	PCB-1	0.883 pg/L	0.883U pg/L
	PCB-11	3.92 pg/L	3.92U pg/L
	PCB-16/32	1.49 pg/L	1.49U pg/L
	PCB-18	1.71 pg/L	1.71U pg/L
	PCB-28	1.64 pg/L	1.64U pg/L
	PCB-31	1.30 pg/L	1.30U pg/L
	PCB-41/64/71/72	1.25 pg/L	1.25U pg/L
	PCB-42/59	0.644 pg/L	0.644U pg/L
	PCB-43/49	0.911 pg/L	0.911U pg/L
	PCB-44	1.04 pg/L	1.04U pg/L
	PCB-47	12.6 pg/L	12.6U pg/L
	PCB-51	1.22 pg/L	1.22U pg/L
	PCB-52/69	1.12 pg/L	1.12U pg/L
	PCB-61/70	0.839 pg/L	0.839U pg/L
	PCB-68	2.21 pg/L	2.21U pg/L
	PCB-138/163/164	1.03 pg/L	1.03U pg/L
	PCB-139/149	1.07 pg/L	1.07U pg/L
	PCB-153	0.785 pg/L	0.785U pg/L
	PCB-194	0.574 pg/L	0.574U pg/L
	PCB-208	0.154 pg/L	0.154U pg/L
	PCB-209	0.155 pg/L	0.155U pg/L
T4-PDI2019-SG05-190417	PCB-1	0.00218 ug/Kg	0.00218U ug/Kg
	PCB-16/32	0.00282 ug/Kg	0.00282U ug/Kg
	PCB-193	0.00117 ug/Kg	0.00117U ug/Kg
T4-PDI2019-SG15-190416	PCB-193	0.00174 ug/Kg	0.00174U ug/Kg
T4-PDI2019-SG16-190416	PCB-1	0.00383 ug/Kg	0.00383U ug/Kg
FD-201904151441	PCB-1	0.00291 ug/Kg	0.00291U ug/Kg
T4-PDI2019-SG18-190415	PCB-1	0.00253 ug/Kg	0.00253U ug/Kg
T4-PDI2019-SG51-190417	PCB-193	0.000847 ug/Kg	0.000847U ug/Kg
T4-PDI2019-SG52-190417	PCB-193	0.000756 ug/Kg	0.000756U ug/Kg
T4-PDI2019-SG53-190416	PCB-193	0.00213 ug/Kg	0.00213U ug/Kg
T4-PDI2019-SG57-190417	PCB-1	0.0044 ug/Kg	0.0044U ug/Kg
T4-PDI2019-SG58-190417**	PCB-1	0.00374 ug/Kg	0.00374U ug/Kg
FD-201904171301	PCB-193	0.00179 ug/Kg	0.00179U ug/Kg

VI. Field Blanks

Sample RB-201904171558 was identified as a rinsate blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration
RB-201904171558	04/17/19	PCB-1	0.883 pg/L
		PCB-5/8	1.74 pg/L
		PCB-11	3.92 pg/L
		PCB-16/32	1.49 pg/L
		PCB-17	0.764 pg/L
		PCB-18	1.71 pg/L
		PCB-20/21/33	1.20 pg/L
		PCB-22	0.510 pg/L
		PCB-28	1.64 pg/L
		PCB-31	1.30 pg/L
		PCB-38	0.426 pg/L
		PCB-41/64/71/72	1.25 pg/L
		PCB-42/59	0.644 pg/L
		PCB-43/49	0.911 pg/L
		PCB-44	1.04 pg/L
		PCB-45	0.330 pg/L
		PCB-47	12.6 pg/L
		PCB-48/75	0.246 pg/L
		PCB-51	1.22 pg/L
		PCB-52/69	1.12 pg/L
		PCB-56/60	0.445 pg/L
		PCB-61/70	0.839 pg/L
		PCB-66/76	0.416 pg/L
		PCB-68	2.21 pg/L
		PCB-74	0.331 pg/L
		PCB-95/98/102	1.33 pg/L
		PCB-132/161	0.204 pg/L
		PCB-136	0.257 pg/L
		PCB-138/163/164	1.03 pg/L
		PCB-139/149	1.07 pg/L
		PCB-141	0.251 pg/L
		PCB-146/165	0.244 pg/L
		PCB-151	0.621 pg/L
		PCB-153	0.785 pg/L
		PCB-155	0.177 pg/L
		PCB-174	0.369 pg/L
		PCB-179	0.244 pg/L
		PCB-180	0.532 pg/L
		PCB-182/187	0.457 pg/L
		PCB-194	0.574 pg/L
		PCB-208	0.154 pg/L
		PCB-209	0.155 pg/L

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Flag	A or P
T4-PDI2019-SG59-190417DUP (T4-PDI2019-SG59-190417**)	PCB-2	-	0.0115 (≤0.00982)	J (all detects)	A
	PCB-4/10	-	0.0497 (≤0.01962)	J (all detects)	
	PCB-5/8	104 (≤35)	-	J (all detects)	
	PCB-6	-	0.0365 (≤0.00982)	J (all detects)	
	PCB-11	115 (≤35)	-	J (all detects)	
	PCB-12/13	-	0.03175 (≤0.01962)	J (all detects)	
	PCB-15	137 (≤35)	-	J (all detects)	
	PCB-16/32	115 (≤35)	-	J (all detects)	
	PCB-17	108 (≤35)	-	J (all detects)	
	PCB-18	106 (≤35)	-	J (all detects)	
	PCB-19	-	0.0406 (≤0.00982)	J (all detects)	
	PCB-20/21/33	129 (≤35)	-	J (all detects)	
	PCB-22	127 (≤35)	-	J (all detects)	
	PCB-24/27	-	0.0211 (≤0.01962)	J (all detects)	
	PCB-25	-	0.0397 (≤0.00982)	J (all detects)	
	PCB-26	111 (≤35)	-	J (all detects)	
	PCB-28	122 (≤35)	-	J (all detects)	
	PCB-31	133 (≤35)	-	J (all detects)	
	PCB-35	-	0.01184 (≤0.00982)	J (all detects)	
	PCB-37	120 (≤35)	-	J (all detects)	
	PCB-40	-	0.0799 (≤0.00982)	J (all detects)	
	PCB-41/64/71/72	98.5 (≤35)	-	J (all detects)	
	PCB-42/59	108 (≤35)	-	J (all detects)	
	PCB-43/49	123 (≤35)	-	J (all detects)	
	PCB-44	106 (≤35)	-	J (all detects)	
	PCB-45	-	0.056 (≤0.00982)	J (all detects)	
	PCB-46	-	0.0219 (≤0.00982)	J (all detects)	
	PCB-47	122 (≤35)	-	J (all detects)	
	PCB-48/75	-	0.0746 (≤0.01962)	J (all detects)	
	PCB-51	-	0.0327 (≤0.00982)	J (all detects)	
	PCB-52/69	101 (≤35)	-	J (all detects)	
	PCB-53	86.6 (≤35)	-	J (all detects)	
	PCB-56/60	119 (≤35)	-	J (all detects)	
	PCB-61/70	111 (≤35)	-	J (all detects)	
	PCB-63	-	0.01609 (≤0.00982)	J (all detects)	
	PCB-66/76	117 (≤35)	-	J (all detects)	
	PCB-67	-	0.01147 (≤0.00982)	J (all detects)	
	PCB-74	105 (≤35)	-	J (all detects)	
	PCB-77	-	0.0504 (≤0.00982)	J (all detects)	
	PCB-82	90.4 (≤35)	-	J (all detects)	
	PCB-84/92	99.8 (≤35)	-	J (all detects)	
	PCB-85/116	-	0.1101 (≤0.01962)	J (all detects)	
	PCB-87/117/125	99.5 (≤35)	-	J (all detects)	
	PCB-88/91	-	0.1198 (≤0.01962)	J (all detects)	
	PCB-90/101	97.4 (≤35)	-	J (all detects)	
	PCB-95/98/102	89.7 (≤35)	-	J (all detects)	
	PCB-97	91.1 (≤35)	-	J (all detects)	
	PCB-99	110 (≤35)	-	J (all detects)	
	PCB-103	-	0.01502 (≤0.00982)	J (all detects)	
	PCB-105	104 (≤35)	-	J (all detects)	
	PCB-106/118	104 (≤35)	-	J (all detects)	
	PCB-107/109	-	0.0464 (≤0.01962)	J (all detects)	
	PCB-110	86 (≤35)	-	J (all detects)	
	PCB-114	-	0.01513 (≤0.00982)	J (all detects)	
	PCB-124	-	0.0234 (≤0.00982)	J (all detects)	
	PCB-128/162	74.3 (≤35)	-	J (all detects)	
	PCB-129	-	0.0439 (≤0.00982)	J (all detects)	
	PCB-130	93 (≤35)	-	J (all detects)	
	PCB-131/133	-	0.026 (≤0.01962)	J (all detects)	
	PCB-132/161	104 (≤35)	-	J (all detects)	
	PCB-134/143	-	0.0566 (≤0.01962)	J (all detects)	
	PCB-135	98.5 (≤35)	-	J (all detects)	
	PCB-136	111 (≤35)	-	J (all detects)	
	PCB-137	77.2 (≤35)	-	J (all detects)	
	PCB-138/163/164	110 (≤35)	-	J (all detects)	
	PCB-139/149	118 (≤35)	-	J (all detects)	
	PCB-141	103 (≤35)	-	J (all detects)	

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Flag	A or P
T4-PDI2019-SG59-190417DUP (T4-PDI2019-SG59-190417**)	PCB-144	-	0.0413 (≤0.00982)	J (all detects)	A
	PCB-146/165	106 (≤35)	-	J (all detects)	
	PCB-147	-	0.0215 (≤0.00982)	J (all detects)	
	PCB-151	127 (≤35)	-	J (all detects)	
	PCB-153	111 (≤35)	-	J (all detects)	
	PCB-154	-	0.02416 (≤0.00982)	J (all detects)	
	PCB-156	104 (≤35)	-	J (all detects)	
	PCB-157	-	0.0219 (≤0.00982)	J (all detects)	
	PCB-158/160	93.6 (≤35)	-	J (all detects)	
	PCB-167	-	0.0417 (≤0.00982)	J (all detects)	
	PCB-170	125 (≤35)	-	J (all detects)	
	PCB-171	-	0.0867 (≤0.00982)	J (all detects)	
	PCB-172	-	0.0456 (≤0.00982)	J (all detects)	
	PCB-174	103 (≤35)	-	J (all detects)	
	PCB-176	-	0.037 (≤0.00982)	J (all detects)	
	PCB-177	130 (≤35)	-	J (all detects)	
	PCB-178	-	0.0684 (≤0.00982)	J (all detects)	
	PCB-179	113 (≤35)	-	J (all detects)	
	PCB-180	125 (≤35)	-	J (all detects)	
	PCB-182/187	135 (≤35)	-	J (all detects)	
	PCB-183	143 (≤35)	-	J (all detects)	
	PCB-185	-	0.03 (≤0.00982)	J (all detects)	
	PCB-190	-	0.0489 (≤0.00982)	J (all detects)	
	PCB-193	-	0.03513 (≤0.00982)	J (all detects)	
	PCB-194	116 (≤35)	-	J (all detects)	
	PCB-195	-	0.0663 (≤0.00982)	J (all detects)	
	PCB-196/203	132 (≤35)	-	J (all detects)	
	PCB-199	126 (≤35)	-	J (all detects)	
	PCB-206	138 (≤35)	-	J (all detects)	
	PCB-208	-	0.0433 (≤0.00982)	J (all detects)	
	PCB-209	151 (≤35)	-	J (all detects)	

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201904151441 and T4-PDI2019-SG18-190415 and samples FD-201904171301 and T4-PDI2019-SG60-190417 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-1	0.00291	0.00253	14 (≤50)
PCB-2	0.00380	0.00321	17 (≤50)
PCB-3	0.00262	0.00270	3 (≤50)
PCB-4/10	0.00555	0.00697	23 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-5/8	0.0133	0.0160	18 (≤50)
PCB-6	0.00356	0.00422	17 (≤50)
PCB-7/9	0.000299U	0.00128	Not calculable
PCB-11	0.0162	0.0180	11 (≤50)
PCB-12/13	0.000258U	0.00318	Not calculable
PCB-15	0.0126	0.0140	11 (≤50)
PCB-16/32	0.0180	0.0206	13 (≤50)
PCB-17	0.0133	0.0160	18 (≤50)
PCB-18	0.0211	0.0262	22 (≤50)
PCB-19	0.00683	0.00771	12 (≤50)
PCB-20/21/33	0.0284	0.0314	10 (≤50)
PCB-22	0.0130	0.0166	24 (≤50)
PCB-24/27	0.00253	0.00307	19 (≤50)
PCB-25	0.00676	0.00803	17 (≤50)
PCB-26	0.0130	0.0148	13 (≤50)
PCB-28	0.0527	0.0628	17 (≤50)
PCB-29	0.000365U	0.000299	Not calculable
PCB-31	0.0412	0.0493	18 (≤50)
PCB-34	0.000655	0.000764	15 (≤50)
PCB-35	0.00145	0.00146	1 (≤50)
PCB-36	0.000246U	0.000374	Not calculable
PCB-37	0.0197	0.0218	10 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-38	0.000936	0.00133	35 (≤50)
PCB-39	0.000447	0.000443	1 (≤50)
PCB-40	0.0110	0.0105	5 (≤50)
PCB-41/64/71/72	0.0569	0.0609	7 (≤50)
PCB-42/59	0.0219	0.0261	18 (≤50)
PCB-43/49	0.0891	0.0977	9 (≤50)
PCB-44	0.0626	0.0757	19 (≤50)
PCB-45	0.00697	0.00839	18 (≤50)
PCB-46	0.00323	0.00515	46 (≤50)
PCB-47	0.0532	0.0601	12 (≤50)
PCB-48/75	0.00941	0.0126	29 (≤50)
PCB-50	0.000240U	0.000382	Not calculable
PCB-51	0.0116	0.0104	11 (≤50)
PCB-52/69	0.0967	0.110	13 (≤50)
PCB-53	0.0157	0.0156	1 (≤50)
PCB-54	0.00205	0.00209	2 (≤50)
PCB-55	0.00137	0.00146	6 (≤50)
PCB-56/60	0.0388	0.0442	13 (≤50)
PCB-57	0.000798	0.000766	4 (≤50)
PCB-58	0.000944	0.000763	21 (≤50)
PCB-61/70	0.0999	0.114	13 (≤50)
PCB-63	0.00335	0.00373	11 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-66/76	0.0829	0.0913	10 (≤50)
PCB-67	0.00195	0.00235	19 (≤50)
PCB-68	0.00169	0.00284	51 (≤50)
PCB-73	0.000565	0.000895	45 (≤50)
PCB-74	0.0305	0.0363	17 (≤50)
PCB-77	0.00981	0.00977	0 (≤50)
PCB-78	0.000357	0.000513	36 (≤50)
PCB-79	0.00310	0.00343	10 (≤50)
PCB-81	0.00156	0.00182	15 (≤50)
PCB-82	0.0141	0.0170	19 (≤50)
PCB-84/92	0.0892	0.103	14 (≤50)
PCB-85/116	0.0226	0.0279	21 (≤50)
PCB-87/117/125	0.0471	0.0583	21 (≤50)
PCB-88/91	0.0368	0.0415	12 (≤50)
PCB-89	0.00110	0.00175	46 (≤50)
PCB-90/101	0.238	0.264	10 (≤50)
PCB-94	0.00181	0.00194	7 (≤50)
PCB-95/98/102	0.149	0.166	11 (≤50)
PCB-96	0.00115	0.00110	4 (≤50)
PCB-97	0.0490	0.0579	17 (≤50)
PCB-99	0.0882	0.103	15 (≤50)
PCB-100	0.00668	0.00745	11 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-103	0.00740	0.00898	19 (≤50)
PCB-104	0.000647	0.000561	14 (≤50)
PCB-105	0.0483	0.0582	19 (≤50)
PCB-106/118	0.148	0.171	14 (≤50)
PCB-107/109	0.0140	0.0156	11 (≤50)
PCB-108/112	0.00759	0.00903	17 (≤50)
PCB-110	0.199	0.227	13 (≤50)
PCB-111/115	0.00205	0.00245	18 (≤50)
PCB-113	0.000909	0.000859	6 (≤50)
PCB-114	0.00284	0.00347	20 (≤50)
PCB-119	0.00986	0.0110	11 (≤50)
PCB-120	0.00218	0.00198	10 (≤50)
PCB-122	0.00190	0.00199	5 (≤50)
PCB-123	0.00198	0.00278	34 (≤50)
PCB-124	0.00559	0.00740	28 (≤50)
PCB-126	0.000918	0.00105	13 (≤50)
PCB-128/162	0.0349	0.0370	6 (≤50)
PCB-129	0.00990	0.0114	14 (≤50)
PCB-130	0.0203	0.0220	8 (≤50)
PCB-131/133	0.0101	0.0125	21 (≤50)
PCB-132/161	0.0822	0.0800	3 (≤50)
PCB-134/143	0.0156	0.0159	2 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-135	0.0548	0.0554	1 (≤50)
PCB-136	0.0563	0.0526	7 (≤50)
PCB-137	0.00987	0.0107	8 (≤50)
PCB-138/163/164	0.280	0.287	2 (≤50)
PCB-139/149	0.299	0.308	3 (≤50)
PCB-140	0.00353	0.00438	21 (≤50)
PCB-141	0.0648	0.0585	10 (≤50)
PCB-144	0.0148	0.0144	3 (≤50)
PCB-146/165	0.0644	0.0708	9 (≤50)
PCB-147	0.00886	0.0107	19 (≤50)
PCB-148	0.00224	0.00295	27 (≤50)
PCB-150	0.00269	0.00301	11 (≤50)
PCB-151	0.101	0.103	2 (≤50)
PCB-152	0.000379	0.000520	31 (≤50)
PCB-153	0.308	0.317	3 (≤50)
PCB-154	0.0125	0.0156	22 (≤50)
PCB-155	0.000283	0.000339	18 (≤50)
PCB-156	0.0248	0.0256	3 (≤50)
PCB-157	0.00435	0.00492	12 (≤50)
PCB-158/160	0.0271	0.0279	3 (≤50)
PCB-166	0.000596	0.000684	14 (≤50)
PCB-167	0.0105	0.0102	3 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-168	0.000756	0.000782	3 (≤50)
PCB-170	0.0989	0.0941	5 (≤50)
PCB-171	0.0298	0.0271	9 (≤50)
PCB-172	0.0165	0.0150	10 (≤50)
PCB-173	0.00221	0.00193	14 (≤50)
PCB-174	0.116	0.109	6 (≤50)
PCB-175	0.00499	0.00402	22 (≤50)
PCB-176	0.0166	0.0150	10 (≤50)
PCB-177	0.0665	0.0627	6 (≤50)
PCB-178	0.0256	0.0261	2 (≤50)
PCB-179	0.0506	0.0500	1 (≤50)
PCB-180	0.221	0.211	5 (≤50)
PCB-182/187	0.134	0.134	0 (≤50)
PCB-183	0.0581	0.0556	4 (≤50)
PCB-184	0.000274	0.000237	14 (≤50)
PCB-185	0.0127	0.0123	3 (≤50)
PCB-188	0.000347	0.000399	14 (≤50)
PCB-189	0.00380	0.00322	17 (≤50)
PCB-190	0.0211	0.0193	9 (≤50)
PCB-191	0.00367	0.00362	1 (≤50)
PCB-193	0.0136	0.0130	5 (≤50)
PCB-194	0.0489	0.0490	0 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904151441	T4-PDI2019-SG18-190415	
PCB-195	0.0210	0.0201	4 (≤50)
PCB-196/203	0.0607	0.0621	2 (≤50)
PCB-197	0.00198	0.00275	33 (≤50)
PCB-198	0.00276	0.00254	8 (≤50)
PCB-199	0.0553	0.0587	6 (≤50)
PCB-200	0.00705	0.00783	10 (≤50)
PCB-201	0.00696	0.00808	15 (≤50)
PCB-202	0.0103	0.0126	20 (≤50)
PCB-205	0.00237	0.00223	6 (≤50)
PCB-206	0.0402	0.0597	39 (≤50)
PCB-207	0.00338	0.00499	38 (≤50)
PCB-208	0.0159	0.0242	41 (≤50)
PCB-209	0.0530	0.108	68 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-001	0.00442	0.0118	91 (≤50)
PCB-002	0.00533	0.0221	122 (≤50)
PCB-003	0.00339	0.0115	109 (≤50)
PCB-004/010	0.00805	0.0347	125 (≤50)
PCB-005/008	0.0278	0.0984	112 (≤50)
PCB-006	0.00569	0.0219	118 (≤50)
PCB-007/009	0.000659U	0.0102	Not calculable

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-011	0.00735	0.0284	118 (≤50)
PCB-012/013	0.000629U	0.0115	Not calculable
PCB-015	0.0247	0.0790	105 (≤50)
PCB-016/032	0.0169	0.0748	126 (≤50)
PCB-017	0.0110	0.0501	128 (≤50)
PCB-018	0.0229	0.102	127 (≤50)
PCB-019	0.00507	0.0195	117 (≤50)
PCB-020/021/033	0.0289	0.116	120 (≤50)
PCB-022	0.0149	0.0620	122 (≤50)
PCB-024/027	0.00279	0.0120	125 (≤50)
PCB-025	0.00367	0.0152	122 (≤50)
PCB-026	0.00652	0.0288	126 (≤50)
PCB-028	0.0414	0.176	124 (≤50)
PCB-029	0.000273U	0.00155	Not calculable
PCB-031	0.0331	0.132	120 (≤50)
PCB-034	0.000273U	0.00106	Not calculable
PCB-035	0.000990	0.00365	115 (≤50)
PCB-037	0.0215	0.0856	120 (≤50)
PCB-038	0.000236U	0.00179	Not calculable
PCB-040	0.00605	0.0338	139 (≤50)
PCB-041/064/071/072	0.0319	0.160	134 (≤50)
PCB-042/059	0.0125	0.0549	126 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-043/049	0.0281	0.117	123 (≤50)
PCB-044	0.0299	0.153	135 (≤50)
PCB-045	0.00501	0.0235	130 (≤50)
PCB-046	0.00250	0.0108	125 (≤50)
PCB-047	0.0201	0.0598	99 (≤50)
PCB-048/075	0.00685	0.0324	130 (≤50)
PCB-050	0.000258U	0.00104	Not calculable
PCB-051	0.00318	0.0129	121 (≤50)
PCB-052/069	0.0318	0.142	127 (≤50)
PCB-053	0.00485	0.0239	133 (≤50)
PCB-054	0.000453	0.00247	138 (≤50)
PCB-055	0.000490	0.00214	125 (≤50)
PCB-056/060	0.0176	0.0712	121 (≤50)
PCB-057	0.000178U	0.00109	Not calculable
PCB-058	0.000179U	0.000527	Not calculable
PCB-061/070	0.0353	0.150	124 (≤50)
PCB-063	0.00133	0.00591	127 (≤50)
PCB-066/076	0.0309	0.125	121 (≤50)
PCB-067	0.00112	0.00550	132 (≤50)
PCB-068	0.000465	0.00189	121 (≤50)
PCB-073	0.000198U	0.000625	Not calculable
PCB-074	0.0137	0.0561	121 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-077	0.00433	0.0169	118 (≤50)
PCB-078	0.000186U	0.000799	Not calculable
PCB-079	0.000651	0.00288	126 (≤50)
PCB-081	0.000367	0.00175	131 (≤50)
PCB-082	0.00438	0.0223	134 (≤50)
PCB-084/092	0.0206	0.0969	130 (≤50)
PCB-085/116	0.00784	0.0361	129 (≤50)
PCB-086	0.000203U	0.000696	Not calculable
PCB-087/117/125	0.0150	0.0703	130 (≤50)
PCB-088/091	0.00690	0.0371	137 (≤50)
PCB-089	0.000180U	0.00225	Not calculable
PCB-090/101	0.0470	0.221	130 (≤50)
PCB-094	0.000215U	0.00203	Not calculable
PCB-095/098/102	0.0333	0.155	129 (≤50)
PCB-096	0.000609	0.00260	124 (≤50)
PCB-097	0.0123	0.0618	134 (≤50)
PCB-099	0.0192	0.0804	123 (≤50)
PCB-100	0.00110	0.00429	118 (≤50)
PCB-103	0.00104	0.00465	127 (≤50)
PCB-104	0.000138U	0.000528	Not calculable
PCB-105	0.0192	0.0854	127 (≤50)
PCB-106/118	0.0426	0.196	129 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-107/109	0.00319	0.0144	127 (≤50)
PCB-108/112	0.00193	0.00863	127 (≤50)
PCB-110	0.0470	0.253	137 (≤50)
PCB-111/115	0.000692	0.00349	134 (≤50)
PCB-113	0.000130U	0.000590	Not calculable
PCB-114	0.00104	0.00475	128 (≤50)
PCB-119	0.00166	0.00650	119 (≤50)
PCB-120	0.000111U	0.00124	Not calculable
PCB-122	0.000475	0.00235	133 (≤50)
PCB-123	0.000759	0.00326	124 (≤50)
PCB-124	0.00160	0.00774	131 (≤50)
PCB-126	0.000192U	0.00166	Not calculable
PCB-128/162	0.0100	0.0452	128 (≤50)
PCB-129	0.00333	0.0129	118 (≤50)
PCB-130	0.00548	0.0194	112 (≤50)
PCB-131/133	0.00206	0.00736	113 (≤50)
PCB-132/161	0.0174	0.0765	126 (≤50)
PCB-134/143	0.00328	0.0150	128 (≤50)
PCB-135	0.00738	0.0369	133 (≤50)
PCB-136	0.00783	0.0381	132 (≤50)
PCB-137	0.00226	0.0154	149 (≤50)
PCB-138/163/164	0.0623	0.273	126 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-139/149	0.0465	0.233	133 (≤50)
PCB-140	0.000146U	0.00197	Not calculable
PCB-141	0.00983	0.0492	133 (≤50)
PCB-144	0.00212	0.00974	128 (≤50)
PCB-146/165	0.00933	0.0430	129 (≤50)
PCB-147	0.00167	0.00852	134 (≤50)
PCB-148	0.000145U	0.000881	Not calculable
PCB-150	0.000109U	0.000928	Not calculable
PCB-151	0.0133	0.0672	134 (≤50)
PCB-152	0.0000969U	0.000408	Not calculable
PCB-153	0.0522	0.237	128 (≤50)
PCB-154	0.00122	0.00597	132 (≤50)
PCB-156	0.00639	0.0293	128 (≤50)
PCB-157	0.00175	0.00679	118 (≤50)
PCB-158/160	0.00681	0.0322	130 (≤50)
PCB-159	0.000607	0.000218	94 (≤50)
PCB-166	0.000273	0.000905	107 (≤50)
PCB-167	0.00294	0.0119	121 (≤50)
PCB-168	0.000124U	0.000435	Not calculable
PCB-170	0.0161	0.0730	128 (≤50)
PCB-171	0.00510	0.0200	119 (≤50)
PCB-172	0.00264	0.0121	128 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-173	0.000156U	0.00143	Not calculable
PCB-174	0.0163	0.0732	127 (≤50)
PCB-175	0.000850	0.00309	114 (≤50)
PCB-176	0.00208	0.00971	129 (≤50)
PCB-177	0.00949	0.0412	125 (≤50)
PCB-178	0.00384	0.0161	123 (≤50)
PCB-179	0.00668	0.0302	128 (≤50)
PCB-180	0.0355	0.161	128 (≤50)
PCB-181	0.000134U	0.000517	Not calculable
PCB-182/187	0.0207	0.0918	126 (≤50)
PCB-183	0.00939	0.0398	124 (≤50)
PCB-185	0.00188	0.00835	126 (≤50)
PCB-189	0.000883	0.00306	110 (≤50)
PCB-190	0.00367	0.0149	121 (≤50)
PCB-191	0.000475	0.00231	132 (≤50)
PCB-193	0.00179	0.00964	137 (≤50)
PCB-194	0.00862	0.0435	134 (≤50)
PCB-195	0.00352	0.0141	120 (≤50)
PCB-196/203	0.0109	0.0539	133 (≤50)
PCB-197	0.000328	0.00171	136 (≤50)
PCB-198	0.0000770U	0.00177	Not calculable
PCB-199	0.0107	0.0478	127 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201904171301	T4-PDI2019-SG60-190417	
PCB-200	0.00104	0.00483	129 (≤50)
PCB-201	0.00139	0.00572	122 (≤50)
PCB-202	0.00156	0.00942	143 (≤50)
PCB-205	0.000322	0.00206	146 (≤50)
PCB-206	0.00599	0.0296	133 (≤50)
PCB-207	0.000658	0.00370	140 (≤50)
PCB-208	0.00196	0.0103	136 (≤50)
PCB-209	0.00473	0.0261	139 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG13-190415	13C-PCB-209	171 (10-145)	PCB-209	J (all detects)	P
T4-PDI2019-SG18-190415	13C-PCB-209	146 (10-145)	PCB-209	J (all detects)	P
T4-PDI2019-SG57-190417	13C-PCB-95 13C-PCB-104	206 (10-145) 244 (10-145)	PCB-88/91 PCB-93 PCB-94 PCB-95/98/102 PCB-96 PCB-100 PCB-103 PCB-104 PCB-121	J (all detects) UJ (all non-detects)	P
T4-PDI2019-SG58-190417**	13C-PCB-54	156 (10-145)	PCB-50 PCB-54	UJ (all non-detects) UJ (all non-detects)	P

Sample	Labeled Compound	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG59-190417**	13C-PCB-11 13C-PCB-54 13C-PCB-104	149 (10-145) 177 (10-145) 161 (10-145)	PCB-11 PCB-12/13 PCB-14 PCB-15 PCB-50 PCB-54 PCB-96 PCB-100 PCB-103 PCB-104	J (all detects) UJ (all non-detects)	P
T4-PDI2019-SG61-190416	13C-PCB-209	148 (10-145)	PCB-209	J (all detects)	P

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1900807	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and difference, labeled compound %R, and results reported as EMPC, data were qualified as estimated in twenty-one samples.

Due to laboratory blank contamination, data were qualified as not detected in twelve samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 1900807

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG59-190417**	PCB-2	J (all detects)	A	Duplicate sample analysis (difference)
	PCB-4/10	J (all detects)		
	PCB-6	J (all detects)		
	PCB-12/13	J (all detects)		
	PCB-19	J (all detects)		
	PCB-24/27	J (all detects)		
	PCB-25	J (all detects)		
	PCB-35	J (all detects)		
	PCB-40	J (all detects)		
	PCB-45	J (all detects)		
	PCB-46	J (all detects)		
	PCB-48/75	J (all detects)		
	PCB-51	J (all detects)		
	PCB-63	J (all detects)		
	PCB-67	J (all detects)		
	PCB-77	J (all detects)		
	PCB-85/116	J (all detects)		
	PCB-88/91	J (all detects)		
	PCB-103	J (all detects)		
	PCB-107/109	J (all detects)		
	PCB-114	J (all detects)		
	PCB-124	J (all detects)		
	PCB-129	J (all detects)		
	PCB-131/133	J (all detects)		
	PCB-134/143	J (all detects)		
	PCB-144	J (all detects)		
	PCB-147	J (all detects)		
	PCB-154	J (all detects)		
	PCB-157	J (all detects)		
	PCB-167	J (all detects)		
	PCB-171	J (all detects)		
	PCB-172	J (all detects)		
	PCB-176	J (all detects)		
	PCB-178	J (all detects)		
	PCB-185	J (all detects)		
	PCB-190	J (all detects)		
	PCB-193	J (all detects)		
	PCB-195	J (all detects)		
	PCB-208	J (all detects)		

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG59-190417**	PCB-5/8	J (all detects)	A	Duplicate sample analysis (RPD)
	PCB-11	J (all detects)		
	PCB-15	J (all detects)		
	PCB-16/32	J (all detects)		
	PCB-17	J (all detects)		
	PCB-18	J (all detects)		
	PCB-20/21/33	J (all detects)		
	PCB-22	J (all detects)		
	PCB-26	J (all detects)		
	PCB-28	J (all detects)		
	PCB-31	J (all detects)		
	PCB-37	J (all detects)		
	PCB-41/64/71/72	J (all detects)		
	PCB-42/59	J (all detects)		
	PCB-43/49	J (all detects)		
	PCB-44	J (all detects)		
	PCB-47	J (all detects)		
	PCB-52/69	J (all detects)		
	PCB-53	J (all detects)		
	PCB-56/60	J (all detects)		
	PCB-61/70	J (all detects)		
	PCB-66/76	J (all detects)		
	PCB-74	J (all detects)		
	PCB-82	J (all detects)		
	PCB-84/92	J (all detects)		
	PCB-87/117/125	J (all detects)		
	PCB-90/101	J (all detects)		
	PCB-95/98/102	J (all detects)		
	PCB-97	J (all detects)		
	PCB-99	J (all detects)		
	PCB-105	J (all detects)		
	PCB-106/118	J (all detects)		
	PCB-110	J (all detects)		
	PCB-128/162	J (all detects)		
	PCB-130	J (all detects)		
	PCB-132/161	J (all detects)		
	PCB-135	J (all detects)		
	PCB-136	J (all detects)		
	PCB-137	J (all detects)		
	PCB-138/163/164	J (all detects)		
	PCB-139/149	J (all detects)		
	PCB-141	J (all detects)		
	PCB-146/165	J (all detects)		
	PCB-151	J (all detects)		
	PCB-153	J (all detects)		
	PCB-156	J (all detects)		
	PCB-158/160	J (all detects)		
	PCB-170	J (all detects)		
	PCB-174	J (all detects)		
	PCB-177	J (all detects)		
	PCB-179	J (all detects)		
	PCB-180	J (all detects)		
	PCB-182/187	J (all detects)		
	PCB-183	J (all detects)		
	PCB-194	J (all detects)		
	PCB-196/203	J (all detects)		
	PCB-199	J (all detects)		
	PCB-206	J (all detects)		
	PCB-209	J (all detects)		
T4-PDI2019-SG13-190415 T4-PDI2019-SG18-190415 T4-PDI2019-SG61-190416	PCB-209	J (all detects)	P	Labeled compounds (%R)

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG57-190417	PCB-88/91 PCB-93 PCB-94 PCB-95/98/102 PCB-96 PCB-100 PCB-103 PCB-104 PCB-121	J (all detects) UJ (all non-detects)	P	Labeled compounds (%R)
T4-PDI2019-SG58-190417**	PCB-50 PCB-54	UJ (all non-detects) UJ (all non-detects)	P	Labeled compounds (%R)
T4-PDI2019-SG59-190417**	PCB-11 PCB-12/13 PCB-14 PCB-15 PCB-50 PCB-54 PCB-96 PCB-100 PCB-103 PCB-104	J (all detects) UJ (all non-detects)	P	Labeled compounds (%R)
RB-201904171558 T4-PDI2019-SG05-190417 T4-PDI2019-SG06-190417 T4-PDI2019-SG08-190415 T4-PDI2019-SG11-190415 T4-PDI2019-SG13-190415 T4-PDI2019-SG15-190416 T4-PDI2019-SG16-190416 T4-PDI2019-SG17-190416 FD-201904151441 T4-PDI2019-SG18-190415 T4-PDI2019-SG51-190417 T4-PDI2019-SG52-190417 T4-PDI2019-SG53-190416 T4-PDI2019-SG54-190416 T4-PDI2019-SG57-190417 T4-PDI2019-SG58-190417** T4-PDI2019-SG59-190417** FD-201904171301 T4-PDI2019-SG60-190417 T4-PDI2019-SG61-190416	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 1900807

Sample	Compound	Modified Final Concentration	A or P
RB-201904171558	PCB-1	0.883U pg/L	A
	PCB-11	3.92U pg/L	
	PCB-16/32	1.49U pg/L	
	PCB-18	1.71U pg/L	
	PCB-28	1.64U pg/L	
	PCB-31	1.30U pg/L	
	PCB-41/64/71/72	1.25U pg/L	
	PCB-42/59	0.644U pg/L	
	PCB-43/49	0.911U pg/L	
	PCB-44	1.04U pg/L	
	PCB-47	12.6U pg/L	
	PCB-51	1.22U pg/L	
	PCB-52/69	1.12U pg/L	
	PCB-61/70	0.839U pg/L	
	PCB-68	2.21U pg/L	
	PCB-138/163/164	1.03U pg/L	
	PCB-139/149	1.07U pg/L	
	PCB-153	0.785U pg/L	
	PCB-194	0.574U pg/L	
	PCB-208	0.154U pg/L	
	PCB-209	0.155U pg/L	
T4-PDI2019-SG05-190417	PCB-1	0.00218U ug/Kg	A
	PCB-16/32	0.00282U ug/Kg	
	PCB-193	0.00117U ug/Kg	
T4-PDI2019-SG15-190416	PCB-193	0.00174U ug/Kg	A
T4-PDI2019-SG16-190416	PCB-1	0.00383U ug/Kg	A
FD-201904151441	PCB-1	0.00291U ug/Kg	A
T4-PDI2019-SG18-190415	PCB-1	0.00253U ug/Kg	A
T4-PDI2019-SG51-190417	PCB-193	0.000847U ug/Kg	A
T4-PDI2019-SG52-190417	PCB-193	0.000756U ug/Kg	A
T4-PDI2019-SG53-190416	PCB-193	0.00213U ug/Kg	A
T4-PDI2019-SG57-190417	PCB-1	0.0044U ug/Kg	A
T4-PDI2019-SG58-190417**	PCB-1	0.00374U ug/Kg	A
FD-201904171301	PCB-193	0.00179U ug/Kg	A

LDC #: 45526A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/5/19
SDG #: 1900807 Stage 2B/4 Page: 1 of 2
Laboratory: Vista Analytical Laboratory Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A *	
III.	Initial calibration/ICV	A / A	RSD ≤ 20 |r| ≥ QC limits
IV.	Continuing calibration	A	~~RS~~ QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	SW	RB = 1
VII.	Matrix spike/Matrix spike duplicates /DUP	N / SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 10+11, 19+20
X.	Labeled Compounds	SW	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	RB-201904171558	1900807-01	Water	04/17/19
2	T4-PDI2019-SG05-190417	1900807-02	Sediment	04/17/19
3	T4-PDI2019-SG06-190417	1900807-03	Sediment	04/17/19
4	T4-PDI2019-SG08-190415	1900807-04	Sediment	04/15/19
5	T4-PDI2019-SG11-190415	1900807-05	Sediment	04/15/19
6	T4-PDI2019-SG13-190415	1900807-06	Sediment	04/15/19
7	T4-PDI2019-SG15-190416	1900807-07	Sediment	04/16/19
8	T4-PDI2019-SG16-190416	1900807-08	Sediment	04/16/19
9	T4-PDI2019-SG17-190416	1900807-09	Sediment	04/16/19
10	FD-201904151441	1900807-10	Sediment	04/15/19
11	T4-PDI2019-SG18-190415	1900807-11	Sediment	04/15/19
12	T4-PDI2019-SG51-190417	1900807-12	Sediment	04/17/19
13	T4-PDI2019-SG52-190417	1900807-13	Sediment	04/17/19
14	T4-PDI2019-SG53-190416	1900807-14	Sediment	04/16/19

LDC #: 45526A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/5/19
SDG #: 1900807 Stage 2B/4 Page: 2 of 2
Laboratory: Vista Analytical Laboratory Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

15	T4-PDI2019-SG54-190416	1900807-15	Sediment	04/16/19
16	T4-PDI2019-SG57-190417	1900807-16	Sediment	04/17/19
17	T4-PDI2019-SG58-190417**	1900807-17**	Sediment	04/17/19
18	T4-PDI2019-SG59-190417**	1900807-18**	Sediment	04/17/19
19	FD-201904171301	1900807-19	Sediment	04/17/19
20	T4-PDI2019-SG60-190417	1900807-20	Sediment	04/17/19
21	T4-PDI2019-SG61-190416	1900807-21	Sediment	04/16/19
22	T4-PDI2019-SG59-190417DUP	1900807-18DUP	Sediment	04/17/19
23				
24				
25				

* Notes: MS resolution < 8000 for m/z 192.4888 & 268.9824. Lab indicated column bleed or PFK bleed or PFK drift. No qual since m/z for PCB-1 is 190.0368 & 268.0016 for 13C-CB3 PCB

LDC #: 45526A31

VALIDATION FINDINGS CHECKLIST

Reviewer: M
2nd Reviewer: [illegible]

Method: HRGC/HRMS Polychlorinated Biphenyls (EPA Method 1668C)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 330.9792 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution (valley) between PCB 23 and PCB 34 and between PCB 182 and PCB 187 ≤ 40% ?	✓			
Is the static resolving power ≥10,000 at m/z 330.9792 and ≥ 8000 throughout the mass range?	✓			
Was the mass resolution adequately checked with PFK?	✓			see note
III. Initial calibration/Initial calibration verification				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤20% for unlabeled and labeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
Were all initial calibration verification (ICV) percent differences (%D) within QC limits for unlabeled and labeled compounds?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all percent differences (%D) ≤25% for unlabeled and percent recoveries (%R) for labeled compounds within 50-145%?	✓			
Did all routine calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
V. Laboratory Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the blanks validation findings worksheet.	✓			
VI. Field blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VII. 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? DUP		✓		
VIII. Laboratory control samples				

LDC #: 45536A31

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compound recoveries within the QC criteria?		✓		
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For polychlorinated biphenyl congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For polychlorinated biphenyl congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For other polychlorinated biphenyl congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound and labeled standard ≥ 2.5?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 45526A31

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668B)

Blank extraction date: 5/15/19 **Blank analysis date:** 5/17/19
Conc. units: pg/L **Associated samples:** All W Qualify U

Compound	Blank ID	Sample Identification								
	B9E0099-BLK1	5X	1							
PCB-1	0.356*	1.78	0.883							
PCB-11	4.91	24.55	3.92							
PCB-16/32	1.06	5.3	1.49							
PCB-18	0.642*	3.21	1.71							
PCB-28	0.957*	4.785	1.64							
PCB-31	0.726*	3.63	1.30							
PCB-41/64/71/72	0.638*	3.19	1.25							
PCB-42/59	0.278	1.39	0.644							
PCB-43/49	0.597*	2.985	0.911							
PCB-44	0.686*	3.43	1.04							
PCB-47	4.91	24.55	12.6							
PCB-51	0.759*	3.795	1.22							
PCB-52/69	0.743*	3.715	1.12							
PCB-61/70	0.480*	2.4	0.839							
PCB-68	0.710*	3.55	2.21							
PCB-110	0.670	3.35								
PCB-138/163/164	0.491	2.455	1.03							
PCB-139/149	0.497	2.485	1.07							
PCB-153	0.364*	1.82	0.785							
PCB-194	0.546	2.73	0.574							
PCB-208	0.218	1.09	0.154							
PCB-209	0.379*	1.895	0.155							

*EMPC

LDC #: 45526A31

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668B)

Blank extraction date: 6/03/19 **Blank analysis date:** 6/07/19
Conc. units: ug/Kg **Associated samples:** All S Qualify U

Compound	Blank ID	Sample Identification								
	B9F0009-BLK1	5X	2	7	8	10	11	12	13	14
PCB-1	0.000880*	0.0044	0.00218		0.00383	0.00291	0.00253			
PCB-16/32	0.000580*	0.0029	0.00282							
PCB-47	0.00102*	0.0051								
PCB-153	0.00132	0.0066								
PCB-193	0.000545*	0.002725	0.00117	0.00174				0.000847	0.000756	0.00213

*EMPC

Compound	Blank ID	Sample Identification								
	B9F0009-BLK1	5X	16	17	19					
PCB-1	0.000880*	0.0044	0.0044	0.00374						
PCB-16/32	0.000580*	0.0029								
PCB-47	0.00102*	0.0051								
PCB-153	0.00132	0.0066								
PCB-193	0.000545*	0.002725			0.00179					

LDC#: 45526A31

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reveiwer: SC
2nd Reviewer:

METHOD: HRGC/HRMS PCB (EPA Method 1668C)
Sample: 1 (RB) Sampling Date: 04/17/19

Compound	Concentration (pg/L)	
PCB-1	0.883	
PCB-5/8	1.74	*
PCB-11	3.92	
PCB-16/32	1.49	*
PCB-17	0.764	
PCB-18	1.71	
PCB-20/21/33	1.20	*
PCB-22	0.510	*
PCB-28	1.64	
PCB-31	1.30	
PCB-38	0.426	
PCB-41/64/71/72	1.25	
PCB-42/59	0.644	
PCB-43/49	0.911	
PCB-44	1.04	*
PCB-45	0.330	*
PCB-47	12.6	
PCB-48/75	0.246	*
PCB-51	1.22	*
PCB-52/69	1.12	*
PCB-56/60	0.445	
PCB-61/70	0.839	*
PCB-66/76	0.416	*
PCB-68	2.21	*
PCB-74	0.331	
PCB-95/98/102	1.33	
PCB-132/161	0.204	*
PCB-136	0.257	*
PCB-138/163/164	1.03	
PCB-139/149	1.07	*
PCB-141	0.251	
PCB-146/165	0.244	*
PCB-151	0.621	*
PCB-153	0.785	*
PCB-155	0.177	
PCB-174	0.369	*
PCB-179	0.244	*
PCB-180	0.532	
PCB-182/187	0.457	*
PCB-194	0.574	
PCB-208	0.154	
PCB-209	0.155	*

LDC #: 45526A31

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y (N) N/A Were all duplicate sample relative percent differences (RPD) within the QC limits?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits)	Associated Samples	Qualifications
		22	Sed	see	attached	18	Jdets/A

Comments:

VALIDATION FINDINGS WORKSHEET

Duplicate Analysis

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		Difference	Diff Limits	Qualification
	18	22	(ug/Kg)	(2XQL)	
PCB-2	0.0221	0.0336	0.0115	0.00982	Jdets/A
PCB-4/10	0.0321	0.0818	0.0497	0.01962	
PCB-6	0.0186	0.0551	0.0365	0.00982	
PCB-12/13	0.00815	0.0399	0.03175	0.01962	
PCB-19	0.0183	0.0589	0.0406	0.00982	
PCB-24/27	0.011	0.0321	0.0211	0.01962	
PCB-25	0.0132	0.0529	0.0397	0.00982	
PCB-35	0.00446	0.0163	0.01184	0.00982	
PCB-40	0.0221	0.102	0.0799	0.00982	
PCB-45	0.0182	0.0742	0.056	0.00982	
PCB-46	0.0118	0.0337	0.0219	0.00982	
PCB-48/75	0.0264	0.101	0.0746	0.01962	
PCB-51	0.0127	0.0454	0.0327	0.00982	
PCB-63	0.00481	0.0209	0.01609	0.00982	
PCB-67	0.00623	0.0177	0.01147	0.00982	
PCB-77	0.0226	0.073	0.0504	0.00982	
PCB-85/116	0.0409	0.151	0.1101	0.01962	
PCB-88/91	0.0412	0.161	0.1198	0.01962	
PCB-103	0.00338	0.0184	0.01502	0.00982	
PCB-107/109	0.0217	0.0681	0.0464	0.01962	
PCB-114	0.00657	0.0217	0.01513	0.00982	
PCB-124	0.0155	0.0389	0.0234	0.00982	
PCB-129	0.0212	0.0651	0.0439	0.00982	
PCB-131/133	0.0152	0.0412	0.026	0.01962	
PCB-134/143	0.0135	0.0701	0.0566	0.01962	
PCB-144	0.0108	0.0521	0.0413	0.00982	
PCB-147	0.0151	0.0366	0.0215	0.00982	
PCB-154	0.00534	0.0295	0.02416	0.00982	
PCB-157	0.0107	0.0326	0.0219	0.00982	
PCB-167	0.0169	0.0586	0.0417	0.00982	
PCB-171	0.0103	0.097	0.0867	0.00982	
PCB-172	0.0113	0.0569	0.0456	0.00982	
PCB-176	0.0072	0.0442	0.037	0.00982	
PCB-178	0.0131	0.0815	0.0684	0.00982	
PCB-185	0.0103	0.0403	0.03	0.00982	
PCB-190	0.0242	0.0731	0.0489	0.00982	
PCB-193	0.00957	0.0447	0.03513	0.00982	
PCB-195	0.0109	0.0772	0.0663	0.00982	
PCB-208	0.0142	0.0575	0.0433	0.00982	

Sample ID: Duplicate

EPA Method 1668C

Source Client ID: T4-PDI2019-SG59-190417
Source LabNumber: 1900807-18
Matrix: Solid

Duplicate Lab Sample: B9F0009-DUP1

≤ 35

Analyte	Dup Conc. (ug/kg	Source Conc.	RPD	RPD Limit
PCB-1	0.0255	0.0265	3.69	25
PCB-2	0.0336	0.0221	**41.1** *	25
PCB-3	0.0272	0.0254	6.88	25
PCB-4/10	0.0818	0.0321	**87.3** *	25
PCB-5/8	0.252	0.0800	**104**	25
PCB-6	0.0551	0.0186	**98.9** *	25
PCB-7/9	0.0254	ND	#	25
PCB-11	0.122	0.0331	**115**	25
PCB-12/13	0.0399	0.00815	**132** *	25
PCB-14	ND	ND	NA	25
PCB-15	0.248	0.0468	**137**	25
PCB-16/32	0.215	0.0579	**115**	25
PCB-17	0.144	0.0426	**108**	25
PCB-18	0.291	0.0898	**106** *	25
PCB-19	0.0589	0.0183	**105** *	25
PCB-20/21/33	0.421	0.0915	**129**	25
PCB-22	0.231	0.0517	**127**	25
PCB-23	ND	ND	NA	25
PCB-24/27	0.0321	0.0110	**98.1** *	25
PCB-25	0.0529	0.0132	**120** *	25
PCB-26	0.102	0.0291	**111**	25
PCB-28	0.603	0.145	**122**	25
PCB-29	0.00447	ND	#	25
PCB-30	ND	ND	NA	25
PCB-31	0.541	0.108	**133**	25
PCB-34	ND	ND	NA	25
PCB-35	0.0163	0.00446	**114** *	25
PCB-36	ND	ND	NA	25
PCB-37	0.297	0.0742	**120**	25
PCB-38	0.00514	ND	#	25
PCB-39	ND	ND	NA	25
PCB-40	0.102	0.0221	**129** *	25
PCB-41/64/71/72	0.452	0.154	**98.5**	25
PCB-42/59	0.179	0.0532	**108**	25

Analyte	Dup Conc. (ug/kg	Source Conc.	RPD	RPD Limit
PCB-43/49	0.462	0.110	**123**	25
PCB-44	0.495	0.153	**106**	25
PCB-45	0.0742	0.0182	**121** *	25
PCB-46	0.0337	0.0118	**96.4** *	25
PCB-47	0.241	0.0582	**122**	25
PCB-48/75	0.101	0.0264	**118** *	25
PCB-50	0.00339	ND	#	25
PCB-51	0.0454	0.0127	**113** *	25
PCB-52/69	0.583	0.191	**101**	25
PCB-53	0.0883	0.0350	**86.6**	25
PCB-54	0.0103	ND	#	25
PCB-55	0.00995	0.00239	**123**	25
PCB-56/60	0.293	0.0746	**119**	25
PCB-57	0.00311	ND	#	25
PCB-58	ND	ND	NA	25
PCB-61/70	0.611	0.174	**111**	25
PCB-62	ND	ND	NA	25
PCB-63	0.0209	ND	# *	25
PCB-65	ND	ND	NA	25
PCB-66/76	0.473	0.124	**117**	25
PCB-67	0.0177	0.00623	**95.7** *	25
PCB-68	0.00648	ND	#	25
PCB-73	ND	ND	NA	25
PCB-74	0.218	0.0684	**105**	25
PCB-77	0.0730	0.0226	**106** *	25
PCB-78	0.00249	ND	#	25
PCB-79	0.0118	ND	#	25
PCB-80	ND	ND	NA	25
PCB-81	0.0111	ND	#	25
PCB-82	0.106	0.0399	**90.4**	25
PCB-83	0.000528	ND	#	25
PCB-84/92	0.424	0.142	**99.8**	25
PCB-85/116	0.151	ND	# *	25
PCB-86	ND	ND	NA	25

* Used difference < 2×QL Used RPD

LCL-UCL - Lower control limit - upper control limit.
- Result could not be calculated due to one or more non-detected analytes
The results are reported in dry weight. The sample size is reported in wet weight.

Sample ID: Duplicate — EPA Method 1668C

Source Client ID: T4-PDI2019-SG59-190417
Source LabNumber: 1900807-18
Matrix: Solid

Duplicate Lab Sample: B9F0009-DUP1

Analyte	Dup Conc. (ug/kg	Source Conc.	RPD	RPD Limit
PCB-87/117/125	0.332	0.112	**99.5**	25
PCB-88/91	0.161	0.0412	**119** *	25
PCB-89	0.00820	ND	#	25
PCB-90/101	1.10	0.380	**97.4**	25
PCB-93	ND	ND	NA	25
PCB-94	0.00874	ND	#	25
PCB-95/98/102	0.703	0.268	**89.7**	25
PCB-96	0.0100	ND	#	25
PCB-97	0.287	0.107	**91.1**	25
PCB-99	0.411	0.119	**110**	25
PCB-100	0.0230	ND	#	25
PCB-103	0.0184	ND	# *	25
PCB-104	ND	ND	NA	25
PCB-105	0.406	0.128	**104**	25
PCB-106/118	0.983	0.309	**104**	25
PCB-107/109 diff	0.0681	0.0217	**103** *	25
PCB-108/112	0.0406	ND	#	25
PCB-110	1.09	~~ND~~	~~#~~ 86	25
PCB-111/115	ND	ND	NA	25
PCB-113	0.00289	ND	#	25
PCB-114	0.0217	ND	# *	25
PCB-119	0.0309	ND	#	25
PCB-120	0.00516	ND	#	25
PCB-121	ND	ND	NA	25
PCB-122	0.0122	0.00474	**88.2**	25
PCB-123	0.0186	ND	#	25
PCB-124	0.0389	0.0155	**86.2** *	25
PCB-126	0.00781	0.00354	**75.1**	25
PCB-127	ND	ND	NA	25
PCB-128/162	0.214	0.0983	**74.3**	25
PCB-129	0.0651	ND	# *	25
PCB-130	0.0919	~~ND~~	~~#~~ 93	25
PCB-131/133	0.0412	0.0152	**92.1** *	25
PCB-132/161	0.362	0.115	**104**	25

Analyte	Dup Conc. (ug/kg	Source Conc.	RPD	RPD Limit
PCB-134/143	0.0701	ND	# *	25
PCB-135	0.167	0.0567	**98.5**	25
PCB-136	0.168	0.0484	**111**	25
PCB-137	0.0651	0.0288	**77.2**	25
PCB-138/163/164	1.32	0.385	**110**	25
PCB-139/149	1.03	0.266	**118**	25
PCB-140	0.0112	ND	#	25
PCB-141	0.235	0.0750	**103**	25
PCB-142	ND	ND	NA	25
PCB-144	0.0521	ND	# *	25
PCB-145	ND	ND	NA	25
PCB-146/165	0.214	0.0655	**106**	25
PCB-147	0.0366	0.0151	**83.2** *	25
PCB-148	ND	ND	NA	25
PCB-150	0.00481	ND	#	25
PCB-151	0.314	~~ND~~	~~#~~ 127	25
PCB-152	ND	ND	NA	25
PCB-153	1.19	0.339	**111**	25
PCB-154	0.0295	0.00534	**139** *	25
PCB-155	0.00114	ND	#	25
PCB-156	0.145	0.0459	**104**	25
PCB-157	0.0326	0.0107	**101** *	25
PCB-158/160	0.156	0.0564	**93.6**	25
PCB-159	ND	ND	NA	25
PCB-166	0.00420	ND	#	25
PCB-167	0.0586	ND	# *	25
PCB-168	0.00344	ND	#	25
PCB-169	ND	ND	NA	25
PCB-170	0.376	~~ND~~	~~#~~ 125	25
PCB-171	0.0970	ND	# *	25
PCB-172	0.0569	ND	# *	25
PCB-173	0.00756	ND	#	25
PCB-174	0.363	0.116	**103**	25
PCB-175	0.0142	ND	#	25

LCL-UCL - Lower control limit - upper control limit.
- Result could not be calculated due to one or more non-detected analytes
The results are reported in dry weight. The sample size is reported in wet weight.

Sample ID: Duplicate

EPA Method 1668C

Source Client ID: T4-PDI2019-SG59-190417
Source LabNumber: 1900807-18
Matrix: Solid

Duplicate Lab Sample: B9F0009-DUP1

Analyte	Dup Conc. (ug/kg	Source Conc.	RPD	RPD Limit
PCB-176	0.0442	ND	# *	25
PCB-177	0.211	~~ND~~	~~#~~ 130	25
PCB-178	0.0815	ND	# *	25
PCB-179	0.152	0.0423	**113**	25
PCB-180	0.777	~~ND~~	~~#~~ 125	25
PCB-181	0.00225	ND	#	25
PCB-182/187	0.467	0.0912	**135**	25
PCB-~~183~~ k	0.192	~~ND~~	~~#~~ 143	25
PCB-184	0.00116	ND	#	25
PCB-185	0.0403	ND	# *	25
PCB-186	ND	ND	NA	25
PCB-188	ND	ND	NA	25
PCB-189	0.0158	ND	#	25
PCB-190	0.0731	0.0242	**101** *	25
PCB-191	0.0137	ND	#	25
PCB-192	ND	ND	NA	25
PCB-193	0.0447	ND	# *	25
PCB-194	0.199	0.0529	**116**	25
PCB-195	0.0772	ND	# *	25
PCB-196/203	0.241	~~ND~~	~~#~~ 132	25
PCB-197	0.00763	ND	#	25
PCB-198	0.00913	ND	#	25
PCB-199	0.225	~~ND~~	~~#~~ 126	25
PCB-200	0.0251	ND	#	25
PCB-201	0.0300	ND	#	25
PCB-202	0.0498	ND	#	25
PCB-204	ND	ND	NA	25
PCB-205	0.00648	ND	#	25
PCB-206	0.170	~~ND~~	~~#~~ 138	25
PCB-207	0.0173	ND	#	25
PCB-208	0.0575	0.0142	**121** *	25
PCB-209	0.191	0.0268	**151**	25

Analyte	Dup Conc. (ug/kg	Source Conc.	RPD	RPD Limit

LCL-UCL - Lower control limit - upper control limit.
- Result could not be calculated due to one or more non-detected analytes
The results are reported in dry weight. The sample size is reported in wet weight.

LDC#: 45526A31

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: N

2nd Reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	10	11	(≤50%)	
PCB-1	0.00291	0.00253	14	
PCB-2	0.00380	0.00321	17	
PCB-3	0.00262	0.00270	3	
PCB-4/10	0.00555	0.00697	23	
PCB-5/8	0.0133	0.0160	18	
PCB-6	0.00356	0.00422	17	
PCB-7/9	0.000299U	0.00128	NC	
PCB-11	0.0162	0.0180	11	
PCB-12/13	0.000258U	0.00318	NC	
PCB-15	0.0126	0.0140	11	
PCB-16/32	0.0180	0.0206	13	
PCB-17	0.0133	0.0160	18	
PCB-18	0.0211	0.0262	22	
PCB-19	0.00683	0.00771	12	
PCB-20/21/33	0.0284	0.0314	10	
PCB-22	0.0130	0.0166	24	
PCB-24/27	0.00253	0.00307	19	
PCB-25	0.00676	0.00803	17	
PCB-26	0.0130	0.0148	13	
PCB-28	0.0527	0.0628	17	
PCB-29	0.000365U	0.000299	NC	
PCB-31	0.0412	0.0493	18	
PCB-34	0.000655	0.000764	15	
PCB-35	0.00145	0.00146	1	
PCB-36	0.000246U	0.000374	NC	
PCB-37	0.0197	0.0218	10	
PCB-38	0.000936	0.00133	35	
PCB-39	0.000447	0.000443	1	
PCB-40	0.0110	0.0105	5	
PCB-41/64/71/72	0.0569	0.0609	7	
PCB-42/59	0.0219	0.0261	18	
PCB-43/49	0.0891	0.0977	9	
PCB-44	0.0626	0.0757	19	
PCB-45	0.00697	0.00839	18	
PCB-46	0.00323	0.00515	46	
PCB-47	0.0532	0.0601	12	
PCB-48/75	0.00941	0.0126	29	
PCB-50	0.000240U	0.000382	NC	
PCB-51	0.0116	0.0104	11	
PCB-52/69	0.0967	0.110	13	
PCB-53	0.0157	0.0156	1	
PCB-54	0.00205	0.00209	2	
PCB-55	0.00137	0.00146	6	
PCB-56/60	0.0388	0.0442	13	
PCB-57	0.000798	0.000766	4	
PCB-58	0.000944	0.000763	21	
PCB-61/70	0.0999	0.114	13	
PCB-63	0.00335	0.00373	11	
PCB-66/76	0.0829	0.0913	10	
PCB-67	0.00195	0.00235	19	
PCB-68	0.00169	0.00284	51	
PCB-73	0.000565	0.000895	45	
PCB-74	0.0305	0.0363	17	
PCB-77	0.00981	0.00977	0	
PCB-78	0.000357	0.000513	36	
PCB-79	0.00310	0.00343	10	
PCB-81	0.00156	0.00182	15	

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: M

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	10	11	(≤50%)	
PCB-82	0.0141	0.0170	19	
PCB-84/92	0.0892	0.103	14	
PCB-85/116	0.0226	0.0279	21	
PCB-87/117/125	0.0471	0.0583	21	
PCB-88/91	0.0368	0.0415	12	
PCB-89	0.00110	0.00175	46	
PCB-90/101	0.238	0.264	10	
PCB-94	0.00181	0.00194	7	
PCB-95/98/102	0.149	0.166	11	
PCB-96	0.00115	0.00110	4	
PCB-97	0.0490	0.0579	17	
PCB-99	0.0882	0.103	15	
PCB-100	0.00668	0.00745	11	
PCB-103	0.00740	0.00898	19	
PCB-104	0.000647	0.000561	14	
PCB-105	0.0483	0.0582	19	
PCB-106/118	0.148	0.171	14	
PCB-107/109	0.0140	0.0156	11	
PCB-108/112	0.00759	0.00903	17	
PCB-110	0.199	0.227	13	
PCB-111/115	0.00205	0.00245	18	
PCB-113	0.000909	0.000859	6	
PCB-114	0.00284	0.00347	20	
PCB-119	0.00986	0.0110	11	
PCB-120	0.00218	0.00198	10	
PCB-122	0.00190	0.00199	5	
PCB-123	0.00198	0.00278	34	
PCB-124	0.00559	0.00740	28	
PCB-126	0.000918	0.00105	13	
PCB-128/162	0.0349	0.0370	6	
PCB-129	0.00990	0.0114	14	
PCB-130	0.0203	0.0220	8	
PCB-131/133	0.0101	0.0125	21	
PCB-132/161	0.0822	0.0800	3	
PCB-134/143	0.0156	0.0159	2	
PCB-135	0.0548	0.0554	1	
PCB-136	0.0563	0.0526	7	
PCB-137	0.00987	0.0107	8	
PCB-138/163/164	0.280	0.287	2	
PCB-139/149	0.299	0.308	3	
PCB-140	0.00353	0.00438	21	
PCB-141	0.0648	0.0585	10	
PCB-144	0.0148	0.0144	3	
PCB-146/165	0.0644	0.0708	9	
PCB-147	0.00886	0.0107	19	
PCB-148	0.00224	0.00295	27	
PCB-150	0.00269	0.00301	11	
PCB-151	0.101	0.103	2	
PCB-152	0.000379	0.000520	31	
PCB-153	0.308	0.317	3	
PCB-154	0.0125	0.0156	22	
PCB-155	0.000283	0.000339	18	
PCB-156	0.0248	0.0256	3	
PCB-157	0.00435	0.00492	12	
PCB-158/160	0.0271	0.0279	3	
PCB-166	0.000596	0.000684	14	
PCB-167	0.0105	0.0102	3	

Field Duplicates

Reviewer: M

2nd Reviewer: [signature]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	10	11	(≤50%)	
PCB-168	0.000756	0.000782	3	
PCB-170	0.0989	0.0941	5	
PCB-171	0.0298	0.0271	9	
PCB-172	0.0165	0.0150	10	
PCB-173	0.00221	0.00193	14	
PCB-174	0.116	0.109	6	
PCB-175	0.00499	0.00402	22	
PCB-176	0.0166	0.0150	10	
PCB-177	0.0665	0.0627	6	
PCB-178	0.0256	0.0261	2	
PCB-179	0.0506	0.0500	1	
PCB-180	0.221	0.211	5	
PCB-182/187	0.134	0.134	0	
PCB-183	0.0581	0.0556	4	
PCB-184	0.000274	0.000237	14	
PCB-185	0.0127	0.0123	3	
PCB-188	0.000347	0.000399	14	
PCB-189	0.00380	0.00322	17	
PCB-190	0.0211	0.0193	9	
PCB-191	0.00367	0.00362	1	
PCB-193	0.0136	0.0130	5	
PCB-194	0.0489	0.0490	0	
PCB-195	0.0210	0.0201	4	
PCB-196/203	0.0607	0.0621	2	
PCB-197	0.00198	0.00275	33	
PCB-198	0.00276	0.00254	8	
PCB-199	0.0553	0.0587	6	
PCB-200	0.00705	0.00783	10	
PCB-201	0.00696	0.00808	15	
PCB-202	0.0103	0.0126	20	
PCB-205	0.00237	0.00223	6	
PCB-206	0.0402	0.0597	39	
PCB-207	0.00338	0.00499	38	
PCB-208	0.0159	0.0242	41	
PCB-209	0.0530	0.108	68	

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VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: TL

2nd Reviewer: [signature]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	19	20	(≤50%)	
PCB-001	0.00442	0.0118	91	
PCB-002	0.00533	0.0221	122	
PCB-003	0.00339	0.0115	109	
PCB-004/010	0.00805	0.0347	125	
PCB-005/008	0.0278	0.0984	112	
PCB-006	0.00569	0.0219	118	
PCB-007/009	0.000659U	0.0102	NC	
PCB-011	0.00735	0.0284	118	
PCB-012/013	0.000629U	0.0115	NC	
PCB-015	0.0247	0.0790	105	
PCB-016/032	0.0169	0.0748	126	
PCB-017	0.0110	0.0501	128	
PCB-018	0.0229	0.102	127	
PCB-019	0.00507	0.0195	117	
PCB-020/021/033	0.0289	0.116	120	
PCB-022	0.0149	0.0620	122	
PCB-024/027	0.00279	0.0120	125	
PCB-025	0.00367	0.0152	122	
PCB-026	0.00652	0.0288	126	
PCB-028	0.0414	0.176	124	
PCB-029	0.000273U	0.00155	NC	
PCB-031	0.0331	0.132	120	
PCB-034	0.000273U	0.00106	NC	
PCB-035	0.000990	0.00365	115	
PCB-037	0.0215	0.0856	120	
PCB-038	0.000236U	0.00179	NC	
PCB-040	0.00605	0.0338	139	
PCB-041/064/071/072	0.0319	0.160	134	
PCB-042/059	0.0125	0.0549	126	
PCB-043/049	0.0281	0.117	123	
PCB-044	0.0299	0.153	135	
PCB-045	0.00501	0.0235	130	
PCB-046	0.00250	0.0108	125	
PCB-047	0.0201	0.0598	99	
PCB-048/075	0.00685	0.0324	130	
PCB-050	0.000258U	0.00104	NC	
PCB-051	0.00318	0.0129	121	
PCB-052/069	0.0318	0.142	127	
PCB-053	0.00485	0.0239	133	
PCB-054	0.000453	0.00247	138	
PCB-055	0.000490	0.00214	125	
PCB-056/060	0.0176	0.0712	121	
PCB-057	0.000178U	0.00109	NC	
PCB-058	0.000179U	0.000527	NC	
PCB-061/070	0.0353	0.150	124	
PCB-063	0.00133	0.00591	127	
PCB-066/076	0.0309	0.125	121	
PCB-067	0.00112	0.00550	132	
PCB-068	0.000465	0.00189	121	
PCB-073	0.000198U	0.000625	NC	
PCB-074	0.0137	0.0561	121	
PCB-077	0.00433	0.0169	118	
PCB-078	0.000186U	0.000799	NC	
PCB-079	0.000651	0.00288	126	
PCB-081	0.000367	0.00175	131	
PCB-082	0.00438	0.0223	134	
PCB-084/092	0.0206	0.0969	130	

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VALIDATION FINDINGS WORKSHEET

Field Duplicates

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Reviewer: n

2nd Reviewer: G

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	19	20	(≤50%)	
PCB-085/116	0.00784	0.0361	129	
PCB-086	0.000203U	0.000696	NC	
PCB-087/117/125	0.0150	0.0703	130	
PCB-088/091	0.00690	0.0371	137	
PCB-089	0.000180U	0.00225	NC	
PCB-090/101	0.0470	0.221	130	
PCB-094	0.000215U	0.00203	NC	
PCB-095/098/102	0.0333	0.155	129	
PCB-096	0.000609	0.00260	124	
PCB-097	0.0123	0.0618	134	
PCB-099	0.0192	0.0804	123	
PCB-100	0.00110	0.00429	118	
PCB-103	0.00104	0.00465	127	
PCB-104	0.000138U	0.000528	NC	
PCB-105	0.0192	0.0854	127	
PCB-106/118	0.0426	0.196	129	
PCB-107/109	0.00319	0.0144	127	
PCB-108/112	0.00193	0.00863	127	
PCB-110	0.0470	0.253	137	
PCB-111/115	0.000692	0.00349	134	
PCB-113	0.000130U	0.000590	NC	
PCB-114	0.00104	0.00475	128	
PCB-119	0.00166	0.00650	119	
PCB-120	0.000111U	0.00124	NC	
PCB-122	0.000475	0.00235	133	
PCB-123	0.000759	0.00326	124	
PCB-124	0.00160	0.00774	131	
PCB-126	0.000192U	0.00166	NC	
PCB-128/162	0.0100	0.0452	128	
PCB-129	0.00333	0.0129	118	
PCB-130	0.00548	0.0194	112	
PCB-131/133	0.00206	0.00736	113	
PCB-132/161	0.0174	0.0765	126	
PCB-134/143	0.00328	0.0150	128	
PCB-135	0.00738	0.0369	133	
PCB-136	0.00783	0.0381	132	
PCB-137	0.00226	0.0154	149	
PCB-138/163/164	0.0623	0.273	126	
PCB-139/149	0.0465	0.233	133	
PCB-140	0.000146U	0.00197	NC	
PCB-141	0.00983	0.0492	133	
PCB-144	0.00212	0.00974	128	
PCB-146/165	0.00933	0.0430	129	
PCB-147	0.00167	0.00852	134	
PCB-148	0.000145U	0.000881	NC	
PCB-150	0.000109U	0.000928	NC	
PCB-151	0.0133	0.0672	134	
PCB-152	0.0000969U	0.000408	NC	
PCB-153	0.0522	0.237	128	
PCB-154	0.00122	0.00597	132	
PCB-156	0.00639	0.0293	128	
PCB-157	0.00175	0.00679	118	
PCB-158/160	0.00681	0.0322	130	
PCB-159	0.000607	0.000218	94	
PCB-166	0.000273	0.000905	107	
PCB-167	0.00294	0.0119	121	
PCB-168	0.000124U	0.000435	NC	

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	19	20	(≤50%)	
PCB-170	0.0161	0.0730	128	
PCB-171	0.00510	0.0200	119	
PCB-172	0.00264	0.0121	128	
PCB-173	0.000156U	0.00143	NC	
PCB-174	0.0163	0.0732	127	
PCB-175	0.000850	0.00309	114	
PCB-176	0.00208	0.00971	129	
PCB-177	0.00949	0.0412	125	
PCB-178	0.00384	0.0161	123	
PCB-179	0.00668	0.0302	128	
PCB-180	0.0355	0.161	128	
PCB-181	0.000134U	0.000517	NC	
PCB-182/187	0.0207	0.0918	126	
PCB-183	0.00939	0.0398	124	
PCB-185	0.00188	0.00835	126	
PCB-189	0.000883	0.00306	110	
PCB-190	0.00367	0.0149	121	
PCB-191	0.000475	0.00231	132	
PCB-193	0.00179	0.00964	137	
PCB-194	0.00862	0.0435	134	
PCB-195	0.00352	0.0141	120	
PCB-196/203	0.0109	0.0539	133	
PCB-197	0.000328	0.00171	136	
PCB-198	0.0000770U	0.00177	NC	
PCB-199	0.0107	0.0478	127	
PCB-200	0.00104	0.00483	129	
PCB-201	0.00139	0.00572	122	
PCB-202	0.00156	0.00942	143	
PCB-205	0.000322	0.00206	146	
PCB-206	0.00599	0.0296	133	
PCB-207	0.000658	0.00370	140	
PCB-208	0.00196	0.0103	136	
PCB-209	0.00473	0.0261	139	

LDC #: 45526A31

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Y N N/A Were all labeled compound recoveries and ion abundance ratios (IAR) within the QC criteria?
Y N N/A Was the S/N ratio all labeled compound peaks ≥ 10?

#	Date	Lab ID/Reference	Labeled Compound	% Recovery/ Ion Abundance Ratio (Limit:)	Qualifications
		6 (dup)	13C-PCB-209	171 (10-145)	J/UJ/P (PCB-209)
		11 (dup)	↓	146 ( )	↓
		16 (ND/dup)	13C-PCB-~~209~~ 95	206 ( )	(see attached)
			104	244 ( )	
		17 (ND)	54	156 ( )	(PCB-50, 54)
		18 (ND/dup)	11	149 ( )	(see attached)
			54	177 ( )	
			104	161 ( )	
		21 (dup)	209	148 ( )	

Table 8

PCB Natives and Corresponding Labeled Compounds

Congener	Labeled	Recovery Standard
PCB-1	^{13}C-PCB-1	^{13}C-PCB-15
PCB-2	^{13}C-PCB-3	^{13}C-PCB-15
PCB-3	^{13}C-PCB-3	^{13}C-PCB-15
PCB-4/10	^{13}C-PCB-4	^{13}C-PCB-15
PCB-7/9	^{13}C-PCB-9	^{13}C-PCB-15
PCB-6	^{13}C-PCB-9	^{13}C-PCB-15
PCB-5/8	^{13}C-PCB-9	^{13}C-PCB-15
PCB-14	^{13}C-PCB-11	^{13}C-PCB-15
PCB-11	^{13}C-PCB-11	^{13}C-PCB-15
PCB-12/13	^{13}C-PCB-11	^{13}C-PCB-15
PCB-15	^{13}C-PCB-11	^{13}C-PCB-15
PCB-19	^{13}C-PCB-19	^{13}C-PCB-15
PCB-30	^{13}C-PCB-19	^{13}C-PCB-15
PCB-18	^{13}C-PCB-32	^{13}C-PCB-15
PCB-17	^{13}C-PCB-32	^{13}C-PCB-15
PCB-24/27	^{13}C-PCB-32	^{13}C-PCB-15
PCB-16/32	^{13}C-PCB-32	^{13}C-PCB-15
PCB-34	^{13}C-PCB-28	^{13}C-PCB-31
PCB-23	^{13}C-PCB-28	^{13}C-PCB-31
PCB-29	^{13}C-PCB-28	^{13}C-PCB-31
PCB-26	^{13}C-PCB-28	^{13}C-PCB-31
PCB-25	^{13}C-PCB-28	^{13}C-PCB-31
PCB-31	^{13}C-PCB-28	^{13}C-PCB-31
PCB-28	^{13}C-PCB-28	^{13}C-PCB-31
PCB-20/21/33	^{13}C-PCB-28	^{13}C-PCB-31
PCB-22	^{13}C-PCB-28	^{13}C-PCB-31
PCB-36	^{13}C-PCB-37	^{13}C-PCB-31
PCB-39	^{13}C-PCB-37	^{13}C-PCB-31
PCB-38	^{13}C-PCB-37	^{13}C-PCB-31
PCB-35	^{13}C-PCB-37	^{13}C-PCB-31
PCB-37	^{13}C-PCB-37	^{13}C-PCB-31
PCB-54	^{13}C-PCB-54	^{13}C-PCB-60
PCB-50	^{13}C-PCB-54	^{13}C-PCB-60
PCB-53	^{13}C-PCB-52	^{13}C-PCB-60
PCB-51	^{13}C-PCB-52	^{13}C-PCB-60
PCB-45	^{13}C-PCB-52	^{13}C-PCB-60
PCB-46	^{13}C-PCB-52	^{13}C-PCB-60
PCB-52/69	^{13}C-PCB-52	^{13}C-PCB-60
PCB-73	^{13}C-PCB-52	^{13}C-PCB-60
PCB-43/49	^{13}C-PCB-52	^{13}C-PCB-60

Table 8

PCB Natives and Corresponding Labeled Compounds

Congener	Labeled	Recovery Standard
PCB-47	^{13}C-PCB-47	^{13}C-PCB-60
PCB-48/75	^{13}C-PCB-47	^{13}C-PCB-60
PCB-65	^{13}C-PCB-47	^{13}C-PCB-60
PCB-62	^{13}C-PCB-47	^{13}C-PCB-60
PCB-44	^{13}C-PCB-47	^{13}C-PCB-60
PCB-42/59	^{13}C-PCB-47	^{13}C-PCB-60
PCB-41/64/71/72	^{13}C-PCB-47	^{13}C-PCB-60
PCB-68	^{13}C-PCB-47	^{13}C-PCB-60
PCB-40	^{13}C-PCB-47	^{13}C-PCB-60
PCB-57	^{13}C-PCB-70	^{13}C-PCB-60
PCB-67	^{13}C-PCB-70	^{13}C-PCB-60
PCB-58	^{13}C-PCB-70	^{13}C-PCB-60
PCB-63	^{13}C-PCB-70	^{13}C-PCB-60
PCB-74	^{13}C-PCB-70	^{13}C-PCB-60
PCB-61/70	^{13}C-PCB-70	^{13}C-PCB-60
PCB-76/66	^{13}C-PCB-70	^{13}C-PCB-60
PCB-80	^{13}C-PCB-80	^{13}C-PCB-60
PCB-55	^{13}C-PCB-80	^{13}C-PCB-60
PCB-56/60	^{13}C-PCB-80	^{13}C-PCB-60
PCB-79	^{13}C-PCB-80	^{13}C-PCB-60
PCB-78	^{13}C-PCB-81	^{13}C-PCB-60
PCB-81	^{13}C-PCB-81	^{13}C-PCB-60
PCB-77	^{13}C-PCB-77	^{13}C-PCB-60
PCB-104	^{13}C-PCB-104	^{13}C-PCB-111
PCB-96	^{13}C-PCB-104	^{13}C-PCB-111
PCB-103	^{13}C-PCB-104	^{13}C-PCB-111
PCB-100	^{13}C-PCB-104	^{13}C-PCB-111
PCB-94	^{13}C-PCB-95	^{13}C-PCB-111
PCB-95/98/102	^{13}C-PCB-95	^{13}C-PCB-111
PCB-93	^{13}C-PCB-95	^{13}C-PCB-111
PCB-88/91	^{13}C-PCB-95	^{13}C-PCB-111
PCB-121	^{13}C-PCB-95	^{13}C-PCB-111
PCB-84/92	^{13}C-PCB-101	^{13}C-PCB-111
PCB-89	^{13}C-PCB-101	^{13}C-PCB-111
PCB-90/101	^{13}C-PCB-101	^{13}C-PCB-111
PCB-113	^{13}C-PCB-101	^{13}C-PCB-111
PCB-99	^{13}C-PCB-101	^{13}C-PCB-111
PCB-119	^{13}C-PCB-97	^{13}C-PCB-111
PCB-108/112	^{13}C-PCB-97	^{13}C-PCB-111
PCB-83	^{13}C-PCB-97	^{13}C-PCB-111
PCB-97	^{13}C-PCB-97	^{13}C-PCB-111

LDC #: 45526A31

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All compounds reported as estimated		Jdets/A
			maximum possible concentration (EMPC).		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 45226A31

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of compound, A_{is} = Area of associated internal standard
average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, C_{is} = Concentration of internal standard
%RSD = 100 * (S/X) — S = Standard deviation of the RRFs, X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported %RSD	Recalculated %RSD
1	ICAL	4/24/18	PCB 77 (^{13}C-PCB 77)	0.98925	0.98850	1.01	1.012	7.03427	6.91465
			PCB 105 (^{13}C-PCB 105)	1.04835	1.04767	1.04 ~~0.998~~	1.048	8.94042	8.94948
			PCB 167 (^{13}C-PCB 167)	1.03864	1.03867	0.973	0.975	15.1411	15.00687
			PCB 189 (^{13}C-PCB 189)	1.32384	1.32500	1.29	1.287	7.02273	7.04358
2			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						
3			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						

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 #: 45326A31

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

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~~ conc (CC)	Recalculated ~~RRF~~ conc (CC)	Reported %D	Recalculated %D
1	ST190607K1-1	6/7/19	PCB 77 (^{13}C-PCB 77)	0.989	48.44	~~47.86~~ 48.38		
			PCB 105 (^{13}C-PCB 105)	1.55	50.64	50.54		
			PCB 167 (^{13}C-PCB 167)	1.04	46.21	46.16		
			PCB 189 (^{13}C-PCB 189)	1.32	47.09	47.18		
2	ST190610K1-1	6/10/19	PCB 77 (^{13}C-PCB 77)		49.92	49.51		
			PCB 105 (^{13}C-PCB 105)		51.47	51.46		
			PCB 167 (^{13}C-PCB 167)		46.53	46.39		
			PCB 189 (^{13}C-PCB 189)		47.24	47.53		
3			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					
4			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45326A31

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F8009-BS1

Compound	Spike Added (pg/g)		Spiked Sample Concentration (pg/g)		OPR Percent Recovery		OPR D Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
PCB 15	1.00		0.987		98.7					
PCB 77	↓		1.04		104					
PCB 169			0.969		96.9					
PCB 206			0.950		95.0					

LDC #: 41326A31

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer:
2nd reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 17, PCB-44:

Conc. = $\frac{(7.01e2)(10)(\quad)}{(1.04e5)(0.745)(15.72)(0.326)}$

= 0.0177 ng/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	17	PCB-44	0.0176	0.0177	–

LDC #: 45526

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 8/7/19
Page: 1 of 1
2nd Reviewer: [illegible]

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	y		
Ib.	- All samples present/match report?	y		
Ic.	- All reported analytes present?	y		
Id.	- 10% or 100% verification of EDD?	y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?			
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	y		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	y		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	y		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	-/-		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	-/-		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

September 9, 2019

SUBJECT: Revised Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on July 25, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

- Updated the QAPP reference

LDC Project #45600_RV1:

SDG #	Fraction
1900951, 1901247	Polychlorinated Dioxins/Dibenzofurans, Polychlorinated Biphenyls as Congeners

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy; March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

4,526 pages-ADV

Attachment 1

EDD **Stage 2B 90/10**

LDC #45600 (Anchor Environmental-Seattle WA / Port of Portland, T4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PCBs (1668C)		Dioxins (1613B)																																	
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	W	S	W	S
A	1900951	07/25/19	08/15/19	0	17	0	11																																
A	1900951	07/25/19	08/15/19	0	2	0	3																																
B	1901247	07/25/19	08/15/19	-	-	0	10																																
Total	J/CR			0	19	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Port of Portland - T4\45600ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1900951

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG04-190429**	1900951-03**	Sediment	04/29/19
T4-PDI2019-SG14-190430	1900951-06	Sediment	04/30/19
T4-PDI2019-SG27-190429	1900951-08	Sediment	04/29/19
T4-PDI2019-SG28-190429**	1900951-09**	Sediment	04/29/19
T4-PDI2019-SG29-190429	1900951-10	Sediment	04/29/19
T4-PDI2019-SG30-190429	1900951-11	Sediment	04/29/19
T4-PDI2019-SG31-190501	1900951-12	Sediment	05/01/19
T4-PDI2019-SG33-190501	1900951-13	Sediment	05/01/19
T4-PDI2019-SG36-190501**	1900951-14**	Sediment	05/01/19
T4-PDI2019-SG37-190430	1900951-15	Sediment	04/30/19
T4-PDI2019-SG42-190501	1900951-16	Sediment	05/01/19
T4-PDI2019-SG43-190501	1900951-17	Sediment	05/01/19
FD-201905011017	1900951-18	Sediment	05/01/19
T4-PDI2019-SG44-190501	1900951-19	Sediment	05/01/19
T4-PDI2019-SG28-190429DUP	1900951-09DUP	Sediment	04/29/19
T4-PDI2019-SG36-190501DUP	1900951-14DUP	Sediment	05/01/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	1,2,3,4,6,7,8-HpCDD	170 (≤35)	-	1,2,3,4,6,7,8-HpCDD Total HpCDD	J (all detects) J (all detects)	A
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	OCDD	165 (≤35)	-	OCDD	J (all detects)	A
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	OCDF	170 (≤35)	-	OCDF	J (all detects)	A
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	1,2,3,6,7,8-HxCDD	-	67.92 ng/Kg (≤8.88)	1,2,3,6,7,8-HxCDD Total HxCDD	J (all detects) J (all detects)	A
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	1,2,3,4,6,7,8-HpCDF	-	58.2 ng/Kg (≤8.88)	1,2,3,4,6,7,8-HpCDF Total HpCDF	J (all detects) J (all detects)	A
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	1,2,3,4,7,8,9-HpCDF	-	24.05 ng/Kg (≤8.88)	1,2,3,4,7,8,9-HpCDF	J (all detects)	A

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201905011017 and T4-PDI2019-SG44-190501 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
1,2,3,6,7,8-HxCDD	4.37	3.22	30 (≤50)
1,2,3,7,8,9-HxCDD	0.528	0.350	41 (≤50)
1,2,3,4,6,7,8-HpCDD	91.7	80.0	14 (≤50)
OCDD	936	783	18 (≤50)
2,3,7,8-TCDF	0.449	0.151U	Not calculable
1,2,3,7,8-PeCDF	1.49	0.957	44 (≤50)
2,3,4,7,8-PeCDF	8.53	4.15	69 (≤50)
1,2,3,4,7,8-HxCDF	31.1	24.0	26 (≤50)
1,2,3,6,7,8-HxCDF	5.18	4.14	22 (≤50)
2,3,4,6,7,8-HxCDF	5.21	3.85	30 (≤50)
1,2,3,7,8,9-HxCDF	3.26	2.68	20 (≤50)
1,2,3,4,6,7,8-HpCDF	42.5	36.5	15 (≤50)
1,2,3,4,7,8,9-HpCDF	5.02	5.66	12 (≤50)
OCDF	102	71.4	35 (≤50)
Total HxCDD	13.1	10.1	26 (≤50)
Total HpCDD	159	142	11 (≤50)
Total TCDF	0.973	0.151U	Not calculable
Total PeCDF	60.3	37.6	46 (≤50)
Total HxCDF	146	116	23 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
Total HpCDF	175	146	18 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
T4-PDI2019-SG14-190430 T4-PDI2019-SG27-190429 T4-PDI2019-SG28-190429** T4-PDI2019-SG29-190429 T4-PDI2019-SG30-190429 T4-PDI2019-SG31-190501 T4-PDI2019-SG33-190501 T4-PDI2019-SG36-190501** T4-PDI2019-SG37-190430 T4-PDI2019-SG42-190501 T4-PDI2019-SG43-190501 FD-201905011017	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

For samples T4-PDI2019-SG29-190429, T4-PDI2019-SG37-190430, and FD-201905011017, 2nd column confirmation was not performed for 2,3,7,8-TCDF by the laboratory since the results were either less than the reporting limit or EMPC.

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and difference and results reported as EMPC, data were qualified as estimated in twelve samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1900951

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG36-190501**	1,2,3,4,6,7,8-HpCDD Total HpCDD OCDD OCDF	J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG36-190501**	1,2,3,6,7,8-HxCDD Total HxCDD 1,2,3,4,6,7,8-HpCDF Total HpCDF 1,2,3,4,7,8,9-HpCDF	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (difference)
T4-PDI2019-SG14-190430 T4-PDI2019-SG27-190429 T4-PDI2019-SG28-190429** T4-PDI2019-SG29-190429 T4-PDI2019-SG30-190429 T4-PDI2019-SG31-190501 T4-PDI2019-SG33-190501 T4-PDI2019-SG36-190501** T4-PDI2019-SG37-190430 T4-PDI2019-SG42-190501 T4-PDI2019-SG43-190501 FD-201905011017	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1900951

No Sample Data Qualified in this SDG

LDC #: 45600A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/10/19

SDG #: 1900951 Stage 2B/4 Page: 1 of 2

Laboratory: Vista Analytical Laboratory Reviewer: M

2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20/35
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 13+14
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1 1	T4-PDI2019-SG04-190429**	1900951-03**	Sediment	04/29/19
2 1	T4-PDI2019-SG14-190430	1900951-06	Sediment	04/30/19
3 1	T4-PDI2019-SG27-190429	1900951-08	Sediment	04/29/19
4 2	T4-PDI2019-SG28-190429**	1900951-09**	Sediment	04/29/19
5 2	T4-PDI2019-SG29-190429	1900951-10	Sediment	04/29/19
6 1	T4-PDI2019-SG30-190429	1900951-11	Sediment	04/29/19
7 2	T4-PDI2019-SG31-190501	1900951-12	Sediment	05/01/19
8 1	T4-PDI2019-SG33-190501	1900951-13	Sediment	05/01/19
9 1	T4-PDI2019-SG36-190501**	1900951-14**	Sediment	05/01/19
10 2	T4-PDI2019-SG37-190430	1900951-15	Sediment	04/30/19
11 1	T4-PDI2019-SG42-190501	1900951-16	Sediment	05/01/19
12 1	T4-PDI2019-SG43-190501	1900951-17	Sediment	05/01/19
13 1	FD-201905011017	1900951-18	Sediment	05/01/19
14 1	T4-PDI2019-SG44-190501	1900951-19	Sediment	05/01/19

LDC #: 45600A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/10/19

SDG #: 1900951 Stage 2B/4 Page: 2 of 2

Laboratory: Vista Analytical Laboratory Reviewer: M

2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

15 2	T4-PDI2019-SG28-190429DUP	1900951-09DUP	Sediment	04/29/19
16 1	T4-PDI2019-SG36-190501DUP	1900951-14DUP	Sediment	05/01/19
17				
18				
19				

Notes:

LDC #: 45600A21

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits? MP		✓		

LDC #: 45600A21

VALIDATION FINDINGS CHECKLIST

Reviewer: R
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	✓	✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 45600A21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 35?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits) Difference (ng/kg)	Associated Samples	Qualifications
		16	Sed	F	170 (≤35)	9 (dets)	J dets / A (+U)
				G	165		
				Q	170		
				D	67.92 (≤8.88)		(+T)
				O	582		(+Y)
				P	24.05		

DUP_16.wpd

LDC#:45600A21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: A
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)

Compound	Concentration (ng/Kg)		RPD (≤50)	
	13	14		
D	4.37	3.22	30	
E	0.528*	0.350	41	
F	91.7	80.0	14	
G	936	783	18	
H	0.449	0.151U	NC	
I	1.49	0.957	44	
J	8.53	4.15	69	
K	31.1	24.0	26	
L	5.18	4.14	22	
M	5.21	3.85	30	
N	3.26	2.68	20	
O	42.5	36.5	15	
P	5.02	5.66	12	
Q	102	71.4	35	
T	13.1*	10.1	26	
U	159	142	11	
V	0.973	0.151U	NC	
W	60.3	37.6	46	
X	146	116	23	
Y	175	146	18	

*EMPC

LDC #: 45600A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		2-13	All results flagged "EMPC"		Jdets/A
		5, 10, 13	H not confirmed by the lab when result < RL		text
			or EMPC		

Comments: Per lab SOP, H reported value is the lower result between two columns

LDC #: 47600A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10/50/100 std)	Recalculated RRF (10/50/100 std)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.87	0.87	5.57	5.43
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.86	0.87	6.57	6.70
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.86	0.86	8.35	8.10
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.99	0.98	10.09	10.06
			OCDF (^{13}C-OCDF)	0.94	0.94	0.97	0.97	12.29	12.28
2	ICAL	5/30/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.9476	0.9483	0.87	0.87	9.58	9.65
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45600A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: A
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190607D1S1	6/7/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	9.28	9.31		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	11.2	11.2		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	53.1	53.1		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	48.5	48.3		
			OCDF (^{13}C-OCDF)	0.94	99.9	100		
2	190607D2S1	6/7/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)		9.34	9.36		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)		10.4	10.4		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)		51.4	51.4		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)		50.6	50.6		
			OCDF (^{13}C-OCDF)		99.9	99.7		
3	190619D2S1	6/19/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)		8.63	8.63		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)		11.4	11.4		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)		49.8	49.7		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)		45.9	45.9		
			OCDF (^{13}C-OCDF)		98.2	98.2		

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45600A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	9070115S2	7/1/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.9476	10.0	10.1		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45600A21

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9E0217-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		OPR Percent Recovery		OPRD Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
2,3,7,8-TCDD	40.0		41.2		103	103				
1,2,3,7,8-PeCDD	200		204		102	102				
1,2,3,4,7,8-HxCDD	↓		208		104	104				
1,2,3,4,7,8,9-HpCDF	↓		213		106	107				
OCDF	400		392		98.0	98.0				

LDC #: 47600A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 1, a:

Conc. = $\frac{(1.70e4)(2000)(\quad)}{(6.08e6)(1.05)(6.90)(0.766)}$

= 1.01 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	1	a	1.01	1.01	—

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1900951

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG01-190429	1900951-01	Sediment	04/29/19
T4-PDI2019-SG02-190429	1900951-02	Sediment	04/29/19
T4-PDI2019-SG04-190429	1900951-03	Sediment	04/29/19
T4-PDI2019-SG09-190430	1900951-04	Sediment	04/30/19
T4-PDI2019-SG10-190430	1900951-05	Sediment	04/30/19
T4-PDI2019-SG14-190430	1900951-06	Sediment	04/30/19
T4-PDI2019-SG20-190430	1900951-07	Sediment	04/30/19
T4-PDI2019-SG27-190429	1900951-08	Sediment	04/29/19
T4-PDI2019-SG28-190429**	1900951-09**	Sediment	04/29/19
T4-PDI2019-SG29-190429	1900951-10	Sediment	04/29/19
T4-PDI2019-SG30-190429	1900951-11	Sediment	04/29/19
T4-PDI2019-SG31-190501	1900951-12	Sediment	05/01/19
T4-PDI2019-SG33-190501	1900951-13	Sediment	05/01/19
T4-PDI2019-SG36-190501**	1900951-14**	Sediment	05/01/19
T4-PDI2019-SG37-190430	1900951-15	Sediment	04/30/19
T4-PDI2019-SG42-190501	1900951-16	Sediment	05/01/19
T4-PDI2019-SG43-190501	1900951-17	Sediment	05/01/19
FD-201905011017	1900951-18	Sediment	05/01/19
T4-PDI2019-SG44-190501	1900951-19	Sediment	05/01/19
T4-PDI2019-SG28-190429DUP	1900951-09DUP	Sediment	04/29/19
T4-PDI2019-SG36-190501DUP	1900951-14DUP	Sediment	05/01/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all congeners. The chromatographic resolution between the congeners PCB-23 and PCB-34 and congeners PCB-182 and PCB-187 was resolved with a valley of less than or equal to 40%.

The static resolving power was less than or equal to 10,000 (10% valley definition) at m/z 330.9792 and greater than or equal to 8000 throughout the mass range.

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF within QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
B9F0064-BLK1	06/07/19	PCB-1	0.000872 ug/Kg	T4-PDI2019-SG01-190429 T4-PDI2019-SG02-190429 T4-PDI2019-SG04-190429 T4-PDI2019-SG09-190430 T4-PDI2019-SG10-190430 T4-PDI2019-SG28-190429**
B9F0079-BLK1	06/12/19	PCB-194	0.000612 ug/Kg	T4-PDI2019-SG29-190429 T4-PDI2019-SG30-190429 T4-PDI2019-SG31-190501 T4-PDI2019-SG33-190501 T4-PDI2019-SG36-190501** T4-PDI2019-SG37-190430 T4-PDI2019-SG42-190501 T4-PDI2019-SG43-190501 FD-201905011017 T4-PDI2019-SG44-190501
B9F0126-BLK1	06/13/19	PCB-47 PCB-194 PCB-208	0.000828 ug/Kg 0.000364 ug/Kg 0.000120 ug/Kg	T4-PDI2019-SG14-190430 T4-PDI2019-SG20-190430 T4-PDI2019-SG27-190429

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
T4-PDI2019-SG01-190429	PCB-1	0.00180 ug/Kg	0.00180U ug/Kg
T4-PDI2019-SG02-190429	PCB-1	0.00134 ug/Kg	0.00134U ug/Kg
T4-PDI2019-SG04-190429	PCB-1	0.00105 ug/Kg	0.00105U ug/Kg
T4-PDI2019-SG10-190430	PCB-1	0.00145 ug/Kg	0.00145U ug/Kg
T4-PDI2019-SG28-190429**	PCB-1	0.00158 ug/Kg	0.00158U ug/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Flag	A or P
T4-PDI2019-SG28-190429DUP (T4-PDI2019-SG28-190429**)	PCB-153	185 (≤35)	-	J (all detects)	A
T4-PDI2019-SG28-190429DUP (T4-PDI2019-SG28-190429**)	PCB-2	-	0.01554 ng/Kg (≤0.0099)	J (all detects)	A
	PCB-16/32	-	0.06198 ng/Kg (≤0.01978)	J (all detects)	
	PCB-17	-	0.04515 ng/Kg (≤0.0099)	J (all detects)	
	PCB-18	-	0.07932 ng/Kg (≤0.0099)	J (all detects)	
	PCB-19	-	0.0267 ng/Kg (≤0.0099)	J (all detects)	
	PCB-20/21/33	-	0.10662 ng/Kg (≤0.0296)	J (all detects)	
	PCB-22	-	0.05848 ng/Kg (≤0.0099)	J (all detects)	
	PCB-25	-	0.018534 ng/Kg (≤0.0099)	J (all detects)	
	PCB-26	-	0.03562 ng/Kg (≤0.0099)	J (all detects)	
	PCB-28	-	0.17956 ng/Kg (≤0.0099)	J (all detects)	
	PCB-31	-	0.15809 ng/Kg (≤0.0099)	J (all detects)	
	PCB-37	-	0.07825 ng/Kg (≤0.0099)	J (all detects)	
	PCB-40	-	0.0277 ng/Kg (≤0.0099)	J (all detects)	
	PCB-41/64/71/72	-	0.14696 ng/Kg (≤0.0396)	J (all detects)	
	PCB-42/59	-	0.06016 ng/Kg (≤0.01978)	J (all detects)	
	PCB-43/49	-	0.1948 ng/Kg (≤0.01978)	J (all detects)	
	PCB-44	-	0.1618 ng/Kg (≤0.0099)	J (all detects)	
	PCB-45	-	0.02142 ng/Kg (≤0.0099)	J (all detects)	
	PCB-47	-	0.12775 ng/Kg (≤0.0099)	J (all detects)	
	PCB-48/75	-	0.02724 ng/Kg (≤0.01978)	J (all detects)	
	PCB-51	-	0.02558 ng/Kg (≤0.0099)	J (all detects)	
	PCB-52/69	-	0.22931 ng/Kg (≤0.01978)	J (all detects)	
	PCB-53	-	0.03867 ng/Kg (≤0.0099)	J (all detects)	
	PCB-56/60	-	0.10637 ng/Kg (≤0.01978)	J (all detects)	
	PCB-61/70	-	0.25589 ng/Kg (≤0.01978)	J (all detects)	
	PCB-66/76	-	0.19581 ng/Kg (≤0.01978)	J (all detects)	
	PCB-74	-	0.08476 ng/Kg (≤0.0099)	J (all detects)	
	PCB-77	-	0.02676 ng/Kg (≤0.0099)	J (all detects)	
	PCB-82	-	0.04293 ng/Kg (≤0.0099)	J (all detects)	
	PCB-84/92	-	0.17967 ng/Kg (≤0.01978)	J (all detects)	
	PCB-85/116	-	0.05902 ng/Kg (≤0.01978)	J (all detects)	
	PCB-87/117/125	-	0.11888 ng/Kg (≤0.0296)	J (all detects)	
	PCB-88/91	-	0.07394 ng/Kg (≤0.01978)	J (all detects)	
	PCB-90/101	-	0.472 ng/Kg (≤0.01978)	J (all detects)	
	PCB-95/98/102	-	0.2869 ng/Kg (≤0.0296)	J (all detects)	
	PCB-97	-	0.1092 ng/Kg (≤0.0099)	J (all detects)	
	PCB-99	-	0.19356 ng/Kg (≤0.0099)	J (all detects)	
	PCB-100	-	0.011875 ng/Kg (≤0.0099)	J (all detects)	
	PCB-103	-	0.011254 ng/Kg (≤0.0099)	J (all detects)	
	PCB-105	-	0.15135 ng/Kg (≤0.0099)	J (all detects)	
	PCB-106/118	-	0.3734 ng/Kg (≤0.01978)	J (all detects)	
	PCB-107/109	-	0.032364 ng/Kg (≤0.01978)	J (all detects)	
	PCB-110	-	0.4207 ng/Kg (≤0.0099)	J (all detects)	
	PCB-119	-	0.015992 ng/Kg (≤0.0099)	J (all detects)	
	PCB-128/162	-	0.09981 ng/Kg (≤0.01978)	J (all detects)	
	PCB-129	-	0.02696 ng/Kg (≤0.0099)	J (all detects)	
	PCB-130	-	0.04812 ng/Kg (≤0.0099)	J (all detects)	

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Flag	A or P
T4-PDI2019-SG28-190429DUP (T4-PDI2019-SG28-190429**) (continued)	PCB-131/133	-	0.021819 ng/Kg (≤0.01978)	J (all detects)	A
	PCB-132/161	-	0.16389 ng/Kg (≤0.01978)	J (all detects)	
	PCB-134/143	-	0.03421 ng/Kg (≤0.01978)	J (all detects)	
	PCB-135	-	0.07837 ng/Kg (≤0.0099)	J (all detects)	
	PCB-136	-	0.08563 ng/Kg (≤0.0099)	J (all detects)	
	PCB-137	-	0.02146 ng/Kg (≤0.0099)	J (all detects)	
	PCB-138/163/164	-	0.7042 ng/Kg (≤0.0296)	J (all detects)	
	PCB-139/149	-	0.4773 ng/Kg (≤0.01978)	J (all detects)	
	PCB-141	-	0.13565 ng/Kg (≤0.0099)	J (all detects)	
	PCB-144	-	0.01927 ng/Kg (≤0.0099)	J (all detects)	
	PCB-146/165	-	0.12524 ng/Kg (≤0.01978)	J (all detects)	
	PCB-147	-	0.015258 ng/Kg (≤0.0099)	J (all detects)	
	PCB-151	-	0.16173 ng/Kg (≤0.0099)	J (all detects)	
	PCB-154	-	0.016905 ng/Kg (≤0.0099)	J (all detects)	
	PCB-156	-	0.06698 ng/Kg (≤0.0099)	J (all detects)	
	PCB-158/160	-	0.07024 ng/Kg (≤0.01978)	J (all detects)	
	PCB-167	-	0.02848 ng/Kg (≤0.0099)	J (all detects)	
	PCB-170	-	0.23794 ng/Kg (≤0.0099)	J (all detects)	
	PCB-171	-	0.06077 ng/Kg (≤0.0099)	J (all detects)	
	PCB-172	-	0.03881 ng/Kg (≤0.0099)	J (all detects)	
	PCB-174	-	0.22513 ng/Kg (≤0.0099)	J (all detects)	
	PCB-176	-	0.02749 ng/Kg (≤0.0099)	J (all detects)	
	PCB-177	-	0.14236 ng/Kg (≤0.0099)	J (all detects)	
	PCB-178	-	0.05119 ng/Kg (≤0.0099)	J (all detects)	
	PCB-179	-	0.09242 ng/Kg (≤0.0099)	J (all detects)	
	PCB-180	-	0.5209 ng/Kg (≤0.0099)	J (all detects)	
	PCB-182/187	-	0.281 ng/Kg (≤0.01978)	J (all detects)	
	PCB-183	-	0.11941 ng/Kg (≤0.0099)	J (all detects)	
	PCB-185	-	0.0269 ng/Kg (≤0.0099)	J (all detects)	
	PCB-190	-	0.04685 ng/Kg (≤0.0099)	J (all detects)	
	PCB-193	-	0.028925 ng/Kg (≤0.0099)	J (all detects)	
	PCB-194	-	0.10939 ng/Kg (≤0.0099)	J (all detects)	
	PCB-195	-	0.04561 ng/Kg (≤0.0099)	J (all detects)	
	PCB-196/203	-	0.14122 ng/Kg (≤0.01978)	J (all detects)	
	PCB-199	-	0.13813 ng/Kg (≤0.0099)	J (all detects)	
	PCB-200	-	0.015174 ng/Kg (≤0.0099)	J (all detects)	
	PCB-206	-	0.15323 ng/Kg (≤0.0099)	J (all detects)	
	PCB-207	-	0.012793 ng/Kg (≤0.0099)	J (all detects)	
	PCB-208	-	0.05804 ng/Kg (≤0.0099)	J (all detects)	
	PCB-209	-	0.22576 ng/Kg (≤0.0099)	J (all detects)	
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	PCB-28	51.2 (≤35)	-	J (all detects)	A
	PCB-37	41.8 (≤35)	-	J (all detects)	
	PCB-105	51.0 (≤35)	-	J (all detects)	
	PCB-106/118	52.2 (≤35)	-	J (all detects)	
T4-PDI2019-SG36-190501DUP (T4-PDI2019-SG36-190501**)	PCB-1	-	0.0656 ng/Kg (≤0.00992)	J (all detects)	A
	PCB-2	-	0.01307 ng/Kg (≤0.00992)	J (all detects)	
	PCB-3	-	0.04298 ng/Kg (≤0.00992)	J (all detects)	
	PCB-97	-	0.0153 ng/Kg (≤0.00992)	J (all detects)	
	PCB-156		0.0138 ng/Kg (≤0.00992)	J (all detects)	

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201905011017 and T4-PDI2019-SG44-190501 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-1	0.00207	0.00157	27 (≤50)
PCB-2	0.00136	0.000764	56 (≤50)
PCB-3	0.00193	0.00139	33 (≤50)
PCB-5/8	0.0103	0.00122U	Not calculable
PCB-15	0.0147	0.0122	19 (≤50)
PCB-16/32	0.00622	0.00564	10 (≤50)
PCB-17	0.00385	0.00398	3 (≤50)
PCB-18	0.00798	0.00813	2 (≤50)
PCB-19	0.000429	0.00147	110 (≤50)
PCB-20/21/33	0.0104	0.00918	12 (≤50)
PCB-22	0.00578	0.00613	6 (≤50)
PCB-25	0.00138	0.00181	27 (≤50)
PCB-26	0.00278	0.00259	7 (≤50)
PCB-28	0.0179	0.0173	3 (≤50)
PCB-31	0.0151	0.0143	5 (≤50)
PCB-35	0.000872	0.000722	19 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-37	0.00994	0.0113	13 (≤50)
PCB-38	0.000242	0.000629	89 (≤50)
PCB-40	0.00278	0.00280	1 (≤50)
PCB-41/64/71/72	0.0130	0.0153	16 (≤50)
PCB-42/59	0.00422	0.00434	3 (≤50)
PCB-43/49	0.0135	0.0141	4 (≤50)
PCB-44	0.00887	0.0131	39 (≤50)
PCB-45	0.00194	0.00154	23 (≤50)
PCB-46	0.000419	0.00101	83 (≤50)
PCB-47	0.00748	0.00783	5 (≤50)
PCB-48/75	0.00240	0.00281	16 (≤50)
PCB-51	0.000318	0.00103	106 (≤50)
PCB-52/69	0.0131	0.0209	46 (≤50)
PCB-53	0.00184	0.00254	32 (≤50)
PCB-56/60	0.00866	0.00957	10 (≤50)
PCB-61/70	0.0191	0.0232	19 (≤50)
PCB-63	0.000526	0.000711	30 (≤50)
PCB-66/76	0.0162	0.0176	8 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-67	0.000677	0.000320	72 (≤50)
PCB-74	0.00698	0.00744	6 (≤50)
PCB-77	0.00348	0.00318	9 (≤50)
PCB-79	0.000207	0.000676	106 (≤50)
PCB-81	0.000229	0.000762	108 (≤50)
PCB-82	0.00212	0.00369	54 (≤50)
PCB-84/92	0.00793	0.0169	72 (≤50)
PCB-85/116	0.00636	0.00682	7 (≤50)
PCB-87/117/125	0.00827	0.0143	53 (≤50)
PCB-88/91	0.00392	0.00583	39 (≤50)
PCB-90/101	0.0243	0.0412	52 (≤50)
PCB-95/98/102	0.0150	0.0319	72 (≤50)
PCB-97	0.00561	0.0111	66 (≤50)
PCB-99	0.0140	0.0178	24 (≤50)
PCB-100	0.00017	0.000684	120 (≤50)
PCB-105	0.0166	0.0210	23 (≤50)
PCB-106/118	0.0333	0.0423	24 (≤50)
PCB-107/109	0.00290	0.00339	16 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-108/112	0.000969	0.00166	53 (≤50)
PCB-110	0.0327	0.0488	40 (≤50)
PCB-111/115	0.000728	0.000629	15 (≤50)
PCB-114	0.000880	0.00141	46 (≤50)
PCB-119	0.00104	0.000736	34 (≤50)
PCB-122	0.000513	0.000385	29 (≤50)
PCB-123	0.000716	0.000666	7 (≤50)
PCB-124	0.00173	0.00196	12 (≤50)
PCB-128/162	0.00929	0.0117	23 (≤50)
PCB-129	0.00225	0.00287	24 (≤50)
PCB-130	0.00334	0.00509	42 (≤50)
PCB-131/133	0.00109	0.00244	76 (≤50)
PCB-132/161	0.0115	0.0167	37 (≤50)
PCB-134/143	0.00242	0.00356	38 (≤50)
PCB-135	0.00551	0.00782	35 (≤50)
PCB-136	0.00467	0.00616	28 (≤50)
PCB-137	0.00292	0.00445	42 (≤50)
PCB-138/163/164	0.0548	0.0660	19 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-139/149	0.0350	0.0421	18 (≤50)
PCB-141	0.00901	0.0108	18 (≤50)
PCB-144	0.00184	0.00285	43 (≤50)
PCB-146/165	0.00761	0.00921	19 (≤50)
PCB-147	0.00126	0.00194	43 (≤50)
PCB-151	0.0111	0.0113	2 (≤50)
PCB-153	0.0442	0.0513	15 (≤50)
PCB-154	0.00109	0.000865	23 (≤50)
PCB-156	0.00586	0.00776	28 (≤50)
PCB-157	0.00147	0.00231	44 (≤50)
PCB-158/160	0.00557	0.00835	40 (≤50)
PCB-167	0.00282	0.00289	2 (≤50)
PCB-170	0.0171	0.0199	15 (≤50)
PCB-171	0.00400	0.00454	13 (≤50)
PCB-172	0.00276	0.00291	5 (≤50)
PCB-174	0.0149	0.0167	11 (≤50)
PCB-176	0.00184	0.00207	12 (≤50)
PCB-177	0.00926	0.00995	7 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-178	0.00363	0.00337	7 (≤50)
PCB-179	0.00593	0.00621	5 (≤50)
PCB-180	0.0342	0.0390	13 (≤50)
PCB-182/187	0.0214	0.0219	2 (≤50)
PCB-183	0.00941	0.00974	3 (≤50)
PCB-185	0.00169	0.00182	7 (≤50)
PCB-189	0.000866	0.000118U	Not calculable
PCB-190	0.00372	0.00399	7 (≤50)
PCB-191	0.000590	0.00102	53 (≤50)
PCB-193	0.00210	0.00194	8 (≤50)
PCB-194	0.00838	0.00781	7 (≤50)
PCB-195	0.00429	0.00399	7 (≤50)
PCB-196/203	0.0110	0.0108	2 (≤50)
PCB-197	0.000415	0.000287	36 (≤50)
PCB-198	0.000257	0.000391	41 (≤50)
PCB-199	0.0102	0.0104	2 (≤50)
PCB-200	0.000978	0.00122	22 (≤50)
PCB-201	0.00175	0.00107	48 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	FD-201905011017	T4-PDI2019-SG44-190501	
PCB-202	0.00164	0.00216	27 (≤50)
PCB-205	0.000744	0.000121U	Not calculable
PCB-206	0.00694	0.00637	9 (≤50)
PCB-207	0.00113	0.000921	20 (≤50)
PCB-208	0.00222	0.00240	8 (≤50)
PCB-209	0.00614	0.00648	5 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG01-190429	13C-PCB-209	147 (10-145)	PCB-209	J (all detects)	P

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1900951	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and difference, labeled compound %R, and results reported as EMPC, data were qualified as estimated in nineteen samples.

Due to laboratory blank contamination, data were qualified as not detected in five samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 1900951

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG28-190429**	PCB-153	J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG28-190429**	PCB-2	J (all detects)	A	Duplicate sample analysis (difference)
	PCB-16/32	J (all detects)		
	PCB-17	J (all detects)		
	PCB-18	J (all detects)		
	PCB-19	J (all detects)		
	PCB-20/21/33	J (all detects)		
	PCB-22	J (all detects)		
	PCB-25	J (all detects)		
	PCB-26	J (all detects)		
	PCB-28	J (all detects)		
	PCB-31	J (all detects)		
	PCB-37	J (all detects)		
	PCB-40	J (all detects)		
	PCB-41/64/71/72	J (all detects)		
	PCB-42/59	J (all detects)		
	PCB-43/49	J (all detects)		
	PCB-44	J (all detects)		
	PCB-45	J (all detects)		
	PCB-47	J (all detects)		
	PCB-48/75	J (all detects)		
	PCB-51	J (all detects)		
	PCB-52/69	J (all detects)		
	PCB-53	J (all detects)		
	PCB-56/60	J (all detects)		
	PCB-61/70	J (all detects)		
	PCB-66/76	J (all detects)		
	PCB-74	J (all detects)		
	PCB-77	J (all detects)		
	PCB-82	J (all detects)		
	PCB-84/92	J (all detects)		
	PCB-85/116	J (all detects)		
	PCB-87/117/125	J (all detects)		
	PCB-88/91	J (all detects)		
	PCB-90/101	J (all detects)		
	PCB-95/98/102	J (all detects)		
	PCB-97	J (all detects)		
	PCB-99	J (all detects)		
	PCB-100	J (all detects)		
	PCB-103	J (all detects)		
	PCB-105	J (all detects)		
	PCB-106/118	J (all detects)		
	PCB-107/109	J (all detects)		
	PCB-110	J (all detects)		
	PCB-119	J (all detects)		
	PCB-128/162	J (all detects)		
	PCB-129	J (all detects)		
	PCB-130	J (all detects)		

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG28-190429** (continued)	PCB-131/133 PCB-132/161 PCB-134/143 PCB-135 PCB-136 PCB-137 PCB-138/163/164 PCB-139/149 PCB-141 PCB-144 PCB-146/165 PCB-147 PCB-151 PCB-154 PCB-156 PCB-158/160 PCB-167 PCB-170 PCB-171 PCB-172 PCB-174 PCB-176 PCB-177 PCB-178 PCB-179 PCB-180 PCB-182/187 PCB-183 PCB-185 PCB-190 PCB-193 PCB-194 PCB-195 PCB-196/203 PCB-199 PCB-200 PCB-206 PCB-207 PCB-208 PCB-209	J (all detects) J (all detects)	A	Duplicate sample analysis (difference)
T4-PDI2019-SG36-190501**	PCB-28 PCB-37 PCB-105 PCB-106/118	J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG36-190501**	PCB-1 PCB-2 PCB-3 PCB-97 PCB-156	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (difference)
T4-PDI2019-SG01-190429	PCB-209	J (all detects)	P	Labeled compounds (%R)

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG01-190429 T4-PDI2019-SG02-190429 T4-PDI2019-SG04-190429 T4-PDI2019-SG09-190430 T4-PDI2019-SG10-190430 T4-PDI2019-SG14-190430 T4-PDI2019-SG20-190430 T4-PDI2019-SG27-190429 T4-PDI2019-SG28-190429** T4-PDI2019-SG29-190429 T4-PDI2019-SG30-190429 T4-PDI2019-SG31-190501 T4-PDI2019-SG33-190501 T4-PDI2019-SG36-190501** T4-PDI2019-SG37-190430 T4-PDI2019-SG42-190501 T4-PDI2019-SG43-190501 FD-201905011017 T4-PDI2019-SG44-190501	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 1900951

Sample	Compound	Modified Final Concentration	A or P
T4-PDI2019-SG01-190429	PCB-1	0.00180U ug/Kg	A
T4-PDI2019-SG02-190429	PCB-1	0.00134U ug/Kg	A
T4-PDI2019-SG04-190429	PCB-1	0.00105U ug/Kg	A
T4-PDI2019-SG10-190430	PCB-1	0.00145U ug/Kg	A
T4-PDI2019-SG28-190429**	PCB-1	0.00158U ug/Kg	A

LDC #: 45600A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/10/19

SDG #: 1900951 Stage 2B/4 Page: 1 of 2

Laboratory: Vista Analytical Laboratory Reviewer: VL

2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	RSD≤20 |r| ≤ QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 18+19
X.	Labeled Compounds	SW	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1 1	T4-PDI2019-SG01-190429	1900951-01	Sediment	04/29/19
2 1	T4-PDI2019-SG02-190429	1900951-02	Sediment	04/29/19
3 1	T4-PDI2019-SG04-190429	1900951-03	Sediment	04/29/19
4 1	T4-PDI2019-SG09-190430	1900951-04	Sediment	04/30/19
5 1	T4-PDI2019-SG10-190430	1900951-05	Sediment	04/30/19
6 3	T4-PDI2019-SG14-190430	1900951-06	Sediment	04/30/19
7 3	T4-PDI2019-SG20-190430	1900951-07	Sediment	04/30/19
8 3	T4-PDI2019-SG27-190429	1900951-08	Sediment	04/29/19
9 1	T4-PDI2019-SG28-190429**	1900951-09**	Sediment	04/29/19
10 2	T4-PDI2019-SG29-190429	1900951-10	Sediment	04/29/19
11 2	T4-PDI2019-SG30-190429	1900951-11	Sediment	04/29/19
12 2	T4-PDI2019-SG31-190501	1900951-12	Sediment	05/01/19
13 2	T4-PDI2019-SG33-190501	1900951-13	Sediment	05/01/19
14 2	T4-PDI2019-SG36-190501**	1900951-14**	Sediment	05/01/19

LDC #: 45600A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/10/19

SDG #: 1900951 Stage 2B/4 Page: 2 of 2

Laboratory: Vista Analytical Laboratory Reviewer: M

2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

15 2	T4-PDI2019-SG37-190430	1900951-15	Sediment	04/30/19
16 2	T4-PDI2019-SG42-190501	1900951-16	Sediment	05/01/19
17 2	T4-PDI2019-SG43-190501	1900951-17	Sediment	05/01/19
18 2	FD-201905011017	1900951-18	Sediment	05/01/19
19 2	T4-PDI2019-SG44-190501	1900951-19	Sediment	05/01/19
20 1	T4-PDI2019-SG28-190429DUP	1900951-09DUP	Sediment	04/29/19
21 2	T4-PDI2019-SG36-190501DUP	1900951-14DUP	Sediment	05/01/19
22				
23				
24				

Notes:

LDC #: 45600A31

VALIDATION FINDINGS CHECKLIST

Reviewer: DC
2nd Reviewer: [illegible]

Method: HRGC/HRMS Polychlorinated Biphenyls (EPA Method 1668C)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 330.9792 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution (valley) between PCB 23 and PCB 34 and between PCB 182 and PCB 187 ≤ 40% ?	✓			
Is the static resolving power ≥10,000 at m/z 330.9792 and ≥ 8000 throughout the mass range?	✓			
Was the mass resolution adequately checked with PFK?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤20% for unlabeled and labeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all percent differences (%D) ≤25% for unlabeled and percent recoveries (%R) for labeled compounds within 50-145%?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
V. Laboratory Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the blanks validation findings worksheet.	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. 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? MP		✓		

LDC #: 45600A31

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compound recoveries within the QC criteria?		✓		
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For polychlorinated biphenyl congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For polychlorinated biphenyl congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For other polychlorinated biphenyl congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound and labeled standard ≥ 2.5?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 45600A31

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: n
2nd Reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668B)

Blank extraction date: 6/07/19 **Blank analysis date:** 6/10/19
Conc. units: ug/Kg **Associated samples:** 1-5,9 Qualify U

Compound	Blank ID	Sample Identification								
	B9F0064-BLK1	5X	1	2	3	5	9			
PCB-1	0.000872	0.00436	0.00180	0.00134	0.00105	0.00145	0.00158			

*EMPC

Blank extraction date: 6/12/19 **Blank analysis date:** 6/14/19
Conc. units: ug/Kg **Associated samples:** 10-19 Qualify U

Compound	Blank ID	Sample Identification								
	B9F0079-BLK1	5X								
PCB-194	0.000612*	0.00306								

Blank extraction date: 6/13/19 **Blank analysis date:** 6/20/19
Conc. units: ug/Kg **Associated samples:** 6-8 Qualify U

Compound	Blank ID	Sample Identification								
	B9F0126-BLK1	5X								
PCB-47	0.000828*	0.00414								
PCB-194	0.000364*	0.00182								
PCB-208	0.000120*	0.0006								

LDC #: 45600 A31

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: R
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) within the QC limits?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits) / Difference (ng/kg)	Associated Samples	Qualifications
		20	Sed	PCB-153	185 (≤35)	9 (dets)	J dets/A
		21	Sed	PCB-28	51.2	14 (dets)	
				37	41.8		
				105	51.0		
				106/118	52.2		
		20 ~~21~~	Sed	attached	Difference	worksheets	
		21	Sed	PCB-1	0.0656 (≤0.00992 ng/kg)	14 (dets)	J dets/A
				2	0.01307		
				3	0.04298		
				97	0.0153		
				156	0.0138		

Comments:

LDC#: 45600A31

VALIDATION FINDINGS WORKSHEET

Duplicate Analysis

Reviewer: M

2nd Reviewer: O

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		Difference (ug/Kg)	Diff Limits (2XQL)	Qualification	
	9	20				
PCB-2	0.00166	0.0172	0.01554	0.0099	Jdets/A	
PCB-16/32	0.00242	0.0644	0.06198	0.01978		
PCB-17	0.00185	0.047	0.04515	0.0099		
PCB-18	0.00438	0.0837	0.07932	0.0099		
PCB-19	0.0015	0.0282	0.0267	0.0099		
PCB-20/21/33	0.00438	0.111	0.10662	0.0296		
PCB-22	0.00272	0.0612	0.05848	0.0099		
PCB-25	0.000666	0.0192	0.018534	0.0099		
PCB-26	0.00148	0.0371	0.03562	0.0099		
PCB-28	0.00744	0.187	0.17956	0.0099		
PCB-31	0.00591	0.164	0.15809	0.0099		
PCB-37	0.00245	0.0807	0.07825	0.0099		
PCB-40	0.0016	0.0293	0.0277	0.0099		
PCB-41/64/71/72	0.00704	0.154	0.14696	0.0396		
PCB-42/59	0.00204	0.0622	0.06016	0.01978		
PCB-43/49	0.0072	0.202	0.1948	0.01978		
PCB-44	0.0062	0.168	0.1618	0.0099		
PCB-45	0.00138	0.0228	0.02142	0.0099		
PCB-47	0.00525	0.133	0.12775	0.0099		
PCB-48/75	0.00146	0.0287	0.02724	0.01978		
PCB-51	0.00142	0.027	0.02558	0.0099		
PCB-52/69	0.00869	0.238	0.22931	0.01978		
PCB-53	0.00193	0.0406	0.03867	0.0099		
PCB-56/60	0.00363	0.11	0.10637	0.01978		
PCB-61/70	0.00911	0.265	0.25589	0.01978		
PCB-66/76	0.00619	0.202	0.19581	0.01978		
PCB-74	0.00264	0.0874	0.08476	0.0099		
PCB-77	0.00114	0.0279	0.02676	0.0099		
PCB-82	0.00107	0.044	0.04293	0.0099		
PCB-84/92	0.00633	0.186	0.17967	0.01978		
PCB-85/116	0.00248	0.0615	0.05902	0.01978		
PCB-87/117/125	0.00412	0.123	0.11888	0.0296		
PCB-88/91	0.00216	0.0761	0.07394	0.01978		
PCB-90/101	0.017	0.489	0.472	0.01978		
PCB-95/98/102	0.0121	0.299	0.2869	0.0296		
PCB-97	0.0038	0.113	0.1092	0.0099		
PCB-99	0.00744	0.201	0.19356	0.0099		
PCB-100	0.000225	0.0121	0.011875	0.0099		
PCB-103	0.000746	0.012	0.011254	0.0099		
PCB-105	0.00565	0.157	0.15135	0.0099		
PCB-106/118	0.0126	0.386	0.3734	0.01978		
PCB-107/109	0.000936	0.0333	0.032364	0.01978		
PCB-110	0.0173	0.438	0.4207	0.0099		
PCB-119	0.000908	0.0169	0.015992	0.0099		√

LDC#: 45600A31

VALIDATION FINDINGS WORKSHEET

Duplicate Analysis

Reviewer: M

2nd Reviewer: ✓

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		Difference (ug/Kg)	Diff Limits (2XQL)	Qualification	
	9	20				
PCB-128/162	0.00419	0.104	0.09981	0.01978	Jdqs/A	
PCB-129	0.00134	0.0283	0.02696	0.0099		
PCB-130	0.00228	0.0504	0.04812	0.0099		
PCB-131/133	0.000581	0.0224	0.021819	0.01978		
PCB-132/161	0.00611	0.17	0.16389	0.01978		
PCB-134/143	0.00109	0.0353	0.03421	0.01978		
PCB-135	0.00343	0.0818	0.07837	0.0099		
PCB-136	0.00397	0.0896	0.08563	0.0099		
PCB-137	0.00104	0.0225	0.02146	0.0099		
PCB-138/163/164	0.0288	0.733	0.7042	0.0296		
PCB-139/149	0.0197	0.497	0.4773	0.01978		
PCB-141	0.00435	0.14	0.13565	0.0099		
PCB-144	0.00123	0.0205	0.01927	0.0099		
PCB-146/165	0.00476	0.13	0.12524	0.01978		
PCB-147	0.000742	0.016	0.015258	0.0099		
PCB-151	0.00627	0.168	0.16173	0.0099		
PCB-154	0.000595	0.0175	0.016905	0.0099		
PCB-156	0.00222	0.0692	0.06698	0.0099		
PCB-158/160	0.00296	0.0732	0.07024	0.01978		
PCB-167	0.00142	0.0299	0.02848	0.0099		
PCB-170	0.00906	0.247	0.23794	0.0099		
PCB-171	0.00263	0.0634	0.06077	0.0099		
PCB-172	0.00179	0.0406	0.03881	0.0099		
PCB-174	0.00987	0.235	0.22513	0.0099		
PCB-176	0.00091	0.0284	0.02749	0.0099		
PCB-177	0.00564	0.148	0.14236	0.0099		
PCB-178	0.00241	0.0536	0.05119	0.0099		
PCB-179	0.00428	0.0967	0.09242	0.0099		
PCB-180	0.0221	0.543	0.5209	0.0099		
PCB-182/187	0.012	0.293	0.281	0.01978		
PCB-183	0.00559	0.125	0.11941	0.0099		
PCB-185	0.0013	0.0282	0.0269	0.0099		
PCB-190	0.00215	0.049	0.04685	0.0099		
PCB-193	0.000975	0.0299	0.028925	0.0099		
PCB-194	0.00461	0.114	0.10939	0.0099		
PCB-195	0.00159	0.0472	0.04561	0.0099		
PCB-196/203	0.00478	0.146	0.14122	0.01978		
PCB-199	0.00487	0.143	0.13813	0.0099		
PCB-200	0.000426	0.0156	0.015174	0.0099		
PCB-206	0.00277	0.156	0.15323	0.0099		
PCB-207	0.000507	0.0133	0.012793	0.0099		
PCB-208	0.00116	0.0592	0.05804	0.0099		
PCB-209	0.00224	0.228	0.22576	0.0099	✓	

LDC#: 45600A31

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: M

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	18	19	(≤50%)	
PCB-1	0.00207	0.00157	27	
PCB-2	0.00136	0.000764	56	
PCB-3	0.00193	0.00139	33	
PCB-5/8	0.0103	0.00122U	NC	
PCB-15	0.0147	0.0122	19	
PCB-16/32	0.00622	0.00564	10	
PCB-17	0.00385	0.00398	3	
PCB-18	0.00798	0.00813	2	
PCB-19	0.000429	0.00147	110	
PCB-20/21/33	0.0104	0.00918	12	
PCB-22	0.00578	0.00613	6	
PCB-25	0.00138	0.00181	27	
PCB-26	0.00278	0.00259	7	
PCB-28	0.0179	0.0173	3	
PCB-31	0.0151	0.0143	5	
PCB-35	0.000872	0.000722	19	
PCB-37	0.00994	0.0113	13	
PCB-38	0.000242	0.000629	89	
PCB-40	0.00278	0.00280	1	
PCB-41/64/71/72	0.0130	0.0153	16	
PCB-42/59	0.00422	0.00434	3	
PCB-43/49	0.0135	0.0141	4	
PCB-44	0.00887	0.0131	39	
PCB-45	0.00194	0.00154	23	
PCB-46	0.000419	0.00101	83	
PCB-47	0.00748	0.00783	5	
PCB-48/75	0.00240	0.00281	16	
PCB-51	0.000318	0.00103	106	
PCB-52/69	0.0131	0.0209	46	
PCB-53	0.00184	0.00254	32	
PCB-56/60	0.00866	0.00957	10	
PCB-61/70	0.0191	0.0232	19	
PCB-63	0.000526	0.000711	30	
PCB-66/76	0.0162	0.0176	8	
PCB-67	0.000677	0.000320	72	
PCB-74	0.00698	0.00744	6	
PCB-77	0.00348	0.00318	9	
PCB-79	0.000207	0.000676	106	
PCB-81	0.000229	0.000762	108	
PCB-82	0.00212	0.00369	54	
PCB-84/92	0.00793	0.0169	72	
PCB-85/116	0.00636	0.00682	7	
PCB-87/117/125	0.00827	0.0143	53	
PCB-88/91	0.00392	0.00583	39	
PCB-90/101	0.0243	0.0412	52	
PCB-95/98/102	0.0150	0.0319	72	
PCB-97	0.00561	0.0111	66	
PCB-99	0.0140	0.0178	24	
PCB-100	0.00017	0.000684	120	
PCB-105	0.0166	0.0210	23	
PCB-106/118	0.0333	0.0423	24	
PCB-107/109	0.00290	0.00339	16	
PCB-108/112	0.000969	0.00166	53	
PCB-110	0.0327	0.0488	40	
PCB-111/115	0.000728	0.000629	15	
PCB-114	0.000880	0.00141	46	
PCB-119	0.00104	0.000736	34	

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VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: M

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	18	19	(≤50%)	
PCB-122	0.000513	0.000385	29	
PCB-123	0.000716	0.000666	7	
PCB-124	0.00173	0.00196	12	
PCB-128/162	0.00929	0.0117	23	
PCB-129	0.00225	0.00287	24	
PCB-130	0.00334	0.00509	42	
PCB-131/133	0.00109	0.00244	76	
PCB-132/161	0.0115	0.0167	37	
PCB-134/143	0.00242	0.00356	38	
PCB-135	0.00551	0.00782	35	
PCB-136	0.00467	0.00616	28	
PCB-137	0.00292	0.00445	42	
PCB-138/163/164	0.0548	0.0660	19	
PCB-139/149	0.0350	0.0421	18	
PCB-141	0.00901	0.0108	18	
PCB-144	0.00184	0.00285	43	
PCB-146/165	0.00761	0.00921	19	
PCB-147	0.00126	0.00194	43	
PCB-151	0.0111	0.0113	2	
PCB-153	0.0442	0.0513	15	
PCB-154	0.00109	0.000865	23	
PCB-156	0.00586	0.00776	28	
PCB-157	0.00147	0.00231	44	
PCB-158/160	0.00557	0.00835	40	
PCB-167	0.00282	0.00289	2	
PCB-170	0.0171	0.0199	15	
PCB-171	0.00400	0.00454	13	
PCB-172	0.00276	0.00291	5	
PCB-174	0.0149	0.0167	11	
PCB-176	0.00184	0.00207	12	
PCB-177	0.00926	0.00995	7	
PCB-178	0.00363	0.00337	7	
PCB-179	0.00593	0.00621	5	
PCB-180	0.0342	0.0390	13	
PCB-182/187	0.0214	0.0219	2	
PCB-183	0.00941	0.00974	3	
PCB-185	0.00169	0.00182	7	
PCB-189	0.000866	0.000118U	NC	
PCB-190	0.00372	0.00399	7	
PCB-191	0.000590	0.00102	53	
PCB-193	0.00210	0.00194	8	
PCB-194	0.00838	0.00781	7	
PCB-195	0.00429	0.00399	7	
PCB-196/203	0.0110	0.0108	2	
PCB-197	0.000415	0.000287	36	
PCB-198	0.000257	0.000391	41	
PCB-199	0.0102	0.0104	2	
PCB-200	0.000978	0.00122	22	
PCB-201	0.00175	0.00107	48	
PCB-202	0.00164	0.00216	27	
PCB-205	0.000744	0.000121U	NC	
PCB-206	0.00694	0.00637	9	
PCB-207	0.00113	0.000921	20	
PCB-208	0.00222	0.00240	8	
PCB-209	0.00614	0.00648	5	

LDC #: 45600A31

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Page: 1 of 1
Reviewer: JC
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Y (N) N/A Were all labeled compound recoveries and ion abundance ratios (IAR) within the QC criteria?
(Y) N N/A Was the S/N ratio all labeled compound peaks > 10?

#	Date	Lab ID/Reference	Labeled Compound	(% Recovery) Ion Abundance Ratio (Limit:)	Qualifications
		1 (dets)	13C-PCB-209	147 (10-145)	J/NJ/P
				( )	
				( )	
				( )	
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LDC #: 45600 A31

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All compounds reported as estimated		Jdets/A
			maximum possible concentration (EMPC).		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 45600A31

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of compound, A_{is} = Area of associated internal standard
average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, C_{is} = Concentration of internal standard
%RSD = 100 * (S/X) — S = Standard deviation of the RRFs, X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported %RSD	Recalculated %RSD
1	1 dtc	2/8/18	PCB 77 (^{13}C-PCB 77)	1.082	1.083	1.00	0.99	8.00	7.93
			PCB 105 (^{13}C-PCB 105)	1.123	1.123	1.06	1.06	5.02	5.03
			PCB 167 (^{13}C-PCB 167)	1.020	1.018	0.95	0.95	5.21	5.43
			PCB 189 (^{13}C-PCB 189)	1.457	1.458	1.35	1.35	7.03	7.04
2			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						
3			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						

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 #: 45600A31

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190611E1S1	6/11/19	PCB 77 (^{13}C-PCB 77)	1.082	46.0	46.1		
			PCB 105 (^{13}C-PCB 105)	1.123	46.7	46.9		
			PCB 167 (^{13}C-PCB 167)	1.020	46.5	46.5		
			PCB 189 (^{13}C-PCB 189)	1.457	42.9	42.9		
2	190614E1S1	6/14/19	PCB 77 (^{13}C-PCB 77)		47.4	47.4		
			PCB 105 (^{13}C-PCB 105)		47.7	47.8		
			PCB 167 (^{13}C-PCB 167)		48.2	48.2		
			PCB 189 (^{13}C-PCB 189)		43.5	43.5		
3	190614E2S1	6/15/19	PCB 77 (^{13}C-PCB 77)		47.9	47.8		
			PCB 105 (^{13}C-PCB 105)		47.6	47.6		
			PCB 167 (^{13}C-PCB 167)		47.7	47.5		
			PCB 189 (^{13}C-PCB 189)		44.6	44.6		
4	190610E1S1	6/10/19	PCB 77 (^{13}C-PCB 77)		47.3	47.2		
			PCB 105 (^{13}C-PCB 105)		45.7	45.8		
			PCB 167 (^{13}C-PCB 167)		46.9	46.9		
			PCB 189 (^{13}C-PCB 189)		45.0	45.1		

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 47600A71

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F0079-BS1

Compound	Spike Added (pg/g)		Spiked Sample Concentration (pg/g)		OPR Percent Recovery		OPR D Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
PCB 15	1.00		0.988		98.8	98.8				
PCB 77	↓		0.971		97.1	97.1				
PCB 169	↓		1.01		101	101				
PCB 206	↓		1.02		102	102				

LDC #: 45600A31

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: R
2nd reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 9, PCB-28:

Conc. = $\frac{(7.6263)(10)(\ )}{(1.78e6)(1.137)(11.5)(0.44)}$

= 0.00744 ug/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	9	PCB-28	0.00744	0.00744	–

LDC Report# 45600B21_RV1

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 20, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901247

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FD-201905241445	1901247-01	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03	1901247-02	Sediment	05/24/19
T4-PDI2019-SC27-190524-03-05	1901247-03	Sediment	05/24/19
T4-PDI2019-SC27-190524-05-07	1901247-04	Sediment	05/24/19
T4-PDI2019-SC28-190524-07-09	1901247-05	Sediment	05/24/19
T4-PDI2019-SC28-190524-09-10.1	1901247-06	Sediment	05/24/19
FD-201905241300	1901247-07	Sediment	05/24/19
T4-PDI2019-SC30-190524-01-03	1901247-08	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05	1901247-09	Sediment	05/24/19
T4-PDI2019-SC30-190524-05-07	1901247-10	Sediment	05/24/19
T4-PDI2019-SC27-190524-01-03DUP	1901247-02DUP	Sediment	05/24/19
T4-PDI2019-SC30-190524-03-05DUP	1901247-09DUP	Sediment	05/24/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for unlabeled compounds and less than or equal to 30.0% for labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SC27-190524-01-03DUP (T4-PDI2019-SC27-190524-01-03)	1,2,3,4,6,7,8-HpCDD	148 (≤35)	-	1,2,3,4,6,7,8-HpCDD Total HpCDD	J (all detects) J (all detects)	A
T4-PDI2019-SC27-190524-01-03DUP (T4-PDI2019-SC27-190524-01-03)	OCDD	151 (≤35)	-	OCDD	J (all detects)	A
T4-PDI2019-SC27-190524-01-03DUP (T4-PDI2019-SC27-190524-01-03)	1,2,3,4,6,7,8-HpCDF	-	28.75 ng/Kg (≤9.54)	1,2,3,4,6,7,8-HpCDF Total HpCDF	J (all detects) J (all detects)	A
T4-PDI2019-SC27-190524-01-03DUP (T4-PDI2019-SC27-190524-01-03)	OCDF	-	87.6 ng/Kg (≤19.06)	OCDF	J (all detects)	A
T4-PDI2019-SC30-190524-03-05DUP (T4-PDI2019-SC30-190524-03-05)	1,2,3,4,6,7,8-HpCDD	72.4 (≤35)	-	1,2,3,4,6,7,8-HpCDD Total HpCDD	J (all detects) J (all detects)	A
T4-PDI2019-SC30-190524-03-05DUP (T4-PDI2019-SC30-190524-03-05)	OCDD	71.4 (≤35)	-	OCDD	J (all detects)	A
T4-PDI2019-SC30-190524-03-05DUP (T4-PDI2019-SC30-190524-03-05)	1,2,3,4,6,7,8-HpCDF	70.2 (≤35)	-	1,2,3,4,6,7,8-HpCDF Total HpCDF	J (all detects) J (all detects)	A
T4-PDI2019-SC30-190524-03-05DUP (T4-PDI2019-SC30-190524-03-05)	OCDF	72.8 (≤35)	-	OCDF	J (all detects)	A
T4-PDI2019-SC30-190524-03-05DUP (T4-PDI2019-SC30-190524-03-05)	1,2,3,6,7,8-HxCDD	-	10.81 ng/Kg (≤10)	1,2,3,6,7,8-HxCDD Total HxCDD	J (all detects) J (all detects)	A

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201905241445 and T4-PDI2019-SC27-190524-05-07 and samples FD-201905241300 and T4-PDI2019-SC30-190524-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905241445	T4-PDI2019-SC27-190524-05-07	
2,3,7,8-TCDD	0.919	1.25	31 (≤50)
1,2,3,7,8-PeCDD	3.45	0.754	128 (≤50)
1,2,3,4,7,8-HxCDD	4.89	8.29	52 (≤50)
1,2,3,6,7,8-HxCDD	33.1	57.1	53 (≤50)
1,2,3,7,8,9-HxCDD	10.2	18.0	55 (≤50)
1,2,3,4,6,7,8-HpCDD	470	905	63 (≤50)
OCDD	4050	8210	68 (≤50)
2,3,7,8-TCDF	5.62	7.40	27 (≤50)
1,2,3,7,8-PeCDF	7.89	9.83	22 (≤50)
2,3,4,7,8-PeCDF	4.69	6.11	26 (≤50)
1,2,3,4,7,8-HxCDF	14.8	23.4	45 (≤50)
1,2,3,6,7,8-HxCDF	7.11	11.6	48 (≤50)
2,3,4,6,7,8-HxCDF	5.99	8.47	34 (≤50)
1,2,3,7,8,9-HxCDF	1.44	2.91	68 (≤50)
1,2,3,4,6,7,8-HpCDF	52.8	121	78 (≤50)
1,2,3,4,7,8,9-HpCDF	5.14	9.60	61 (≤50)
OCDF	102	216	72 (≤50)
Total TCDD	12.1	13.4	10 (≤50)
Total PeCDD	30.3	40.9	30 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905241445	T4-PDI2019-SC27-190524-05-07	
Total HxCDD	215	320	39 (≤50)
Total HpCDD	1030	1790	54 (≤50)
Total TCDF	45.2	56.8	23 (≤50)
Total PeCDF	87.4	116	28 (≤50)
Total HxCDF	161	266	49 (≤50)
Total HpCDF	199	372	61 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905241300	T4-PDI2019-SC30-190524-01-03	
2,3,7,8-TCDD	0.387U	0.415	Not calculable
1,2,3,7,8-PeCDD	1.07	0.523	69 (≤50)
1,2,3,4,7,8-HxCDD	1.20	0.907	28 (≤50)
1,2,3,6,7,8-HxCDD	7.20	6.35	13 (≤50)
1,2,3,7,8,9-HxCDD	2.90	2.76	5 (≤50)
1,2,3,4,6,7,8-HpCDD	163	167	2 (≤50)
OCDD	1550	1590	3 (≤50)
2,3,7,8-TCDF	1.34	1.11	19 (≤50)
1,2,3,7,8-PeCDF	0.986	2.32	81 (≤50)
2,3,4,7,8-PeCDF	1.34	1.46	9 (≤50)
1,2,3,4,7,8-HxCDF	4.79	6.95	37 (≤50)
1,2,3,6,7,8-HxCDF	1.64	2.06	23 (≤50)
2,3,4,6,7,8-HxCDF	1.51	1.68	11 (≤50)
1,2,3,7,8,9-HxCDF	0.492	1.03	71 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905241300	T4-PDI2019-SC30-190524-01-03	
1,2,3,4,6,7,8-HpCDF	25.3	24.7	2 (≤50)
1,2,3,4,7,8,9-HpCDF	2.07	2.72	27 (≤50)
OCDF	72.9	65.1	11 (≤50)
Total TCDD	1.20	2.38	66 (≤50)
Total PeCDD	5.66	7.46	27 (≤50)
Total HxCDD	55.2	50.1	10 (≤50)
Total HpCDD	405	457	12 (≤50)
Total TCDF	3.34	4.86	37 (≤50)
Total PeCDF	17.1	21.5	23 (≤50)
Total HxCDF	44.8	46.9	5 (≤50)
Total HpCDF	90.8	89.8	1 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1901247	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

For samples T4-PDI2019-SC28-190524-07-09 and T4-PDI2019-SC30-190524-05-07, 2nd column confirmation was not performed for 2,3,7,8-TCDF by the laboratory since the results were either less than the reporting limit or EMPC.

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to DUP RPD and difference and results reported as EMPC, data were qualified as estimated in ten samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901247

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC27-190524-01-03	1,2,3,4,6,7,8-HpCDD Total HpCDD OCDD	J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SC27-190524-01-03	1,2,3,4,6,7,8-HpCDF Total HpCDF OCDF	J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (difference)
T4-PDI2019-SC30-190524-03-05	1,2,3,4,6,7,8-HpCDD Total HpCDD OCDD 1,2,3,4,6,7,8-HpCDF Total HpCDF OCDF	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SC30-190524-03-05	1,2,3,6,7,8-HxCDD Total HxCDD	J (all detects) J (all detects)	A	Duplicate sample analysis (difference)
FD-201905241445 T4-PDI2019-SC27-190524-01-03 T4-PDI2019-SC27-190524-03-05 T4-PDI2019-SC27-190524-05-07 T4-PDI2019-SC28-190524-07-09 T4-PDI2019-SC28-190524-09-10.1 FD-201905241300 T4-PDI2019-SC30-190524-01-03 T4-PDI2019-SC30-190524-03-05 T4-PDI2019-SC30-190524-05-07	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901247

No Sample Data Qualified in this SDG

LDC #: 45600B21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/10/19
SDG #: 1901247 Stage 2B Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20/35 ICV ≤ QC limits
IV.	Continuing calibration	SW	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N / SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 7+8, 1+2 4
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	All - EMPC - Jdet/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1 2	FD-201905241445	1901247-01	Sediment	05/24/19
2 1	T4-PDI2019-SC27-190524-01-03	1901247-02	Sediment	05/24/19
3 1	T4-PDI2019-SC27-190524-03-05	1901247-03	Sediment	05/24/19
4 1	T4-PDI2019-SC27-190524-05-07	1901247-04	Sediment	05/24/19
5 2	T4-PDI2019-SC28-190524-07-09	1901247-05	Sediment	05/24/19
6 1	T4-PDI2019-SC28-190524-09-10.1	1901247-06	Sediment	05/24/19
7 1	FD-201905241300	1901247-07	Sediment	05/24/19
8 2	T4-PDI2019-SC30-190524-01-03	1901247-08	Sediment	05/24/19
9 2	T4-PDI2019-SC30-190524-03-05	1901247-09	Sediment	05/24/19
10 1	T4-PDI2019-SC30-190524-05-07	1901247-10	Sediment	05/24/19
11 1	T4-PDI2019-SC27-190524-01-03DUP	1901247-02DUP	Sediment	05/24/19
12 2	T4-PDI2019-SC30-190524-03-05DUP	1901247-09DUP	Sediment	05/24/19
13				
14				

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 45600B21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration performed at the beginning of each 12 hour period?
Y N N/A Were all concentrations within method QC limits for unlabeled and labeled compounds?
Y (N) N/A Did all continuing calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	conc (ng/mL) Finding %D	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	6/25/19	190625D1S#1	13C-C		1.44 (1.05-1.43)	B9F0172-BLK1	J/UJ/P (C,T)

LDC #: 46600B21

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: M
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?
Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 35?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits) Diff (ng/kg)	Associated Samples	Qualifications
		11	Sed	F	148 (≤35)	2 (defs)	J defs/A (+U)
				G	151		
				O	28.75 (≤9.54) ng/kg		(+Y)
				Q	87.6 (≤19.06)		
		12	Sed	F	72.4 (≤35)	9 (defs)	J defs/A (+U)
				G	71.4		
				O	70.2		(+Y)
				Q	72.8		
				D	10.81 (≤10 ng/kg)		(+T)

LDC#:45600B21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: M
2nd Reviewer: G

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)

Compound	Concentration (ng/Kg)		RPD (≤50)	
	1	4		
A	0.919*	1.25	31	
B	3.45	0.754	128	
C	4.89	8.29	52	
D	33.1	57.1	53	
E	10.2	18.0	55	
F	470	905	63	
G	4050	8210	68	
H	5.62	7.40	27	
I	7.89	9.83	22	
J	4.69	6.11	26	
K	14.8	23.4	45	
L	7.11	11.6	48	
M	5.99	8.47	34	
N	1.44	2.91	68	
O	52.8	121	78	
P	5.14	9.60	61	
Q	102	216	72	
R	12.1*	13.4*	10	
S	30.3*	40.9*	30	
T	215	320	39	
U	1030	1790	54	
V	45.2*	56.8*	23	
W	87.4*	116*	28	
X	161*	266*	49	
Y	199	372	61	

*EMPC

LDC#:45600B21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: M
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)

Compound	Concentration (ng/Kg)		RPD (≤50)	
	7	8		
A	0.387U	0.415*	NC	
B	1.07	0.523	69	
C	1.20	0.907*	28	
D	7.20	6.35	13	
E	2.90	2.76	5	
F	163	167	2	
G	1550	1590	3	
H	1.34	1.11	19	
I	0.986	2.32	81	
J	1.34	1.46	9	
K	4.79	6.95	37	
L	1.64*	2.06	23	
M	1.51	1.68	11	
N	0.492	1.03	71	
O	25.3	24.7	2	
P	2.07	2.72	27	
Q	72.9	65.1	11	
R	1.20	2.38*	66	
S	5.66*	7.46*	27	
T	55.2*	50.1*	10	
U	405	457	12	
V	3.34	4.86	37	
W	17.1*	21.5*	23	
X	44.8*	46.9*	5	
Y	90.8	89.8	1	

LDC #: 45600B21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: n
2nd Reviewer: a

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	All results flagged "EMPC"		Jdets/A
		5, 10	H not confirmed by the lab when result < RL		text
			or EMPC		

Comments: Per lab SOP, H reported value is the lower result between two columns

LDC #: 45600

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 8/16/19

2nd Reviewer: JE

The LDC job number listed above was entered by CD.

Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-		
Ia.	- All methods present?	y	CD	
Ib.	- All samples present/match report?	↓	↓	
Ic.	- All reported analytes present?			
Id.	- 10% or 100% verification of EDD?			
II.	EDD Preparation/Entry	-		
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	y	CD	
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	y	CD	
III.	Reasonableness Checks	-		
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	y	CD	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	y		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	y		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	N/NA		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	N/NA		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N	↓	

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

August 22, 2019

SUBJECT: Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on July 31, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #45631:

SDG #	Fraction
1901249, 1901384	Polychlorinated Dioxins/Dibenzofurans, Polychlorinated Biphenyls as Congeners

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy - Wheeler Bay Shoreline Stabilization Area; March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

EDD Stage 2B 90/10

LDC #45631 (Anchor Environmental-Seattle WA / Port of Portland, T4, PDI)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PCBs (1668C)		Dioxins (1613B)																																	
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	W	S	W	S
A	1901249	07/31/19	08/21/19	1	0	1	1																																
B	1901384	07/31/19	08/21/19	1	2	1	0																																
B	1901384	07/31/19	08/21/19	0	1	0	1																																
Total	T/CR			2	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

LDC Report# 45631A21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 21, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901249

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905231817	1901249-01	Water	05/23/19
T4-PDI2019-SC32-190523-01-03	1901249-02	Sediment	05/23/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample RB-201905231817 was identified as a rinsate blank. No contaminants were found with the following exceptions:

Blank ID	Compound	Concentration
RB-201905231817	OCDD	5.23 pg/L

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
T4-PDI2019-SC32-190523-01-03	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to results reported as EMPC, data were qualified as estimated in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901249

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC32-190523-01-03	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901249

No Sample Data Qualified in this SDG

LDC #: 45631A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/19
SDG #: 1901249 Stage 2B Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	RSD ≤ 20/35 ICV ≤ QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	RB = 1
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	#2 - EMPC - Jdet/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1 1	RB-201905231817	1901249-01	Water	05/23/19
2 2	T4-PDI2019-SC32-190523-01-03	1901249-02	Sediment	05/23/19
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

1	B9F0141						
2	B9F0255						

LDC#: 45631A21

VALIDATION FINDINGS WORKSHEET

Field Blanks

Reveiwer: SC

2nd Reviewer:

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)

Sample: 1 (RB) Sampling Date: 05/23/19

Compound	Concentration (pg/L)
OCDD	5.23

LDC Report# 45631A31

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 21, 2019

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2B

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901249

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905231817	1901249-01	Water	05/23/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all congeners. The chromatographic resolution between the congeners PCB-23 and PCB-34 and congeners PCB-182 and PCB-187 was resolved with a valley of less than or equal to 40%.

The static resolving power was less than or equal to 10,000 (10% valley definition) at m/z 330.9792 and greater than or equal to 8000 throughout the mass range.

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were within QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
B9F0159-BLK1	06/17/19	PCB-11 PCB-28 PCB-47 PCB-153	5.29 pg/L 0.763 pg/L 2.73 pg/L 0.794 pg/L	RB-201905231817

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
RB-201905231817	PCB-11	19.8 pg/L	19.8U pg/L

VI. Field Blanks

Sample RB-201905231817 was identified as a rinsate blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration
RB-201905231817	05/23/19	PCB-1	2270 pg/L
		PCB-2	504 pg/L
		PCB-3	1780 pg/L
		PCB-4/10	121 pg/L
		PCB-5/8	768 pg/L
		PCB-6	131 pg/L
		PCB-7/9	136 pg/L
		PCB-11	19.8 pg/L
		PCB-12/13	119 pg/L
		PCB-14	21.2 pg/L
		PCB-15	230 pg/L
		PCB-16/32	22.1 pg/L
		PCB-17	16.6 pg/L
		PCB-18	30.5 pg/L
		PCB-19	2.92 pg/L
		PCB-20/21/33	44.9 pg/L
		PCB-22	14.9 pg/L
		PCB-23	2.15 pg/L
		PCB-24/27	5.01 pg/L
		PCB-25	6.38 pg/L
		PCB-26	12.1 pg/L
		PCB-28	33.9 pg/L
		PCB-29	3.2 pg/L
		PCB-31	35 pg/L
		PCB-34	1.84 pg/L
		PCB-35	5.8 pg/L
		PCB-37	15.5 pg/L
		PCB-38	0.49 pg/L
		PCB-39	1.04 pg/L
		PCB-40	1.61 pg/L
		PCB-41/64/71/72	5.38 pg/L
		PCB-42/59	2.09 pg/L
		PCB-43/49	5.87 pg/L

Blank ID	Collection Date	Compound	Concentration
RB-201905231817 (continued)	05/23/19	PCB-44	7.01 pg/L
		PCB-45	0.927 pg/L
		PCB-47	17.8 pg/L
		PCB-48/75	1.38 pg/L
		PCB-51	1.43 pg/L
		PCB-52/69	6.69 pg/L
		PCB-56/60	4.53 pg/L
		PCB-61/70	7.77 pg/L
		PCB-66/76	4.9 pg/L
		PCB-68	1.73 pg/L
		PCB-74	2.86 pg/L
		PCB-77	1.5 pg/L
		PCB-84/92	4.08 pg/L
		PCB-87/117/125	2.33 pg/L
		PCB-90/101	8.13 pg/L
		PCB-95/98/102	4.79 pg/L
		PCB-97	1.94 pg/L
		PCB-99	3.39 pg/L
		PCB-105	1.81 pg/L
		PCB-106/118	3.84 pg/L
		PCB-108/112	0.537 pg/L
		PCB-110	5.93 pg/L
		PCB-132/161	2.52 pg/L
		PCB-135	1.9 pg/L
		PCB-136	1.88 pg/L
		PCB-138/163/164	8.13 pg/L
		PCB-139/149	10.1 pg/L
		PCB-141	1.71 pg/L
		PCB-146/165	1.53 pg/L
		PCB-151	4.69 pg/L
		PCB-153	9.72 pg/L
		PCB-170	2.67 pg/L
		PCB-174	3.22 pg/L
		PCB-176	1.25 pg/L
		PCB-177	2.43 pg/L
		PCB-179	2 pg/L
		PCB-180	7.74 pg/L
		PCB-182/187	3 pg/L
		PCB-183	2.21 pg/L
		PCB-190	1.08 pg/L
		PCB-194	1.78 pg/L
		PCB-195	0.6 pg/L
		PCB-196/203	1.59 pg/L
		PCB-198	1 pg/L
		PCB-208	0.511 pg/L
		PCB-209	0.802 pg/L

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1901249	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound 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.

Due to results reported as EMPC, data were qualified as estimated in one sample.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 1901249

Sample	Compound	Flag	A or P	Reason
RB-201905231817	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 1901249

Sample	Compound	Modified Final Concentration	A or P
RB-201905231817	PCB-11	19.8U pg/L	A

LDC #: 45631A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/19
SDG #: 1901249 Stage 2B Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20 |ICV| ≤ QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	SW	RB=1
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SN	EMPC - Tables/A
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	RB-201905231817	1901249-01	Water	05/23/19
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	B9F0159						

LDC#: 45631A31

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reveiwer: SC
2nd Reviewer:

METHOD: HRGC/HRMS PCB (EPA Method 1668C)
Extraction Date: 06/17/19 Analysis Date: 06/18/19 Associated Samples: All W Qualify U

Compound	B9F0159-BLK1 Concentration (pg/L)	5X	1
PCB-11	5.29	26.45	19.8
PCB-28	0.763	3.815	
PCB-47	2.73	13.65	
PCB-153	0.794	3.97	

*EMPC

LDC#: 45631A31

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reveiwer: SC
2nd Reviewer:

METHOD: HRGC/HRMS PCB (EPA Method 1668C)
Sample: 1 (RB) Sampling Date: 05/23/19

Compound	Concentration (pg/L)
PCB-1	2270
PCB-2	504
PCB-3	1780
PCB-4/10	121
PCB-5/8	768
PCB-6	131
PCB-7/9	136
PCB-11	19.8
PCB-12/13	119
PCB-14	21.2
PCB-15	230
PCB-16/32	22.1
PCB-17	16.6
PCB-18	30.5
PCB-19	2.92
PCB-20/21/33	44.9
PCB-22	14.9
PCB-23	2.15
PCB-24/27	5.01
PCB-25	6.38
PCB-26	12.1
PCB-28	33.9
PCB-29	3.2
PCB-31	35
PCB-34	1.84
PCB-35	5.8
PCB-37	15.5
PCB-38	0.49
PCB-39	1.04
PCB-40	1.61
PCB-41/64/71/72	5.38
PCB-42/59	2.09
PCB-43/49	5.87
PCB-44	7.01
PCB-45	0.927 *
PCB-47	17.8
PCB-48/75	1.38 *
PCB-51	1.43 *
PCB-52/69	6.69
PCB-56/60	4.53
PCB-61/70	7.77
PCB-66/76	4.9
PCB-68	1.73
PCB-74	2.86
PCB-77	1.5
PCB-84/92	4.08
PCB-87/117/125	2.33
PCB-90/101	8.13
PCB-95/98/102	4.79
PCB-97	1.94
PCB-99	3.39
PCB-105	1.81
PCB-106/118	3.84
PCB-108/112	0.537
PCB-110	5.93
PCB-132/161	2.52

LDC#: 45631A31

VALIDATION FINDINGS WORKSHEET

Field Blanks

Reveiwer: SC

2nd Reviewer:

METHOD: HRGC/HRMS PCB (EPA Method 1668C)

PCB-135	1.9
PCB-136	1.88
PCB-138/163/164	8.13
PCB-139/149	10.1
PCB-141	1.71
PCB-146/165	1.53
PCB-151	4.69
PCB-153	9.72
PCB-170	2.67
PCB-174	3.22
PCB-176	1.25
PCB-177	2.43
PCB-179	2
PCB-180	7.74
PCB-182/187	3
PCB-183	2.21
PCB-190	1.08
PCB-194	1.78
PCB-195	0.6
PCB-196/203	1.59
PCB-198	1
PCB-208	0.511 *
PCB-209	0.802

*EMPC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 21, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901384

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905301712	1901384-01	Water	05/30/19
T4-PDI2019-SG38-190531**	1901384-04**	Sediment	05/31/19
T4-PDI2019-SG38-190531DUP	1901384-04DUP	Sediment	05/31/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample RB-201905301712 was identified as a rinsate blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
T4-PDI2019-SG38-190531**	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to results reported as EMPC, data were qualified as estimated in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901384

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG38-190531**	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901384

No Sample Data Qualified in this SDG

LDC #: 45631B21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/19
SDG #: 1901384 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: JL
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 20/35 ICV = QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	RB = 1
VII.	Matrix spike/Matrix spike duplicates/DUP	N/A	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation #2 - EMPC - JMPC/A
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	RB-201905301712	1901384-01	Water	05/30/19
2	T4-PDI2019-SG38-190531**	1901384-04**	Sediment	05/31/19
3	T4-PDI2019-SG38-190531DUP	1901384-04DUP	Sediment	05/31/19
4				
5				
6				
7				
8				
9				
10				

Notes:

1	B9F0141						
2	B9F0255						

LDC #: 46631B21

VALIDATION FINDINGS CHECKLIST

Reviewer: 2
2nd Reviewer:

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits? DUP	✓			

LDC #: 45631B21

VALIDATION FINDINGS CHECKLIST

Reviewer:
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?			✓	
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 45671B21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: DR
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10/50/100 std)	Recalculated RRF (10/50/100 std)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.87	0.87	5.57	5.43
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.86	0.87	6.57	6.70
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.86	0.86	8.35	8.10
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.99	0.98	10.09	10.06
			OCDF (^{13}C-OCDF)	0.94	0.94	0.97	0.97	12.29	12.28
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45631B21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	STI907080221	7/8/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	8.71	8.73		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	10.5	10.5		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	50.1	50.0		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	47.3	47.1		
			OCDF (^{13}C-OCDF)	0.94	94.1	93.8		
2	STI907110221	7/11/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	↓	8.78	8.71		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)		11.5	11.5		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)		52.4	52.5		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)		47.6	47.6		
			OCDF (^{13}C-OCDF)		99.4	99.2		
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45631B21

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F0255-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		OPR Percent Recovery		OPRD Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
2,3,7,8-TCDD	40.0		42.4		106	106				
1,2,3,7,8-PeCDD	200		224		112	112				
1,2,3,4,7,8-HxCDD	↓		217		108	109				
1,2,3,4,7,8,9-HpCDF			211		106	106				
OCDF	400		405		101	101				

LDC #: 45318V1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: R
2nd reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 2, F:

Conc. = $\frac{(1.95e6)(2000)(\ )}{(6.41e6)(0.99)(6.42)(0.778)}$

= 123 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	2	F	123	123	–

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 21, 2019

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901384

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
RB-201905301712	1901384-01	Water	05/30/19
T4-PDI2019-SG21-190531	1901384-02	Sediment	05/31/19
T4-PDI2019-SG26-190530	1901384-03	Sediment	05/30/19
T4-PDI2019-SG38-190531**	1901384-04**	Sediment	05/31/19
T4-PDI2019-SG38-190531DUP	1901384-04DUP	Sediment	05/31/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all congeners. The chromatographic resolution between the congeners PCB-23 and PCB-34 and congeners PCB-182 and PCB-187 was resolved with a valley of less than or equal to 40%.

The static resolving power was less than or equal to 10,000 (10% valley definition) at m/z 330.9792 and greater than or equal to 8000 throughout the mass range.

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF within QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
B9F0159-BLK	06/17/19	PCB-11 PCB-28 PCB-47 PCB-153	5.29 pg/L 0.763 pg/L 2.73 pg/L 0.794 pg/L	RB-201905301712

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
RB-201905301712	PCB-28 PCB153	0.599 pg/L 1.26 pg/L	0.599U pg/L 1.26U pg/L

VI. Field Blanks

Sample RB-201905301712 was identified as a rinsate blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration
RB-201905301712	05/30/19	PCB-1	2.89 pg/L
		PCB-28	0.599 pg/L
		PCB-31	0.681 pg/L
		PCB-44	0.957 pg/L
		PCB-52/69	0.424 pg/L
		PCB-61/70	0.734 pg/L
		PCB-66/76	0.450 pg/L
		PCB-87/117/125	0.276 pg/L
		PCB-97	0.331 pg/L
		PCB-105	0.335 pg/L
		PCB-106/118	0.567 pg/L
		PCB-110	0.949 pg/L
		PCB-132/161	0.507 pg/L
		PCB-135	0.306 pg/L
		PCB-138/163/164	1.45 pg/L
		PCB-139/149	0.959 pg/L
		PCB-141	0.552 pg/L
		PCB-151	0.688 pg/L
		PCB-153	1.26 pg/L
		PCB-170	0.450 pg/L
		PCB-182/187	0.827 pg/L
		PCB-190	0.311 pg/L
		PCB-194	0.745 pg/L
		PCB-196/203	0.442 pg/L
		PCB-198	0.529 pg/L

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Flag	A or P
T4-PDI2019-SG38-190531DUP (T4-PDI2019-SG38-190531**)	PCB-209	-	0.01362 ug/Kg (≤0.00904)	J (all detects)	A

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1901384	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP difference and results reported as EMPC, data were qualified as estimated in four samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 1901384

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG38-190531**	PCB-209	J (all detects)	A	Duplicate sample analysis (difference)
RB-201905301712 T4-PDI2019-SG21-190531 T4-PDI2019-SG26-190530 T4-PDI2019-SG38-190531**	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 1901384

Sample	Compound	Modified Final Concentration	A or P
RB-201905301712	PCB-28 PCB153	0.599U pg/L 1.26U pg/L	A

LDC #: 45631B31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/19
SDG #: 1901384 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	HRGC/HRMS Instrument performance check	A*	
III.	Initial calibration/ICV	A, A	RSD ≤ 20
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	SW	RB = 1
VII.	Matrix spike/Matrix spike duplicates /DUP	N/SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation All - EMPC - Jdets A
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	RB-201905301712	1901384-01	Water	05/30/19
2	T4-PDI2019-SG21-190531	1901384-02	Sediment	05/31/19
3	T4-PDI2019-SG26-190530	1901384-03	Sediment	05/30/19
4	T4-PDI2019-SG38-190531**	1901384-04**	Sediment	05/31/19
5	T4-PDI2019-SG38-190531DUP	1901384-04DUP	Sediment	05/31/19
6				
7				
8				
9				
10				

Notes: * MS resolution ≤ 8000 for m/z 192.9888 & 268.9834 due to PFK leak/bleed.

1	B9F0159				No qual since	m/z (PCB-1)	190.0362
2	B9F0214					m/z (13C-Cl3)	268.0016

LDC#: 45631B31

VALIDATION FINDINGS WORKSHEET

Blanks

Reveiwer: SC

2nd Reviewer:

METHOD: HRGC/HRMS PCB (EPA Method 1668C)

Extraction Date: 06/17/19 Analysis Date: 06/18/19 Associated Samples: All W Qualify U

Compound	B9F0159-BLK1 Concentration (pg/L)	5X	1
PCB-11	5.29	26.45	
PCB-28	0.763	3.815	0.599
PCB-47	2.73	13.65	
PCB-153	0.794	3.97	1.26

*EMPC

LDC#: 45631B31

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reveiwer: SC
2nd Reviewer:

METHOD: HRGC/HRMS PCB (EPA Method 1668C)
Sample: 1 (RB) Sampling Date: 05/30/19

Compound	Concentration (pg/L)	
PCB-1	2.89	
PCB-28	0.599	
PCB-31	0.681	*
PCB-44	0.957	
PCB-52/69	0.424	*
PCB-61/70	0.734	*
PCB-66/76	0.450	*
PCB-87/117/125	0.276	*
PCB-97	0.331	*
PCB-105	0.335	*
PCB-106/118	0.567	*
PCB-110	0.949	
PCB-132/161	0.507	
PCB-135	0.306	*
PCB-138/163/164	1.45	
PCB-139/149	0.959	*
PCB-141	0.552	
PCB-151	0.688	
PCB-153	1.26	
PCB-170	0.450	*
PCB-182/187	0.827	*
PCB-190	0.311	*
PCB-194	0.745	
PCB-196/203	0.442	*
PCB-198	0.529	

*EMPC

LDC #: 45231B31

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) within the QC limits?

#	Date	Duplicate ID	Matrix	Compound	RPD (Limits) Diff (ng/kg)	Associated Samples	Qualifications
		5	sed	PCB-209	0.01362 (≤0.00904)	4 (dup)	J all detects

Comments:

LDC #: 45671B71

VALIDATION FINDINGS CHECKLIST

Reviewer: M
2nd Reviewer: [illegible]

Method: HRGC/HRMS Polychlorinated Biphenyls (EPA Method 1668C)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 330.9792 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution (valley) between PCB 23 and PCB 34 and between PCB 182 and PCB 187 ≤ 40% ?	✓			
Is the static resolving power ≥10,000 at m/z 330.9792 and ≥ 8000 throughout the mass range?	✓			
Was the mass resolution adequately checked with PFK?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤20% for unlabeled and labeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all percent differences (%D) ≤25% for unlabeled and percent recoveries (%R) for labeled compounds within 50-145%?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
V. Laboratory Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the blanks validation findings worksheet.	✓			
VI. Field blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VII. 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? DUP		✓		

LDC #: 45631B31

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compound recoveries within the QC criteria?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For polychlorinated biphenyl congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For polychlorinated biphenyl congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For other polychlorinated biphenyl congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound and labeled standard ≥ 2.5?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 45631B31

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: R
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of compound, A_{is} = Area of associated internal standard
average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, C_{is} = Concentration of internal standard
%RSD = 100 * (S/X) — S = Standard deviation of the RRFs, X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported %RSD	Recalculated %RSD
1	ICAL	4/24/18	PCB 77 (^{13}C-PCB 77)	1.03273	1.03383	1.07	1.07	7.70007	7.73829
			PCB 105 (^{13}C-PCB 105)	1.10086	1.10693	1.11	1.10	5.66896	5.72413
			PCB 167 (^{13}C-PCB 167)	1.04252	1.04000	1.03	1.03	4.87414	4.78842
			PCB 189 (^{13}C-PCB 189)	1.33264	1.33333	1.39	1.39	8.70494	8.57321
2			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						
3			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						

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 #: 45631B31

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	ST190629K1-1	6/29/19	PCB 77 (^{13}C-PCB 77)	1.03	51.78	51.80		
			PCB 105 (^{13}C-PCB 105)	1.10	50.53	50.34		
			PCB 167 (^{13}C-PCB 167)	1.04	50.68	50.83		
			PCB 189 (^{13}C-PCB 189)	1.33	51.37	51.49		
2	ST190711K2-1	7/11/19	PCB 77 (^{13}C-PCB 77)		46.45	46.44		
			PCB 105 (^{13}C-PCB 105)		46.77	46.83		
			PCB 167 (^{13}C-PCB 167)		49.26	49.35		
			PCB 189 (^{13}C-PCB 189)		52.02	52.09		
3			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					
4			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45631B31

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Page: 1 of 1
Reviewer: R
2nd Reviewer: a

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F0214-BS1

Compound	Spike Added (pg/g)		Spiked Sample Concentration (pg/g)		OPR Percent Recovery		OPR D Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
PCB 15	0.500		0.516		103	103				
PCB 77	↓		0.503		101	101				
PCB 169	↓		0.486		97.1	97.2				
PCB 206	↓		0.472		94.3	94.4				

LDC #: 45631B31

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: M
2nd reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 4, PCB-3:

Conc. = $\frac{(1.15e3)(10)(\quad)}{(5.11e5)(1.01)(7.10)(0.778)}$

= 0.004034 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	4	PCB-3	0.00403	0.00403	–

LDC #: 45291

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 8/21/19
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	y		
Ib.	- All samples present/match report?	y		
Ic.	- All reported analytes present?	y		
Id.	- 10% or 100% verification of EDD?	y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	y		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	—		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	y		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	y		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

August 23, 2019

SUBJECT: Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the final validation reports for the fractions listed below. This SDG was received on August 1, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #45640:

SDG #	Fraction
1901305	Polychlorinated Dioxins/Dibenzofurans, Polychlorinated Biphenyls as Congeners

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

EDD Stage 2B 90/10

LDC #45640 (Anchor Environmental-Seattle WA / Port of Portland, T4, PDI)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PCBs (1668C)		Dioxins (1613B)																																	
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	W	S	W	S
A	1901305	08/01/19	08/22/19	0	6	0	2																																
A	1901305	08/01/19	08/22/19	0	1	0	1																																
Total	T/CR			0	7	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

LDC Report# 45640A21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 22, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901305

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG23-190529**	1901305-02**	Sediment	05/29/19
FD-201905281308	1901305-06	Sediment	05/28/19
T4-PDI2019-SG41-190528	1901305-07	Sediment	05/28/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria with the following exceptions:

Date	Compound	Ion Abundance Ratio (Limits)	Associated Samples	Affected Compound	Flag	A or P
06/25/19	13C-1,2,3,4,7,8-HxCDD	1.44 (1.05-1.43)	T4-PDI2019-SG41-190528	1,2,3,4,7,8-HxCDD Total HxCDD	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201905281308 and T4-PDI2019-SG41-190528 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
1,2,3,7,8-PeCDD	0.156	0.411U	Not calculable
1,2,3,6,7,8-HxCDD	3.15	2.05	42 (≤50)

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905281308	T4-PDI2019-SG41-190528	
1,2,3,4,6,7,8-HpCDD	115	48.9	81 (≤50)
OCDD	1070	530	68 (≤50)
1,2,3,7,8-PeCDF	0.676	0.395	52 (≤50)
2,3,4,7,8-PeCDF	4.43	2.65	50 (≤50)
1,2,3,4,7,8-HxCDF	17.4	18.7	7 (≤50)
1,2,3,6,7,8-HxCDF	3.12	3.56	13 (≤50)
2,3,4,6,7,8-HxCDF	3.06	2.73	11 (≤50)
1,2,3,7,8,9-HxCDF	1.56	2.14	31 (≤50)
1,2,3,4,6,7,8-HpCDF	25.1	24.8	1 (≤50)
1,2,3,4,7,8,9-HpCDF	4.76	3.96	18 (≤50)
OCDF	35.4	36.6	3 (≤50)
Total PeCDD	0.459	0.411U	Not calculable
Total HxCDD	23.3	11.4	184 (≤50)
Total HpCDD	270	110	122 (≤50)
Total PeCDF	26.6	21.6	21 (≤50)
Total HxCDF	84.4	78.3	7 (≤50)
Total HpCDF	98.0	66.7	38 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1901305	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

For sample T4-PDI2019-SG23-190529**, a 2nd column confirmation was not performed for 2,3,7,8-TCDF by the laboratory since the result was either less than the reporting limit or EMPC.

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to continuing calibration ion abundance ratio and results reported as EMPC, data were qualified as estimated in three samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901305

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG41-190528	1,2,3,4,7,8-HxCDD Total HxCDD	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P	Continuing calibration (ion abundance ratio)
T4-PDI2019-SG23-190529** FD-201905281308 T4-PDI2019-SG41-190528	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901305

No Sample Data Qualified in this SDG

LDC #: 45640A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/9/19
SDG #: 1901305 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 20/35
IV.	Continuing calibration	SW	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/A	1901384-04 (-SG38-190531)
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 2+3
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation All - EMPC - Tab A
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1 2	T4-PDI2019-SG23-190529**	1901305-02**	Sediment	05/29/19
2 2	FD-201905281308	1901305-06	Sediment	05/28/19
3 1	T4-PDI2019-SG41-190528	1901305-07	Sediment	05/28/19
4				
5				
6				
7				
8				
9				
10				

Notes:

	B9F0172						
	B9F0255						

LDC #: 47640A21

VALIDATION FINDINGS CHECKLIST

Reviewer: R
2nd Reviewer: [illegible]

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	~~✓~~ R	✓		
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits? N/A	✓			

LDC #: 45640A21

VALIDATION FINDINGS CHECKLIST

Reviewer: R
2nd Reviewer: 2

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compounds within QC limits (Method 1613B, Table 7)?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?			✓	
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 45640A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration performed at the beginning of each 12 hour period?
(Y) N N/A Were all concentrations within method QC limits for unlabeled and labeled compounds?
Y (N) N/A Did all continuing calibration standards meet the Ion Abundance Ratio criteria?

#	Date	Standard ID	Compound	conc (ng/mL) Finding %D	Finding Ion Abundance Ratio	Associated Samples	Qualifications
	6/25/19	190625D1	13C-C		1.44 (1.05-1.43)	3 (det/ND)	J/UJ/P (+T)

LDC#: 45640A21

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: M

2nd Reviewer: C

METHOD: HRGC/HRMS PCDD/PCDF (EPA Method 1613B)

Compound Name	Concentration (ng/Kg)		RPD (≤50%)	
	2	3		
B	0.156	0.411U	NC	
D	3.15	2.05	42	
F	115	48.9	81	
G	1070	530	68	
I	0.676	0.395	52	
J	4.43	2.65	50	
K	17.4	18.7	7	
L	3.12	3.56	13	
M	3.06	2.73	11	
N	1.56	2.14	31	
O	25.1	24.8	1	
P	4.76	3.96	18	
Q	35.4	36.6	3	
S	0.459	0.411U	NC	
T	23.3	11.4	184	
U	270	110	122	
W	26.6	21.6	21	
X	84.4	78.3	7	
Y	98.0	66.7	38	

LDC #: 45640A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		tee	All results flagged "EMPC"		Jdets/A
		\	H not confirmed by the lab when result < RL		text
			or EMPC		

Comments: Per lab SOP, H reported value is the lower result between two columns

LDC #: 45640A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (10/50/100 std)	Recalculated RRF (10/50/100 std)	Reported %RSD	Recalculated %RSD
1	ICAL	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.87	0.87	5.57	5.43
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.86	0.87	6.57	6.70
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.86	0.86	8.35	8.10
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.99	0.98	10.09	10.06
			OCDF (^{13}C-OCDF)	0.94	0.94	0.97	0.97	12.29	12.28
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDF)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45640A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190708D2S1	7/8/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	8.71	8.73		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	10.5	10.5		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	50.1	49.9		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	47.3	47.1		
			OCDF (^{13}C-OCDF)	~~0.78~~ 0.94	94.1	93.8		
2	190711D2S1	7/11/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)		8.78	8.77		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)		11.5	11.5		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)		52.4	52.5		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)		47.6	47.6		
			OCDF (^{13}C-OCDF)		99.4	99.2		
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDF)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45640A21

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F025C-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		OPR Percent Recovery		OPRD Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	40.0		42.4		106	106				
1,2,3,7,8-PeCDD	200		224		112	112				
1,2,3,4,7,8-HxCDD	↓		217		108	109				
1,2,3,4,7,8,9-HpCDF	↓		211		106	106				
OCDF	400		405		101	101				

LDC #: 45640 A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 1, H:

Conc. = $\frac{(1.71e4)(2000)(\quad)}{(1.33e7)(0.94)(6.47)(0.774)}$

= 0.546 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	1	H	0.542	0.546	—

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: August 22, 2019

Parameters: Polychlorinated Biphenyls as Congeners

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901305

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG22-190529	1901305-01	Sediment	05/29/19
T4-PDI2019-SG23-190529**	1901305-02**	Sediment	05/29/19
T4-PDI2019-SG24-190529	1901305-03	Sediment	05/29/19
T4-PDI2019-SG25-190529	1901305-04	Sediment	05/29/19
T4-PDI2019-SG40-190528	1901305-05	Sediment	05/28/19
FD-201905281308	1901305-06	Sediment	05/28/19
T4-PDI2019-SG41-190528	1901305-07	Sediment	05/28/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) as Congeners by Environmental Protection Agency (EPA) Method 1668C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all congeners. The chromatographic resolution between the congeners PCB-23 and PCB-34 and congeners PCB-182 and PCB-187 was resolved with a valley of less than or equal to 40%.

The static resolving power was less than or equal to 10,000 (10% valley definition) at m/z 330.9792 and greater than or equal to 8000 throughout the mass range.

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF within QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all compounds were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples T4-PDI2019-SG23-190529** and T4-PDI2019-SG24-190529 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/Kg)		RPD (Limits)
	T4-PDI2019-SG23-190529**	T4-PDI2019-SG24-190529	
PCB-1	0.0450	0.00279	177 (≤50)
PCB-2	0.00322	0.00118U	Not calculable
PCB-3	0.0260	0.00119U	Not calculable
PCB-5/8	0.0502	0.00389U	Not calculable
PCB-15	0.0248	0.00316U	Not calculable
PCB-16/32	0.804	0.444	58 (≤50)
PCB-17	0.0395	0.0197	67 (≤50)
PCB-18	0.0538	0.0295	58 (≤50)
PCB-19	0.0319	0.0163	65 (≤50)
PCB-20/21/33	0.181	0.0928	64 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	T4-PDI2019-SG23-190529**	T4-PDI2019-SG24-190529	
PCB-22	0.262	0.130	67 (≤50)
PCB-24/27	0.0655	0.0411	46 (≤50)
PCB-25	0.106	0.0492	73 (≤50)
PCB-26	0.170	0.0937	58 (≤50)
PCB-28	0.213	0.0881	83 (≤50)
PCB-31	0.127	0.0573	76 (≤50)
PCB-34	0.0134	0.00608	75 (≤50)
PCB-35	0.00107	0.00141U	Not calculable
PCB-37	0.0102	0.00392	89 (≤50)
PCB-38	0.266	0.150	56 (≤50)
PCB-40	0.00837	0.00267U	Not calculable
PCB-41/64/71/72	1.48	1.04	35 (≤50)
PCB-42/59	0.0826	0.0577	35 (≤50)
PCB-43/49	9.57	6.21	43 (≤50)
PCB-44	0.117	0.0839	33 (≤50)
PCB-45	0.00473	0.00218U	Not calculable
PCB-46	0.132	0.0936	34 (≤50)
PCB-47	11.8	6.35	60 (≤50)
PCB-48/75	0.306	0.165	60 (≤50)
PCB-50	0.0155	0.00804	63 (≤50)
PCB-51	5.97	3.41	55 (≤50)
PCB-52/69	4.89	3.66	29 (≤50)
PCB-53	3.80	2.51	41 (≤50)
PCB-54	0.705	0.417	51 (≤50)
PCB-55	0.140	0.0794	55 (≤50)
PCB-56/60	0.0195	0.0117	50 (≤50)
PCB-57	0.0473	0.0305	43 (≤50)
PCB-61/70	0.289	0.169	52 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	T4-PDI2019-SG23-190529**	T4-PDI2019-SG24-190529	
PCB-63	0.0164	0.00802	69 (≤50)
PCB-66/76	0.343	0.214	46 (≤50)
PCB-67	0.0939	0.0464	68 (≤50)
PCB-68	0.102	0.0661	43 (≤50)
PCB-73	0.218	0.140	44 (≤50)
PCB-74	0.0413	0.0234	55 (≤50)
PCB-77	0.00619	0.00372	50 (≤50)
PCB-78	0.00281	0.00286	2 (≤50)
PCB-79	0.0808	0.0606	29 (≤50)
PCB-81	0.0155	0.00810	63 (≤50)
PCB-82	0.0149	0.0106	34 (≤50)
PCB-84/92	2.48	1.89	27 (≤50)
PCB-85/116	0.0936	0.0737	24 (≤50)
PCB-87/117/125	0.724	0.465	44 (≤50)
PCB-88/91	5.27	3.18	49 (≤50)
PCB-89	0.000442U	0.00596	Not calculable
PCB-90/101	9.41	7.19	27 (≤50)
PCB-93	0.000497U	0.0169	Not calculable
PCB-94	0.327	0.197	50 (≤50)
PCB-95/98/102	5.17	4.01	25 (≤50)
PCB-96	0.504	0.317	46 (≤50)
PCB-97	0.206	0.159	26 (≤50)
PCB-99	3.99	2.75	37 (≤50)
PCB-100	3.58	2.03	55 (≤50)
PCB-103	1.55	1.08	36 (≤50)
PCB-104	0.303	0.168	57 (≤50)
PCB-105	0.368	0.267	32 (≤50)
PCB-106/118	2.49	1.80	32 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	T4-PDI2019-SG23-190529**	T4-PDI2019-SG24-190529	
PCB-107/109	0.374	0.264	34 (≤50)
PCB-108/112	0.0603	0.0480	23 (≤50)
PCB-110	3.88	2.91	29 (≤50)
PCB-111/115	0.0422	0.0289	37 (≤50)
PCB-113	0.124	0.129	4 (≤50)
PCB-114	0.0417	0.0152	93 (≤50)
PCB-119	1.40	0.883	45 (≤50)
PCB-120	0.145	0.111	27 (≤50)
PCB-124	0.177	0.105	51 (≤50)
PCB-126	0.0161	0.0106	41 (≤50)
PCB-128/162	1.33	0.989	29 (≤50)
PCB-129	0.301	0.226	28 (≤50)
PCB-130	1.03	0.810	24 (≤50)
PCB-131/133	0.829	0.578	36 (≤50)
PCB-132/161	4.56	3.44	28 (≤50)
PCB-134/143	0.885	0.620	35 (≤50)
PCB-135	3.69	3.00	21 (≤50)
PCB-136	4.52	3.57	23 (≤50)
PCB-137	0.190	0.113	51 (≤50)
PCB-138/163/164	23.2	18.1	25 (≤50)
PCB-139/149	24.3	20.8	16 (≤50)
PCB-140	0.429	0.330	26 (≤50)
PCB-141	5.22	4.04	25 (≤50)
PCB-144	1.21	1.01	18 (≤50)
PCB-145	0.000442	0.000545U	Not calculable
PCB-146/165	5.42	3.86	34 (≤50)
PCB-147	2.22	1.40	45 (≤50)
PCB-148	0.321	0.140	79 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	T4-PDI2019-SG23-190529**	T4-PDI2019-SG24-190529	
PCB-150	0.473	0.284	50 (≤50)
PCB-151	8.15	6.87	17 (≤50)
PCB-152	0.0785	0.0378	70 (≤50)
PCB-153	31.5	24.2	26 (≤50)
PCB-154	2.11	1.50	34 (≤50)
PCB-155	0.0552	0.0344	46 (≤50)
PCB-156	1.90	1.33	35 (≤50)
PCB-157	0.100	0.0703	35 (≤50)
PCB-158/160	2.32	1.78	26 (≤50)
PCB-166	0.107	0.00149U	Not calculable
PCB-167	0.700	0.494	35 (≤50)
PCB-168	0.106	0.0849	22 (≤50)
PCB-170	14.1	10.0	34 (≤50)
PCB-171	3.69	2.61	34 (≤50)
PCB-172	1.83	1.24	38 (≤50)
PCB-173	0.228	0.166	31 (≤50)
PCB-174	11.2	7.95	34 (≤50)
PCB-175	0.490	0.395	21 (≤50)
PCB-176	1.66	1.30	24 (≤50)
PCB-177	7.01	5.02	33 (≤50)
PCB-178	2.70	2.16	22 (≤50)
PCB-179	4.99	3.90	25 (≤50)
PCB-180	32.8	23.1	35 (≤50)
PCB-181	0.113	0.0373	101 (≤50)
PCB-182/187	15.3	12.9	17 (≤50)
PCB-183	8.01	6.65	19 (≤50)
PCB-184	0.00781	0.00537	37 (≤50)
PCB-185	1.13	0.804	34 (≤50)

Compound	Concentration (ug/Kg)		RPD (Limits)
	T4-PDI2019-SG23-190529**	T4-PDI2019-SG24-190529	
PCB-188	0.0644	0.0454	35 (≤50)
PCB-189	0.593	0.378	44 (≤50)
PCB-190	2.99	2.14	33 (≤50)
PCB-191	0.596	0.413	36 (≤50)
PCB-193	1.61	1.14	34 (≤50)
PCB-194	6.27	4.10	42 (≤50)
PCB-195	2.97	1.88	45 (≤50)
PCB-196/203	7.21	5.58	25 (≤50)
PCB-197	0.266	0.200	28 (≤50)
PCB-198	0.257	0.201	24 (≤50)
PCB-199	5.12	4.02	24 (≤50)
PCB-200	0.647	0.492	27 (≤50)
PCB-201	0.719	0.532	30 (≤50)
PCB-202	0.682	0.529	25 (≤50)
PCB-205	0.314	0.206	42 (≤50)
PCB-206	0.93	0.612	41 (≤50)
PCB-207	0.137	0.0954	36 (≤50)
PCB-208	0.120	0.0809	39 (≤50)
PCB-209	0.0106	0.00575	59 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits with the following exceptions:

Sample	Labeled Compound	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SG25-190529	13C-PCB-11 13C-PCB-32	148 (10-145) 149 (10-145)	PCB-14 PCB-11 PCB-12/13 PCB-15 PCB-18 PCB-17 PCB-24/27 PCB-16/32	J (all detects) UJ (all non-detects)	P

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1901305	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to labeled compound %R and results reported as EMPC, data were qualified as estimated in seven samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Data Qualification Summary - SDG 1901305

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG25-190529	PCB-14 PCB-11 PCB-12/13 PCB-15 PCB-18 PCB-17 PCB-24/27 PCB-16/32	J (all detects) UJ (all non-detects)	P	Labeled compounds (%R)
T4-PDI2019-SG22-190529 T4-PDI2019-SG23-190529** T4-PDI2019-SG24-190529 T4-PDI2019-SG25-190529 T4-PDI2019-SG40-190528 FD-201905281308 T4-PDI2019-SG41-190528	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Biphenyls as Congeners - Laboratory Blank Data Qualification Summary - SDG 1901305

No Sample Data Qualified in this SDG

LDC #: 45640A31 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/19/19
SDG #: 1901305 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Biphenyl Congeners (EPA Method 1668C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A*	
III.	Initial calibration/ICV	A/A	RSD ≤ 20
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/SW	1901384-04 (SG38-190531) - no qual
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = 6+7
X.	Labeled Compounds	SW	
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation All - EMPC - Jlefs A
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG2~~3~~2-190529	1901305-01	Sediment	05/29/19
2	T4-PDI2019-SG23-190529**	1901305-02**	Sediment	05/29/19
3	T4-PDI2019-SG24-190529	1901305-03	Sediment	05/29/19
4	T4-PDI2019-SG25-190529	1901305-04	Sediment	05/29/19
5	T4-PDI2019-SG40-190528	1901305-05	Sediment	05/28/19
6	FD-201905281308	1901305-06	Sediment	05/28/19
7	T4-PDI2019-SG41-190528	1901305-07	Sediment	05/28/19
8				
9				
10				

Notes: * MS resolution < 10000 for m/z 192.9888 & 268.9824 due to PFK leak or bleed

	B9F0214				No qual	m/z 190.0363	(PCB-1)
						m/z 268.0016	(13C-C13)

LDC #: 45040A31

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: R
2nd Reviewer: [illegible]

Method: HRGC/HRMS Polychlorinated Biphenyls (EPA Method 1668C)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 330.9792 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution (valley) between PCB 23 and PCB 34 and between PCB 182 and PCB 187 ≤ 40% ?		✓		
Is the static resolving power ≥10,000 at m/z 330.9792 and ≥ 8000 throughout the mass range?	✓			
Was the mass resolution adequately checked with PFK?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?		✓		
Were all percent relative standard deviations (%RSD) ≤20% for unlabeled and labeled compounds?		✓		
Did all calibration standards meet the Ion Abundance Ratio criteria?		✓		
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?		✓		
Were all percent differences (%D) within QC limits?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning of each 12 hour period?	✓			
Were all percent differences (%D) ≤25% for unlabeled and percent recoveries (%R) for labeled compounds within 50-145%?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and internal standard ≥ 10?	✓			
V. Laboratory Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the blanks validation findings worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. 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? MP		✓		

LDC #: 45640A31

VALIDATION FINDINGS CHECKLIST

Reviewer: R
2nd Reviewer: ✓

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compound recoveries within the QC criteria?		✓		
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the labeled compound, quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For polychlorinated biphenyl congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For polychlorinated biphenyl congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For other polychlorinated biphenyl congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?		✓		
Was the signal to noise ratio for each target compound and labeled standard ≥ 2.5?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC#: 45640A31

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD (≤50%)	
	2	3		
PCB-1	0.0450	0.00279	177	
PCB-2	0.00322	0.00118U	NC	
PCB-3	0.0260	0.00119U	NC	
PCB-5/8	0.0502	0.00389U	NC	
PCB-15	0.0248	0.00316U	NC	
PCB-16/32	0.804	0.444	58	
PCB-17	0.0395	0.0197	67	
PCB-18	0.0538	0.0295	58	
PCB-19	0.0319	0.0163	65	
PCB-20/21/33	0.181	0.0928	64	
PCB-22	0.262	0.130	67	
PCB-24/27	0.0655	0.0411	46	
PCB-25	0.106	0.0492	73	
PCB-26	0.170	0.0937	58	
PCB-28	0.213	0.0881	83	
PCB-31	0.127	0.0573	76	
PCB-34	0.0134	0.00608	75	
PCB-35	0.00107	0.00141U	NC	
PCB-37	0.0102	0.00392	89	
PCB-38	0.266	0.150	56	
PCB-40	0.00837	0.00267U	NC	
PCB-41/64/71/72	1.48	1.04	35	
PCB-42/59	0.0826	0.0577	35	
PCB-43/49	9.57	6.21	43	
PCB-44	0.117	0.0839	33	
PCB-45	0.00473	0.00218U	NC	
PCB-46	0.132	0.0936	34	
PCB-47	11.8	6.35	60	
PCB-48/75	0.306	0.165	60	
PCB-50	0.0155	0.00804	63	
PCB-51	5.97	3.41	55	
PCB-52/69	4.89	3.66	29	
PCB-53	3.80	2.51	41	
PCB-54	0.705	0.417	51	
PCB-55	0.140	0.0794	55	
PCB-56/60	0.0195	0.0117	50	
PCB-57	0.0473	0.0305	43	
PCB-61/70	0.289	0.169	52	
PCB-63	0.0164	0.00802	69	
PCB-66/76	0.343	0.214	46	
PCB-67	0.0939	0.0464	68	
PCB-68	0.102	0.0661	43	
PCB-73	0.218	0.140	44	
PCB-74	0.0413	0.0234	55	
PCB-77	0.00619	0.00372	50	
PCB-78	0.00281	0.00286	2	
PCB-79	0.0808	0.0606	29	
PCB-81	0.0155	0.00810	63	
PCB-82	0.0149	0.0106	34	
PCB-84/92	2.48	1.89	27	
PCB-85/116	0.0936	0.0737	24	
PCB-87/117/125	0.724	0.465	44	
PCB-88/91	5.27	3.18	49	
PCB-89	0.000442U	0.00596	NC	
PCB-90/101	9.41	7.19	27	

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: R

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	2	3	(≤50%)	
PCB-93	0.000497U	0.0169	NC	
PCB-94	0.327	0.197	50	
PCB-95/98/102	5.17	4.01	25	
PCB-96	0.504	0.317	46	
PCB-97	0.206	0.159	26	
PCB-99	3.99	2.75	37	
PCB-100	3.58	2.03	55	
PCB-103	1.55	1.08	36	
PCB-104	0.303	0.168	57	
PCB-105	0.368	0.267	32	
PCB-106/118	2.49	1.80	32	
PCB-107/109	0.374	0.264	34	
PCB-108/112	0.0603	0.0480	23	
PCB-110	3.88	2.91	29	
PCB-111/115	0.0422	0.0289	37	
PCB-113	0.124	0.129	4	
PCB-114	0.0417	0.0152	93	
PCB-119	1.40	0.883	45	
PCB-120	0.145	0.111	27	
PCB-124	0.177	0.105	51	
PCB-126	0.0161	0.0106	41	
PCB-128/162	1.33	0.989	29	
PCB-129	0.301	0.226	28	
PCB-130	1.03	0.810	24	
PCB-131/133	0.829	0.578	36	
PCB-132/161	4.56	3.44	28	
PCB-134/143	0.885	0.620	35	
PCB-135	3.69	3.00	21	
PCB-136	4.52	3.57	23	
PCB-137	0.190	0.113	51	
PCB-138/163/164	23.2	18.1	25	
PCB-139/149	24.3	20.8	16	
PCB-140	0.429	0.330	26	
PCB-141	5.22	4.04	25	
PCB-144	1.21	1.01	18	
PCB-145	0.000442	0.000545U	NC	
PCB-146/165	5.42	3.86	34	
PCB-147	2.22	1.40	45	
PCB-148	0.321	0.140	79	
PCB-150	0.473	0.284	50	
PCB-151	8.15	6.87	17	
PCB-152	0.0785	0.0378	70	
PCB-153	31.5	24.2	26	
PCB-154	2.11	1.50	34	
PCB-155	0.0552	0.0344	46	
PCB-156	1.90	1.33	35	
PCB-157	0.100	0.0703	35	
PCB-158/160	2.32	1.73	26	
PCB-166	0.107	0.00149U	NC	
PCB-167	0.700	0.494	35	
PCB-168	0.106	0.0849	22	
PCB-170	14.1	10.0	34	
PCB-171	3.69	2.61	34	
PCB-172	1.83	1.24	38	
PCB-173	0.228	0.166	31	
PCB-174	11.2	7.95	34	
PCB-175	0.490	0.395	21	

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: M

2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Compound Name	Concentration (ug/Kg)		RPD	
	2	3	(≤50%)	
PCB-176	1.66	1.30	24	
PCB-177	7.01	5.02	33	
PCB-178	2.70	2.16	22	
PCB-179	4.99	3.90	25	
PCB-180	32.8	23.1	35	
PCB-181	0.113	0.0373	101	
PCB-182/187	15.3	12.9	17	
PCB-183	8.01	6.65	19	
PCB-184	0.00781	0.00537	37	
PCB-185	1.13	0.804	34	
PCB-188	0.0644	0.0454	35	
PCB-189	0.593	0.378	44	
PCB-190	2.99	2.14	33	
PCB-191	0.596	0.413	36	
PCB-193	1.61	1.14	34	
PCB-194	6.27	4.10	42	
PCB-195	2.97	1.88	45	
PCB-196/203	7.21	5.58	25	
PCB-197	0.266	0.200	28	
PCB-198	0.257	0.201	24	
PCB-199	5.12	4.02	24	
PCB-200	0.647	0.492	27	
PCB-201	0.719	0.532	30	
PCB-202	0.682	0.529	25	
PCB-205	0.314	0.206	42	
PCB-206	0.93	0.612	41	
PCB-207	0.137	0.0954	36	
PCB-208	0.120	0.0809	39	
PCB-209	0.0106	0.00575	59	

LDC #: 45640A31

VALIDATION FINDINGS WORKSHEET
Labeled Compounds

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A — Were all labeled compound recoveries and ion abundance ratios (IAR) within the QC criteria?

(Y) N N/A — Was the S/N ratio all labeled compound peaks ≥ 10?

#	Date	Lab ID/Reference	Labeled Compound	%(Recovery) Ion Abundance Ratio (Limit:)	Qualifications
		4 (det/ND)	13C-PCB-11	148 (10-145)	J/UJ/P (see attached)
			↓ 32	149 (↓)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	

Table 8

PCB Natives and Corresponding Labeled Compounds

Congener	Labeled	Recovery Standard
PCB-1	^{13}C-PCB-1	^{13}C-PCB-15
PCB-2	^{13}C-PCB-3	^{13}C-PCB-15
PCB-3	^{13}C-PCB-3	^{13}C-PCB-15
PCB-4/10	^{13}C-PCB-4	^{13}C-PCB-15
PCB-7/9	^{13}C-PCB-9	^{13}C-PCB-15
PCB-6	^{13}C-PCB-9	^{13}C-PCB-15
PCB-5/8	^{13}C-PCB-9	^{13}C-PCB-15
PCB-14	^{13}C-PCB-11	^{13}C-PCB-15
PCB-11	^{13}C-PCB-11	^{13}C-PCB-15
PCB-12/13	^{13}C-PCB-11	^{13}C-PCB-15
PCB-15	^{13}C-PCB-11	^{13}C-PCB-15
PCB-19	^{13}C-PCB-19	^{13}C-PCB-15
PCB-30	^{13}C-PCB-19	^{13}C-PCB-15
PCB-18	^{13}C-PCB-32	^{13}C-PCB-15
PCB-17	^{13}C-PCB-32	^{13}C-PCB-15
PCB-24/27	^{13}C-PCB-32	^{13}C-PCB-15
PCB-16/32	^{13}C-PCB-32	^{13}C-PCB-15
PCB-34	^{13}C-PCB-28	^{13}C-PCB-31
PCB-23	^{13}C-PCB-28	^{13}C-PCB-31
PCB-29	^{13}C-PCB-28	^{13}C-PCB-31
PCB-26	^{13}C-PCB-28	^{13}C-PCB-31
PCB-25	^{13}C-PCB-28	^{13}C-PCB-31
PCB-31	^{13}C-PCB-28	^{13}C-PCB-31
PCB-28	^{13}C-PCB-28	^{13}C-PCB-31
PCB-20/21/33	^{13}C-PCB-28	^{13}C-PCB-31
PCB-22	^{13}C-PCB-28	^{13}C-PCB-31
PCB-36	^{13}C-PCB-37	^{13}C-PCB-31
PCB-39	^{13}C-PCB-37	^{13}C-PCB-31
PCB-38	^{13}C-PCB-37	^{13}C-PCB-31
PCB-35	^{13}C-PCB-37	^{13}C-PCB-31
PCB-37	^{13}C-PCB-37	^{13}C-PCB-31
PCB-54	^{13}C-PCB-54	^{13}C-PCB-60
PCB-50	^{13}C-PCB-54	^{13}C-PCB-60
PCB-53	^{13}C-PCB-52	^{13}C-PCB-60
PCB-51	^{13}C-PCB-52	^{13}C-PCB-60
PCB-45	^{13}C-PCB-52	^{13}C-PCB-60
PCB-46	^{13}C-PCB-52	^{13}C-PCB-60
PCB-52/69	^{13}C-PCB-52	^{13}C-PCB-60
PCB-73	^{13}C-PCB-52	^{13}C-PCB-60
PCB-43/49	^{13}C-PCB-52	^{13}C-PCB-60

LDC #: 47404A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of compound, A_{is} = Area of associated internal standard
average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, C_{is} = Concentration of internal standard
%RSD = 100 * (S/X) — S = Standard deviation of the RRFs, X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported %RSD	Recalculated %RSD
1	ICAL	4/24/18	PCB 77 (^{13}C-PCB 77)	1.03273	1.03383	1.07	1.07	7.70007	7.73829
			PCB 105 (^{13}C-PCB 105)	1.10086	1.10693	1.11	1.10	5.66896	5.72413
			PCB 167 (^{13}C-PCB 167)	1.04252	1.04000	1.03	1.03	4.87414	4.78842
			PCB 189 (^{13}C-PCB 189)	1.33264	1.33333	1.39	1.39	8.70494	8.57321
2			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						
3			PCB 77 (^{13}C-PCB 77)						
			PCB 105 (^{13}C-PCB 105)						
			PCB 167 (^{13}C-PCB 167)						
			PCB 189 (^{13}C-PCB 189)						

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 #: 45640A31

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported Conc (CC)	Recalculated Conc (CC)	Reported %D	Recalculated %D
1	190629K1_1	6/29/19	PCB 77 (^{13}C-PCB 77)	1.03	51.78	51.80		
			PCB 105 (^{13}C-PCB 105)	1.10	50.53	50.34		
			PCB 167 (^{13}C-PCB 167)	1.04	50.68	50.84		
			PCB 189 (^{13}C-PCB 189)	1.33	51.37	51.49		
2	190711K1_1	7/11/19	PCB 77 (^{13}C-PCB 77)	↓	48.57	48.70		
			PCB 105 (^{13}C-PCB 105)	↓	47.33	47.39		
			PCB 167 (^{13}C-PCB 167)	↓	49.27	49.44		
			PCB 189 (^{13}C-PCB 189)	↓	50.32	50.41		
3			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					
4			PCB 77 (^{13}C-PCB 77)					
			PCB 105 (^{13}C-PCB 105)					
			PCB 167 (^{13}C-PCB 167)					
			PCB 189 (^{13}C-PCB 189)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45640A31

VALIDATION FINDINGS WORKSHEET
Ongoing Precision and Recovery Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

The percent recoveries (%R) of the Ongoing Precision and Recovery (OPR) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA

Where: SSC = Spiked sample concentration
SSCD = Duplicate Spiked sample concentration
SA = Spike added

RPD = I SSC- SSCDI * 2/(SSC+ SSCD)

OPR ID: B9F0214-BS1

Compound	Spike Added (pg/g)		Spiked Sample Concentration (pg/g)		OPR Percent Recovery		OPR D Percent Recovery		OPR/OPRD RPD	
	OPR	OPRD	OPR	OPRD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
PCB 15	0.500		0.516		103	103				
PCB 77	↓		0.503		101	101				
PCB 169			0.486		97.1	97.2				
PCB 206	↓		0.472		94.3	94.4				

LDC #: 45640A31

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: HRGC/HRMS PCB Congeners (EPA Method 1668C)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. 2, PCB-44:

Conc. = $\frac{(27467.621)(10)(\quad)}{(4946428.9)(0.761)(9.07)(0.774)}$

= 0.1039 ng/kg

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	2	PCB-44	0.104	0.104	–

LDC #: 45640

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 8/22/19
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	Y		
Ib.	- All samples present/match report?	Y		
Ic.	- All reported analytes present?	Y		
Id.	- 10% or 100% verification of EDD?	Y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	Y		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	—		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
1201 Third Ave. Suite 2600
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

September 4, 2019

SUBJECT: Port of Portland, T4, PDI, Data Validation

Dear Ms. Peterson,

Enclosed is the final validation report for the fraction listed below. This SDG was received on August 12, 2019. Attachment 1 is a summary of the samples that were reviewed for analysis.

LDC Project #45719:

SDG #	**Fraction**
1901246	Polychlorinated Dioxins/Dibenzofurans

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

EDD **Stage 2B 90/10**

LDC #45719 (Anchor Environmental-Seattle WA / Port of Portland, T4, PDI)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Dioxins (1613B)																																	
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	W	S
A	1901246	08/12/19	09/02/19	0	15																																
A	1901246	08/12/19	09/02/19	0	2																																
Total	J/CR			0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

LDC Report# 45719A21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: September 4, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901246

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC12-190521-01-03**	1901246-01**	Sediment	05/21/19
T4-PDI2019-SC12-190521-03-05	1901246-02	Sediment	05/21/19
T4-PDI2019-SC12-190521-05-07	1901246-03	Sediment	05/21/19
T4-PDI2019-SC12-190521-07-8.3	1901246-04	Sediment	05/21/19
FD-201905211556	1901246-05	Sediment	05/21/19
T4-PDI2019-SC13-190521-01-03	1901246-06	Sediment	05/21/19
T4-PDI2019-SC13-190521-03-05	1901246-07	Sediment	05/21/19
T4-PDI2019-SC13-190521-05-07	1901246-08	Sediment	05/21/19
T4-PDI2019-SC13-190521-07-09	1901246-09	Sediment	05/21/19
T4-PDI2019-SC13-190521-09-11.1	1901246-10	Sediment	05/21/19
FD-201905211730	1901246-11	Sediment	05/21/19
T4-PDI2019-SC19-190521-01-03	1901246-12	Sediment	05/21/19
T4-PDI2019-SC19-190521-03-05	1901246-13	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07**	1901246-14**	Sediment	05/21/19
T4-PDI2019-SC19-190521-07-09	1901246-15	Sediment	05/21/19
T4-PDI2019-SC19-190521-09-11	1901246-16	Sediment	05/21/19
T4-PDI2019-SC19-190521-11-11.8	1901246-17	Sediment	05/21/19
T4-PDI2019-SC19-190521-05-07DUP	1901246-14DUP	Sediment	05/29/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
B9F029-BLK1	06/21/19	Total TCDF Total PeCDF	1.51 ng/Kg 0.919 ng/Kg	T4-PDI2019-SC12-190521-01-03** T4-PDI2019-SC12-190521-03-05 T4-PDI2019-SC12-190521-05-07 T4-PDI2019-SC12-190521-07-8.3 FD-201905211556 T4-PDI2019-SC13-190521-01-03 T4-PDI2019-SC13-190521-03-05 T4-PDI2019-SC13-190521-05-07 T4-PDI2019-SC13-190521-09-11.1 FD-201905211730 T4-PDI2019-SC19-190521-01-03 T4-PDI2019-SC19-190521-07-09 T4-PDI2019-SC19-190521-11-11.8

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
T4-PDI2019-SC12-190521-01-03**	Total TCDF	6.88 ng/Kg	6.88J ng/Kg
T4-PDI2019-SC13-190521-01-03	Total TCDF	1.91 ng/Kg	1.91J ng/Kg

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples FD-201905211556 and T4-PDI2019-SC13-190521-07-09 and samples FD-201905211730 and T4-PDI2019-SC19-190521-01-03 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905211556	T4-PDI2019-SC13-190521-07-09	
1,2,3,4,6,7,8-HpCDD	0.747	0.666	11 (≤50)
OCDD	5.89	5.20	12 (≤50)
Total HxCDD	0.387	0.521	30 (≤50)
Total HpCDD	1.79	1.77	1 (≤50)
Total TCDD	0.212U	0.339	Not calculable

Compound	Concentration (ng/Kg)		RPD (Limits)
	FD-201905211730	T4-PDI2019-SC19-190521-01-03	
1,2,3,4,6,7,8-HpCDD	6.71	2.03	107 (≤50)
OCDD	55.4	10.6	136 (≤50)
1,2,3,4,7,8-HxCDF	0.261	0.119U	Not calculable
1,2,3,4,6,7,8-HpCDF	0.889	0.103U	Not calculable
OCDF	1.50	0.236U	Not calculable
Total HxCDD	3.73	1.53	84 (≤50)
Total HpCDD	17.9	4.90	114 (≤50)
Total HxCDF	1.10	0.141U	Not calculable
Total HpCDF	2.48	0.341	152 (≤50)

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
T4-PDI2019-SC12-190521-01-03** T4-PDI2019-SC12-190521-03-05 T4-PDI2019-SC12-190521-05-07 T4-PDI2019-SC12-190521-07-8.3 FD-201905211556 T4-PDI2019-SC13-190521-01-03 T4-PDI2019-SC13-190521-03-05 T4-PDI2019-SC13-190521-05-07 FD-201905211730 T4-PDI2019-SC19-190521-05-07** T4-PDI2019-SC19-190521-09-11	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Sample	Compound	Finding	Criteria	Flag	A or P
T4-PDI2019-SC12-190521-03-05	OCDD	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	P

For sample T4-PDI2019-SC13-190521-01-03, a 2nd column confirmation was not performed for 2,3,7,8-TCDF by the laboratory since the result was either less than the reporting limit or EMPC.

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to results reported as EMPC and results exceeding calibration range, data were qualified as estimated in eleven samples.

Due to laboratory blank contamination, data were qualified as estimated in two samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901246

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC12-190521-01-03** T4-PDI2019-SC12-190521-03-05 T4-PDI2019-SC12-190521-05-07 T4-PDI2019-SC12-190521-07-8.3 FD-201905211556 T4-PDI2019-SC13-190521-01-03 T4-PDI2019-SC13-190521-03-05 T4-PDI2019-SC13-190521-05-07 FD-201905211730 T4-PDI2019-SC19-190521-05-07** T4-PDI2019-SC19-190521-09-11	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)
T4-PDI2019-SC12-190521-03-05	OCDD	J (all detects)	P	Compound quantitation (exceeded range)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901246

Sample	Compound	Modified Final Concentration	A or P
T4-PDI2019-SC12-190521-01-03**	Total TCDF	6.88J ng/Kg	A
T4-PDI2019-SC13-190521-01-03	Total TCDF	1.91J ng/Kg	A

LDC #: 45719A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/31/19
SDG #: 1901246 Stage 2B/4 Page: 1 of 2
Laboratory: Vista Analytical Laboratory Reviewer: FY
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	% RSD ≤ 20/35 ICV = QC limit
IV.	Continuing calibration	A	CCV = QC limit
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/A	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	SW	D = ~~4~~, 5 ~~10~~, ~~11~~ 11, 12
X.	Labeled Compounds	A	5, 9
XI.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1 1	T4-PDI2019-SC12-190521-01-03**	1901246-01**	Sediment	05/21/19
2 1	T4-PDI2019-SC12-190521-03-05	1901246-02	Sediment	05/21/19
3 1	T4-PDI2019-SC12-190521-05-07	1901246-03	Sediment	05/21/19
4 1	T4-PDI2019-SC12-190521-07-8.3 ~~1~~	1901246-04	Sediment	05/21/19
5 1	FD-201905211556 1 D	1901246-05	Sediment	05/21/19
6 1	T4-PDI2019-SC13-190521-01-03	1901246-06	Sediment	05/21/19
7 1	T4-PDI2019-SC13-190521-03-05	1901246-07	Sediment	05/21/19
8 1	T4-PDI2019-SC13-190521-05-07	1901246-08	Sediment	05/21/19
9 2	T4-PDI2019-SC13-190521-07-09 D	1901246-09	Sediment	05/21/19
10 1	T4-PDI2019-SC13-190521-09-11.1	1901246-10	Sediment	05/21/19
11 1	FD-201905211730 1 D1	1901246-11	Sediment	05/21/19
12 1	T4-PDI2019-SC19-190521-01-03 D1	1901246-12	Sediment	05/21/19
13 2	T4-PDI2019-SC19-190521-03-05	1901246-13	Sediment	05/21/19
14 2	T4-PDI2019-SC19-190521-05-07**	1901246-14**	Sediment	05/21/19

LDC #: 45719A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/31/19
SDG #: 1901246 Stage 2B/4 Page: 2 of 2
Laboratory: Vista Analytical Laboratory Reviewer: FM
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

	Client ID	Lab ID	Matrix	Date
15 1	T4-PDI2019-SC19-190521-07-09	1901246-15	Sediment	05/21/19
16 2	T4-PDI2019-SC19-190521-09-11	1901246-16	Sediment	05/21/19
17 1	T4-PDI2019-SC19-190521-11-11.8	1901246-17	Sediment	05/21/19
18 2	T4-PDI2019-SC19-190521-05-07DUP	1901246-14DUP	Sediment	05/29/19
19				
20				
21				

Notes:

+	B9F0201 - BLK	1					
-	B9G0073 - BLK	1					

LDC #: 45719A21

VALIDATION FINDINGS CHECKLIST

Reviewer: FT

2nd Reviewer: [illegible]

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled and 35% for llabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) for the unlabeled compounds ≤ 20% and for labeled compounds ≤ 30% ?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning and end of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 45719A21

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Labeled Compounds				
Were labeled compounds within the QC criteria?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	✓			
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:

LDC #: 45719A21

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: FT
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A Was the method blank contaminated?

Blank extraction date: 6/21/19 **Blank analysis date:** 6/27/19 **Associated samples:** 1→8, 10→12, 15, 17
Conc. units: ng/kg

Compound	Blank ID	5X	Sample Identification								
	B9F029-BLK1	1	6								
~~#~~ Y	1.51	7.55	6.88 ~~U~~ J	1.91 ~~U~~ J							
~~☒~~ W	0.919	4.595	-								

Blank extraction date:_____ **Blank analysis date:**_____
Conc. units:_____ Associated Samples:_____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC#: 45719 A21

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: EZ
2nd Reviewer: [illegible]

METHOD: 1613B

Compound	Concentration (ng/Kg)		(≤50)
	5	9	RPD
F	0.747	0.666	11
G	5.89	5.20	12
T	0.387	0.521	30
U	1.79	1.77	1
R	0.212U	0.339	NC

Compound	Concentration (ng/Kg)		(≤50)
	11	12	RPD
F	6.71	2.03	107
G	55.4	10.6	136
K	0.261	0.119U	NC
O	0.889	0.103U	NC
Q	1.50	0.236U	NC
T	3.73	1.53	84
U	17.9	4.90	114
X	1.10	0.141U	NC
Y	2.48	0.341	152

LDC #: 45719A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		1-8, 11, 14, 16	all compounds reported as estimated maximum possible concentration (EMPC)		Jdet /A
		2	G x'd cal Range		Jdet /P
		6	2nd column confirmation		text
			was not performed		
			for H since the		
			results were either		
			less than RL or EMPC		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 45719A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (CS3 std)	Recalculated RRF (CS3 std)	Reported %RSD	Recalculated %RSD
1	ICAL ZB 5MS	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.92	0.92	5.57	5.57
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.95	0.95	6.57	6.57
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.91	0.91	8.35	8.35
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.90	0.90	10.09	10.09
			OCDF (^{13}C-OCDD)	0.94	0.94	0.85	0.85	12.29	12.29
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						

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 #: 45719A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (CS3 std)	Recalculated RRF (CS3 std)	Reported %RSD	Recalculated %RSD
1	ICAL DB-225	5/30/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.9476	0.9476	0.88	0.88	9.58	9.58
	confirmation		2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						

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 #: 45719A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: FT
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Actual Amount	Reported Amount (CC)	Recalculated Amount (CC)	Reported %D	Recalculated %D
1	CCV 0440	6/27/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	10.0	9.65	9.65		
	ZB-5MS		2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	10.0	11.3	11.3		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	50.0	53.1	53.1		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	50.0	47.9	47.9		
			OCDF (^{13}C-OCDD)	100.0	100.0	100.0		
2	CCV 1334	7/12/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	10.0	9.35	9.35		
	ZB-5MS		2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	10.0	11.0	11.0		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	50.0	50.0	50.0		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	50.0	47.3	47.3		
			OCDF (^{13}C-OCDD)	100	98.3	98.3		
3	CCV 1736	7/19/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	10.0	10.0	10.0		
	DB-225		2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDD)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45719A21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboraotry control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS ID: B9F0201-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
2,3,7,8-TCDD	40.0	NA	46.1	NA	115	115				
1,2,3,7,8-PeCDD	200.0		236		118	118				
1,2,3,4,7,8-HxCDD	200.0		219		109	109				
1,2,3,4,7,8,9-HpCDF	200.0		221		110	110				
OCDF	400.0		423		106	106				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 45719A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: FT
2nd reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. #1, OCDD:

FT

Conc. = $\frac{\cancel{5.47\times1}\ 5.43\times10^{7}\ (4000)}{1.44\times10^{7}\ (0.99)\ (9.0)\ (0.556)}$

= 3045 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	#1	OCDD	3060	3045	
		2,3,7,8 TCDF conf	1.05		
	2,3,7,8	TCDF conf. (DB225)			
		$= \frac{(4.75\times10^{4})(2000)}{(1.28\times10^{7})(0.9476)(9.0)(0.556)}$			
		= 1.565			
		Lab Reported the lower Results			
		but 2 column =	1.05 ng/kg		

LDC #: 45719

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 9/11/19

2nd Reviewer: GV

The LDC job number listed above was entered by FM

Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	y		
Ib.	- All samples present/match report?	y		
Ic.	- All reported analytes present?	y		
Id.	- 10% or 100% verification of EDD?	y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	y		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	—		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	y		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	y		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
1201 Third Ave. Suite 2600
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

October 1, 2019

SUBJECT: Port of Portland, T4, PDI, Data Validation

Dear Ms. Peterson,

Enclosed is the final validation report for the fraction listed below. This SDG was received on September 24, 2019. Attachment 1 is a summary of the samples that were reviewed for analysis.

LDC Project #46013:

SDG #	**Fraction**
1901305_R1	Polychlorinated Dioxins/Dibenzofurans

The data validation was performed under Stage 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

1,667 pages-ADV 3 DAY TAT (additional sample from 1901305) Attachment 1

EDD Stage 2B 90/10

LDC #46013 (Anchor Environmental-Seattle WA / Port of Portland, T4, PDI)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Dioxins (1613B)																																	
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	W	S
A	1901305_R1	09/24/19	09/27/19	0	1																																
Total	T/CR			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Port of Portland - T4\46013ST.wpd

LDC Report# 46013A21

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: September 25, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1901305 R1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SG40-190528	1901305-05	Sediment	05/28/19
T4-PDI2019-SG40-190528DUP	1901305-05DUP	Sediment	05/28/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
T4-PDI2019-SG40-190528DUP (All samples in SDG 1901305 R1)	1,2,3,4,6,7,8-HpCDD	148 (≤35)	J (all detects)	A
	OCDD	197 (≤35)	J (all detects)	
	1,2,3,4,6,7,8-HpCDF	132 (≤35)	J (all detects)	
	OCDF	182 (≤35)	J (all detects)	
	Total HxCDD	114 (≤35)	J (all detects)	
	Total HpCDD	148 (≤35)	J (all detects)	
	Total HxCDF	51 (≤35)	J (all detects)	
	Total HpCDF	153 (≤35)	J (all detects)	

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1901305 R1	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

XII. Target Compound Identifications

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and results reported as EMPC, data were qualified as estimated in one sample.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1901305 R1

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SG40-190528	1,2,3,4,6,7,8-HpCDD OCDD 1,2,3,4,6,7,8-HpCDF OCDF Total HxCDD Total HpCDD Total HxCDF Total HpCDF	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SG40-190528	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1901305 R1

No Sample Data Qualified in this SDG

LDC #: 46013A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 9/25/19
SDG #: 1901305 R1 Stage 4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: F7
2nd Reviewer: KK

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A A	%RSD ≤ 20/35 ICV = QC limits
IV.	Continuing calibration	A	CCV = QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/SW	F7 C7
VIII.	Laboratory control samples /OPR	A	~~LCS~~ OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs	SW	
XII.	Target compound identification	A	
XIII.	System performance	A	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SG40-190528	1901305-05	Sediment	05/28/19
2	T4-PDI2019-SG40-190528DUP	1901305-05DUP	Sediment	05/28/19
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	~~B9F0172-BLK1~~						
	B9H0007-BLK1						

LDC #: 46013A21

VALIDATION FINDINGS CHECKLIST

Reviewer: FZ
2nd Reviewer: KK

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	✓			
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% for unlabeled compounds and ≤ 35% for unlabeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) for the unlabeled compounds ~~≤ 20% and for~~ labeled compounds ~~≤ 30% ?~~ QC Limits	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning and end of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 46013A21

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compounds within the ~~25-150% criteria?~~ QC limit	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	✓			
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:

LDC#: 46013A21

VALIDATION FINDINGS WORKSHEET
Laboratory Duplicates

Reviewer: EJ
2nd Reviewer: KK

METHOD: EPA Method 1613B)

Compound	Concentration (ng/Kg)		RPD (≤ 35%)	Qual
	2	1		
F	162	24.3	148	Jdet/A
G	2890	23.4	197	Jdet/A
O	38.2	7.79	132	Jdet/A
Q	293	14.1	182	Jdet/A
T	19.3	5.30	114	Jdet/A
U	331	49.9	148	Jdet/A
X	42.1	25.1	51	Jdet/A
Y	231	31.1	153	Jdet/A

LDC #: 46013A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: FT
2nd Reviewer: KK

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	all compounds reported as estimated maximum possible concentration (EMPC)		J dw /A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 46013A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: CK

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (CS3 std)	Recalculated RRF (CS3 std)	Reported %RSD	Recalculated %RSD
1	ICAL ZB 5MS	5/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.94	0.94	0.92	0.92	5.57	5.57
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.90	0.90	0.95	0.95	6.57	6.57
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.93	0.93	0.91	0.91	8.35	8.35
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.99	0.99	0.90	0.90	10.09	10.09
			OCDF (^{13}C-OCDD)	0.94	0.94	0.85	0.85	12.29	12.29
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						

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 #: 46013A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: FT
2nd Reviewer: KK

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Actual Amount	Reported Amount (CC)	Recalculated Amount (CC)	Reported %D	Recalculated %D
1	CCV	8/16/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	10.0	10.2	10.2		
	ZB-5MS		2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	10.0	10.7	10.7		
	01:13		1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	50.0	53.4	53.4		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	50.0	50.0	50.0		
			OCDF (^{13}C-OCDD)	100.0	107	107		
2			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDD)					
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDD)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 46013A21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: FT
2nd Reviewer: KK

METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboraotry control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS ID: B9#0007-BS1

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
2,3,7,8-TCDD	40.0	NA	53.0	NA	133	133				
1,2,3,7,8-PeCDD	200		270		135	135				
1,2,3,4,7,8-HxCDD	200		270		135	135				
1,2,3,4,7,8,9-HpCDF	200		243		122	122				
OCDF	400		514		129	129	NA			

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 46013A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: FT
2nd reviewer: KK

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

RRF = Relative Response Factor (average) from the initial calibration

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. #1, OCDF:

Conc. = $\frac{1.77 \times 10^5 (200)(20)}{1.05 \times 10^7 (0.94)(7.26)(0.694)}$

= 14.23 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	#1	OCDF	14.1	14.23	

LDC #: 46013

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 10/1
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by FM.
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	Y		
Ib.	- All samples present/match report?	Y		
Ic.	- All reported analytes present?	Y		
Id.	- 10% or 100% verification of EDD?	Y		
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	Y		
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	—		
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	—		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
1201 Third Ave. Suite 2600
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

October 22, 2019

SUBJECT: Port of Portland, T4, PDI, Data Validation

Dear Ms. Peterson,

Enclosed is the final validation report for the fraction listed below. This SDG was received on October 14, 2019. Attachment 1 is a summary of the samples that were reviewed for analysis.

LDC Project #46172:

SDG #	**Fraction**
1903103	Polychlorinated Dioxins/Dibenzofurans

The data validation was performed under Stage 2B & guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy March 2019
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review; April 2016

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

637 pages-ADV (RV1 - 1 WEEK TAT) Attachment 1

EDD Stage 2B 90/10

LDC #46172 (Anchor Environmental-Seattle WA / Port of Portland, T4, PDI)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Dioxins (1613B)																																	
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	W	S
A	1903103	10/14/19	10/21/19	0	1																																
A	1903103	10/14/19	10/21/19	0	1																																
Total	J/CR			0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Port of Portland - T4\46172ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: October 22, 2019

Parameters: Polychlorinated Dioxins/Dibenzofurans

Validation Level: Stage 2B & 4

Laboratory: Vista Analytical Laboratory

Sample Delivery Group (SDG): 1903103

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC47-190522-01-03**	1903103-01**	Sediment	05/22/19
T4-PDI2019-SC47-190522-03-05	1903103-02	Sediment	05/22/19
T4-PDI2019-SC47-190522-01-03DUP	1903103-01DUP	Sediment	05/22/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) and a modified outline of the USEPA National Functional Guidelines (NFG) for High Resolution Superfund Methods Data Review (April 2016). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were within QC limits for unlabeled and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The minimum S/N ratio was greater than or equal to 10 for each unlabeled compound and labeled compound associated to samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

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/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
T4-PDI2019-SC47-190522-01-03DUP (T4-PDI2019-SC47-190522-01-03)	1,2,3,4,6,7,8-HpCDD OCDD 1,2,3,4,7,8-HxCDF	49 (≤35) 46 (≤35) 40 (≤35)	J (all detects) J (all detects) J (all detects)	A

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Labeled Compounds

All percent recoveries (%R) for labeled compounds used to quantitate target compounds were within QC limits.

XI. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG 1903103	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to DUP RPD and results reported as EMPC and results exceeding calibration range, data were qualified as estimated in two samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Data Qualification Summary - SDG 1903103

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC47-190522-01-03	1,2,3,4,6,7,8-HpCDD OCDD 1,2,3,4,7,8-HxCDF	J (all detects) J (all detects) J (all detects)	A	Duplicate sample analysis (RPD)
T4-PDI2019-SC47-190522-01-03** T4-PDI2019-SC47-190522-03-05	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)

Port of Portland, T4
Polychlorinated Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG 1903103

No Sample Data Qualified in this SDG

LDC #: 46172A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 10/16/19
SDG #: 1903103 Stage 2B/4 Page: 1 of 1
Laboratory: Vista Analytical Laboratory Reviewer: F7
2nd Reviewer:

METHOD: HRGC/HRMS Polychlorinated Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	% RSD ≤ 20/35 ICV = QC limit
IV.	Continuing calibration	A	CCV = ↓
V.	Laboratory Blanks A	~~SW~~	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N/SW	
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Labeled Compounds	A	
XI.	Compound quantitation RL/LOQ/LODs SW A	~~SW~~	Not reviewed for Stage 2B validation
XII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIII.	System performance	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:

**Indicates samples underwent Stage 4 review

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC47-190522-01-0~~5~~3	1903103-01**	Sediment	05/22/19
2	T4-PDI2019-SC47-190522-03-0~~5~~3	1903103-02	Sediment	05/22/19
3	T4-PDI2019-SC47-190522-01-0DUP	1903103-01DUP	Sediment	05/22/19
4				
5				
6				
7				
8				
9				

Notes:

	B9I0240 BLK1						

LDC #: 46172A21

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

Method: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?				
Were the retention time windows established for all homologues?	✓			
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers ≤ 25% ?	✓			
Is the static resolving power at least 10,000 (10% valley definition)?	✓			
Was the mass resolution adequately check with PFK?	✓			
Was the presence of 1,2,3,9-TCDD and 1,3,4,6,8-PeCDF verified?	✓			
IIIa. Initial calibration				
Was the initial calibration performed at 5 concentration levels?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20/35% for unlabeled and labeled compounds?	✓			
Did all calibration standards meet the Ion Abundance Ratio criteria?	✓			
Was the signal to noise ratio for each target compound and labeled compound ≥ 10?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
IV. Continuing calibration				
Was a continuing calibration performed at the beginning and end of each 12 hour period?	✓			
Were all concentrations for the unlabeled compounds and for labeled compounds within QC limits (Method 1613B, Table 6)?	✓			
Did all continuing calibration standards meet the Ion Abundance Ratio criteria?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank performed for each matrix and whenever a sample extraction was performed?	✓			
Was there contamination in the method blanks?	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		~~✓~~	✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 46172A21

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Labeled Compounds				
Were labeled compounds within the QC criteria?	✓			
Was the minimum S/N ratio of all labeled compound peaks ≥ 10?	✓			
XI. Compound quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. Target compound identification				
For 2,3,7,8 substituted congeners with associated labeled standards, were the retention times of the two quantitation peaks within -1 to 3 sec. of the RT of the labeled standard?	✓			
For 2,3,7,8 substituted congeners without associated labeled standards, were the relative retention times of the two quantitation peaks within 0.005 time units of the RRT measured in the routine calibration?	✓			
For non-2,3,7,8 substituted congeners, were the retention times of the two quantitation peaks within RT established in the performance check solution?	✓			
Did compound spectra contain all characteristic ions listed in the table attached?	✓			
Was the Ion Abundance Ratio for the two quantitation ions within criteria?	✓			
Was the signal to noise ratio for each target compound ≥2.5 and ≥10 for the labeled compound?	✓			
Does the maximum intensity of each specified characteristic ion coincide within ± 2 seconds (includes labeled standards)?	✓			
For PCDF identification, was any signal (S/N ≥ 2.5, at ± seconds RT) detected in the corresponding PCDPE channel?	✓			
Was an acceptable lock mass recorded and monitored?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC#: 46172A21

VALIDATION FINDINGS WORKSHEET
Laboratory Duplicates

Page: 1 of 1
Reviewer: F
2nd Reviewer: O

METHOD: EPA Method 1613B)

Compound	Concentration (ng/Kg)		RPD (≤ 35%)	Qual
	3	1		
F	1720	1040	49	~~Jdet/A~~ J det/A
G	18300	11500	46	Jdet/A
K	72.3	48.3	40	~~Jdet/A~~ O

LDC #: 46172A2/

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N N/A Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		All	all compounds reported as estimated maximum possible concentration (EMPC)		Jdet/A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 46172A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (CS3 std)	Recalculated RRF (CS3 std)	Reported %RSD	Recalculated %RSD
1	ICAL DB 225	5/30/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.95	0.95	0.88	0.88	9.58	9.58
	confirmation		2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						

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 #: 46172 A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (CS3 std)	Recalculated RRF (CS3 std)	Reported %RSD	Recalculated %RSD
1	ICAL ZB 5MS	9/23/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.78	0.78	0.82	0.82	7.60	7.60
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.83	0.83	0.84	0.84	4.06	4.06
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.82	0.82	0.81	0.81	5.36	5.36
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.83	0.83	0.83	0.83	5.28	5.28
			OCDF (^{13}C-OCDD)	0.77	0.77	0.75	0.75	5.92	5.92
			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						

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 #: 46172A21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported RRF (CS3 std)	Recalculated RRF (CS3 std)	Reported %RSD	Recalculated %RSD
1	ICAL ZB 5MS	10/9/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	0.95	0.95	0.89	0.89	8.27	8.27
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	0.91	0.91	0.87	0.87	7.55	7.55
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	0.94	0.94	1.01	1.01	7.68	7.68
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	0.98	0.98	0.95	0.95	5.84	5.84
			OCDF (^{13}C-OCDD)	0.95	0.95	0.91	0.91	3.80	3.80
			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						
3			2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)						
			OCDF (^{13}C-OCDD)						

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 #: 46172A21

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Actual Amount	Reported Amount (CC)	Recalculated Amount (CC)	Reported %D	Recalculated %D
1	CCV 1244	10/2/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	10.0	8.73	8.73		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)	↓	9.90	9.90		
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)	50.0	47.7	47.7		
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)	50.0	45.4	45.4		
			OCDF (^{13}C-OCDD)	100	93.9	93.9		
2	ICV 2146 for OCDD DL only	10/9/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDD)	100	105	105		
3	CCV DB225 I,3,7,8 conf	10/10/19	2,3,7,8-TCDF (^{13}C-2,3,7,8-TCDF)	10.0	10.6	10.6		
			2,3,7,8-TCDD (^{13}C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (^{13}C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (^{13}C-1,2,4,6,7,8,-HpCDD)					
			OCDF (^{13}C-OCDD)					

Comments: Refer to Routine Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 46172A21

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboraotry control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS ID: B9I0240-OPR

Compound	Spike Added (ng/kg)		Spiked Sample Concentration (ng/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
2,3,7,8-TCDD	20.0	NA	19.7	NA	98.4	98.4				
1,2,3,7,8-PeCDD	100		93.3		93.3	93.3				
1,2,3,4,7,8-HxCDD	100		97.1		97.1	97.1				
1,2,3,4,7,8,9-HpCDF	100		104		104	104				
OCDF	200		192		95.9	95.9	NA			

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 46172A21

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: FT
2nd reviewer: [signature]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 1613B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
RRF	=	Relative Response Factor (average) from the initial calibration
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.

Example:

Sample I.D. #1, OCDD:

Conc. = $\frac{3.71 \times 10^7 (200)(20)}{1.33 \times 10^6 (0.9585)(18.38)(0.55}$

=

11515 ng/kg

#	Sample ID	Compound	Reported Concentration (ng/kg)	Calculated Concentration (ng/kg)	Qualification
	#1	OCDD	11500	11515	
		2,3,7,8 TCDF conf	7.599	7.570	
	2,3,7,8 TCDF	$= \frac{4.46 \times 10^5 (100)(20)}{1.23 \times 10^7 (0.9476)(18.38)(0.55)}$			
	*				
		= 7.570 ng/kg			

LDC #: 46072

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 10/21/19
Page: 1 of 1
2nd Reviewer: SR

The LDC job number listed above was entered by SR
Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-		
Ia.	- All methods present?	Y	SR	
Ib.	- All samples present/match report?	Y	SR	
Ic.	- All reported analytes present?	Y	SR	
Id.	- 10% or 100% verification of EDD?	Y	SR	
II.	EDD Preparation/Entry	-		
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y	SR	
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	Y	SR	
III.	Reasonableness Checks	-		
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y	SR	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y		
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	NA		
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	NA		
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	N/NA		
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y		
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	N/NA		
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N		

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
1201 Third Ave. Suite 2600
Seattle, WA 98101
ATTN: Ms. Delaney Peterson
dpeterson@anchorqea.com

October 24, 2019

SUBJECT: Port of Portland, T4, Data Validation

Dear Ms. Peterson,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on October 16, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #46182:

SDG #	Fraction
A9I0305, A9I0309	Polynuclear Aromatic Hydrocarbons, Polychlorinated Biphenyls, Wet Chemistry

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy; March 2019
- 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,

Christina Rink

Christina Rink
crink@lab-data.com
Project Manager/Senior Chemist

1,209 pages-ADV 1 WEEK TAT Attachment 1

EDD Stage 2B 90/10

LDC #46182 (Anchor Environmental-Seattle WA / Port of Portland, T4, PDI)

LDC	SDG#	DATE REC'D	(3) DATE DUE	SVOA (8270D)		PCBs (8082A)		TOC (9060A)		Total Solids (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	W	S	W	S
A	A9I0305	10/16/19	10/23/19	0	4	-	-	0	4	0	4																										
B	A9I0309	10/16/19	10/23/19	0	1	0	1	0	1	0	1																										
B	A9I0309	10/16/19	10/23/19	0	1	0	1	0	1	0	1																										
Total	J/CR			0	6	0	2	0	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Port of Portland - T4\46182ST.wpd

LDC Report# 46182A2a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: October 17, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9I0305

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC24-190529-01-02	A9I0305-01	Sediment	05/29/19
T4-PDI2019-SC24-190529-02-2.2	A9I0305-02	Sediment	05/29/19
T4-PDI2019-SC25-190529-01-02	A9I0305-03	Sediment	05/29/19
T4-PDI2019-SC25-190529-02-2.21	A9I0305-04	Sediment	05/29/19
T4-PDI2019-SC25-190529-02-2.21DUP	A9I0305-04DUP	Sediment	05/29/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

VIII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

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. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Finding	Flag	A or P
All samples in SDG A9I0305	Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to peak separation, data were qualified as estimated in four samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9I0305

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC24-190529-01-02 T4-PDI2019-SC24-190529-02-2.2 T4-PDI2019-SC25-190529-01-02 T4-PDI2019-SC25-190529-02-2.21	Benzo(k)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9I0305

No Sample Data Qualified in this SDG

LDC #: 46182A2a
SDG #: A9I0305
Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 10/16/19
Page: 1 of 1
Reviewer: FT
2nd Reviewer:

METHOD: GC/MS ~~Semivolatiles~~ PAH (EPA SW 846 Method 8270D)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20 ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates /DUP	N / A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1 2	T4-PDI2019-SC24-190529-01-02	A9I0305-01	Sediment	05/29/19
2 2	T4-PDI2019-SC24-190529-02-2.2	A9I0305-02	Sediment	05/29/19
3 2	T4-PDI2019-SC25-190529-01-02	A9I0305-03	Sediment	05/29/19
4 1	T4-PDI2019-SC25-190529-02-2.21	A9I0305-04	Sediment	05/29/19
5 1	T4-PDI2019-SC25-190529-02-2.21DUP	A9I0305-04DUP	Sediment	05/29/19
6				
7				
8				

Notes:

1	9090825		9/13/19				
2	9090772		9/12/19				

All Frozen samples

LDC #: 46182 A2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: FT
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)
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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	All	surrogates outside limit	( )	no qual > 5x DL
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 46182 A2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Page: 1 of 1
Reviewer: FT
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Compound	Finding	Associated Samples	Qualifications
		HHW	Peak separation for	All	Jdu / A all RiT
			structural isomers is		
			insufficient for		
			accurate quantification		

Comments: See sample calculation verification worksheet for recalculations

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: October 17, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9I0305

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC24-190529-01-02	A9I0305-01	Sediment	05/29/19
T4-PDI2019-SC24-190529-02-2.2	A9I0305-02	Sediment	05/29/19
T4-PDI2019-SC25-190529-01-02	A9I0305-03	Sediment	05/29/19
T4-PDI2019-SC25-190529-02-2.21	A9I0305-04	Sediment	05/29/19

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9I0305

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9I0305

No Sample Data Qualified in this SDG

LDC #: 46182A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 10/16/19
SDG #: ~~A10305~~ A9I0305 Stage 2B Page: 1 of 1
Laboratory: Apex Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986)

The samples listed below were reviewed for 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	Frozen
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC24-190529-01-02	A9I0305-01	Sediment	05/29/19
2	T4-PDI2019-SC24-190529-02-2.2	A9I0305-02	Sediment	05/29/19
3	T4-PDI2019-SC25-190529-01-02	A9I0305-03	Sediment	05/29/19
4	T4-PDI2019-SC25-190529-02-2.21	A9I0305-04	Sediment	05/29/19
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes:

LDC #: 46182A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-4	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC Report# 46182B2a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: October 17, 2019

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9I0309

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC26-190530-01-02**	A9I0309-01**	Sediment	05/30/19
T4-PDI2019-SC26-190530-02-2.27	A9I0309-02	Sediment	05/30/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

VIII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

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. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Finding	Flag	A or P
All samples in SDG A9I0309	Benzo(k)fluoranthene	Peak separation for structural isomers is insufficient for accurate quantification.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to peak separation, data were qualified as estimated in two samples.

No results were rejected in this SDG.

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Data Qualification Summary – SDG A9I0309

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC26-190530-01-02** T4-PDI2019-SC26-190530-02-2.27	Benzo(k)fluoranthene	J (all detects)	A	Compound quantitation (peak separation)

Port of Portland, T4
Polynuclear Aromatic Hydrocarbons – Laboratory Blank Data Qualification Summary – SDG A9I0309

No Sample Data Qualified in this SDG

LDC #: 46182B2a

SDG #: A9I0309

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 10/16/19

Page: 1 of 1

Reviewer:

2nd Reviewer:

METHOD: GC/MS ~~Semivolatiles~~ PAH (EPA SW 846 Method 8270D)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 20 ICV ≤ 30
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates /DUP	N / A	A9I0305-04DUP
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XIII.	Target compound identification	A	Not reviewed for Stage 2B validation
XIV.	System performance	A	Not reviewed for Stage 2B validation
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:

**Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC26-190530-01-02**	A9I0309-01**	Sediment	05/30/19
2	T4-PDI2019-SC26-190530-02-2.27	A9I0309-02	Sediment	05/30/19
3				
4				
5				
6				
7				

Notes:

-	9090825						

Frozen Samples

LDC #: 46182 B2a

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [signature]

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			✓	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 30%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?		✓		
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10%, was a reanalysis performed to confirm %R ?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?			✓	

LDC #: 46182 B2a

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer: [illegible]

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	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU.Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV.Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW.Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2.Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2.Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2.Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 46182B2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	All	surrogates outside	limit ( )	no qual >5x PL
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
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			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl - d14
(2FP) = 2-Fluorophenol
(TBP) = 2,4,6 -Tribromophenol
(2CP) = 2-Chlorophenol - d4

LDC #: 46182B2a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Page: 1 of 1
Reviewer: FT
2nd 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 the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Sample ID	Compound	Finding	Qualifications
	All	HHH	Peak separation for structural isomers ~~in~~ is insuffecient for accurate quantification	Jdet / A all Det

Comments: See sample calculation verification worksheet for recalculations

LDC #: 46182B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

RRF = (Ax)(Cis)/(Ais)(Cx)
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

Where:

Ax = Area of compound
Cx = Concentration of compound
S = Standard deviation of the RRFs
X = Mean of the RRFs
Ais = Area of associated internal standard
Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF1000ng/ml std)	Recalculated (RRF 1000ng/ml std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	1/30/2019	S	1.063	1.063	1.067	1.067	5.54	5.54
	GCMS25		GG	1.331	1.331	1.321	1.321	5.95	5.95
			UU	1.114	1.114	1.098	1.098	6.05	6.05
			DDD	1.079	1.079	1.075	1.075	1.52	1.52
			III	1.016	1.016	0.959	0.959	12.80	12.80
			LLL	1.138	1.138	1.079	1.079	6.88	6.88

LDC #: 46182 B2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: FT
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
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 (Internal Standard)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	CCV 0935	9/16/19	S (1st IS)	1.067	~~NR~~ 1.048481	F ~~4.184~~ 1.0484	1.7	1.7
			GG (2nd IS)	1.321	1.356421	1.356	F ~~4.6~~ 2.7	2.65
			UU (3rd IS)	1.098	1.117823	1.1178	1.8	1.8
			DDD (4th IS)	1.075	1.104668	1.1046	2.8	2.8
			III (5th IS)	0.959	1.133719	1.1337	18.2	18.2
			LLL (6th IS)	1.079	1.021446	1.0214	5.4	5.33
2			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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 #: 46182 B2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: FT
2nd reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1 10000X DL

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	2500	0.87	347	347	0
2-Fluorobiphenyl		-	-		
Terphenyl-d14	2500	0.23	91	92	1
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 #: 46182B2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: 9090825-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										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene	533	NA	497	NA	93	93				
Pentachlorophenol										
Pyrene	533	↓	547	↓	103	103	NA			

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 #: 46182B2a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: FT
2nd reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, III:

Conc. = $\frac{109172\ (2000)\ (2)\ (10000)}{503257\ (0.959)\ (15.02)\ (0.653)}$

= 922528 ug/kg

10,000X %S = 65.3

#	Sample ID	Compound	Reported Concentration (ug/kg)	Calculated Concentration (ug/kg)	Qualification
	#1	III	922000	922528	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: October 17, 2019

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9I0309

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC26-190530-01-02**	A9I0309-01**	Sediment	05/30/19
T4-PDI2019-SC26-190530-02-2.27	A9I0309-02	Sediment	05/30/19
T4-PDI2019-SC26-190530-01-02DUP	A9I0309-01DUP	Sediment	05/30/19
T4-PDI2019-SC26-190530-02-2.27MS	A9I0309-02MS	Sediment	05/30/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Column	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
T4-PDI2019-SC26-190530-01-02**	Rear column	Decachlorobiphenyl	19 (60-125)	All compounds	J (all detects) UJ (all non-detects)	P

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analysis

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)	Compound	%R (Limits)	Flag	A or P
T4-PDI2019-SC26-190530-02-2.27MS (T4-PDI2019-SC26-190530-02-2.27)	Aroclor-1260	46 (50-150)	J (all detects)	A

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 method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Finding	Flag	A or P
T4-PDI2019-SC26-190530-01-02**	Aroclor-1242 Aroclor-1260	Results were estimated due to the presence of multiple PCB Aroclors or matrix interference.	J (all detects) J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to surrogate %R, MS %R, and matrix interference, data were qualified as estimated in two samples.

No results were rejected in this SDG.

Port of Portland, T4
Polychlorinated Biphenyls - Data Qualification Summary - SDG A9I0309

Sample	Compound	Flag	A or P	Reason
T4-PDI2019-SC26-190530-01-02**	All compounds	J (all detects) UJ (all non-detects)	P	Surrogates (%R)
T4-PDI2019-SC26-190530-02-2.27	Aroclor-1260	J (all detects)	A	Matrix spike (%R)
T4-PDI2019-SC26-190530-01-02**	Aroclor-1242 Aroclor-1260	J (all detects) J (all detects)	A	Compound quantitation (matrix interference)

Port of Portland, T4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG A9I0309

No Sample Data Qualified in this SDG

LDC #: 46182B3b

SDG #: AI0309

Laboratory: Apex Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 10/16/19

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 / A	
II.	Initial calibration/ICV	A / A	%D PSP / ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates /DUP	SW / A	MS only
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	SW	Not reviewed for Stage 2B validation
XI.	Target compound identification	A	Not reviewed for Stage 2B validation
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:

**Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC26-190530-01-02**	A9I0309-01**	Sediment	05/30/19
2	T4-PDI2019-SC26-190530-02-2.27	A9I0309-02	Sediment	05/30/19
3	T4-PDI2019-SC26-190530-01-02DUP	A9I0309-01DUP	Sediment	05/30/19
4	T4-PDI2019-SC26-190530-02-2.27MS	A9I0309-02MS	Sediment	05/30/19
5				
6				
7				
8				
9				
10				
11				

Notes:

	~~9090753-BLK1~~						
1	9091033-BLK1						

LDC #: 46182 B3b

VALIDATION FINDINGS CHECKLIST

Reviewer: FT

2nd Reviewer: [illegible]

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?		✓		
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?	✓			

LDC #: 46182B36

VALIDATION FINDINGS CHECKLIST

Reviewer: FT
2nd Reviewer:

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: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	I. Dieldrin	Q. Endrin ketone	Y. Aroclor-1242	GG. Chlordane
B. beta-BHC	J. 4,4'-DDE	R. Endrin aldehyde	Z. Aroclor-1248	HH. Chlordane (Technical)
C. delta-BHC	K. Endrin	S. alpha-Chlordane	AA. Aroclor-1254	II. Aroclor 1262
D. gamma-BHC	L. Endosulfan II	T. gamma-Chlordane	BB. Aroclor-1260	JJ. Aroclor 1268
E. Heptachlor	M. 4,4'-DDD	U. Toxaphene	CC. 2,4'-DDD	KK. Oxychlordane
F. Aldrin	N. Endosulfan sulfate	V. Aroclor-1016	DD. 2,4'-DDE	LL. trans-Nonachlor
G. Heptachlor epoxide	O. 4,4'-DDT	W. Aroclor-1221	EE. 2,4'-DDT	MM. cis-Nonachlor
H. Endosulfan I	P. Methoxychlor	X. Aroclor-1232	FF. Hexachlorobenzene	NN.

Notes:

LDC #: 46182B3b

VALIDATION FINDINDS WORKSHEET
Surrogate Recovery

Reviewer: FT
2nd Reviewer: [signature]

METHOD: ✓ **GC** __ **HPLC**

Are surrogates required by the method? Yes___ or No___.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	1	Rear Column	O	19 (60-125)	J/UJ/P ND + Det
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	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	2-Bromonaphthalene
C`	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin	AA	Chloro-octadecane
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 46182B36

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

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
	4	BB	46 (50-150)	( )	( )	2	J/UJ/A Det
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 46182B3b

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	Findings	Qualifications
	1	Y, BB	Results estimated	J det / A (all Det)
			due to the presence	
			of multiple PCB	
			~~arol~~ aroclor and/or	
			matrix interference	

Comments: See sample calculation verification worksheet for recalculations

COMQUA_r1.wpd

LDC #: 46182B3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

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 (200ng/mL std)	Recalculated CF (200ng/mL std)	Reported CF (initial)	Recalculated CF (intial)	Reported %RSD	Recalculated %RSD
1	ICAL Front	8/5/19	1260-1	5.184×10^3	5.184×10^3	5.411×10^3	5.411×10^3	10.26	10.26
2	ICAL Rear	8/5/19	1260-1	1.865×10^3	1.865×10^3	1.925×10^3	1.925×10^3	10.19	10.19
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 #: 46182B3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: [illegible]

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	CCV 1612 9I19031-CCV1	9/19/19	Aroclor 1260	500	520	520	4	4
			Front					
2	CCV 1612 9I19032-CCV1	9/19/19	Aroclor 1260	500	475	475	5.1	5.1
			Rear					
3								
4								

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 #: 46182B36

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: FT
2nd 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	Rear Column	250	47.933	19	19	0

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	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	2-Bromonaphthalene
C`	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin	AA	Chloro-octadecane
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 46182B3b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer:

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

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added; MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: 4

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)											
Phorate (8141A)											
Malathion (8141A)											
Formaldehyde (8315A)											
Aroclor 1260	427	NA	319	515	NA	46					

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 #: 46182B3b

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: [illegible]

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/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; LCS = Laboratory Control Sample; SA = Spike added; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 9091033 - LCS

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)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										
Aroclor 1260	250	NA	196	NA	79	79	NA			

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 #: 46182B36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd reviewer: G

METHOD: GC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, Aroclor 1260-1

Conc. = $\frac{79455}{1.925 \times 10^3}$

= 41.267

2/10.48 %S = 65.3

#	Sample ID	Compound	Reported Concentration (ug/Kg)	Calculated Concentration (ug/Kg)	Qualification
	#1	Aroclor 1260	11.6	11.6	
	1260-1 =	41.267	Final Conc =	$\frac{(39.77)(2)}{(10.48)(0.653)}$	
	-2 =	43.982			
	-3 =	41.147			
	-4 =	38.786	=	11.6 ug/Kg	
	-5 =	37.642			
	-6 =	35.818			
	Ave =	39.77			

LDC Report# 46182B6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Port of Portland, T4

LDC Report Date: October 17, 2019

Parameters: Wet Chemistry

Validation Level: Stage 2B & 4

Laboratory: Apex Laboratories, LLC

Sample Delivery Group (SDG): A9I0309

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
T4-PDI2019-SC26-190530-01-02**	A9I0309-01**	Sediment	05/30/19
T4-PDI2019-SC26-190530-02-2.27	A9I0309-02	Sediment	05/30/19

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A to the Sampling Quality Assurance Project Plan for Terminal 4 Remedy (March 2019) 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 Modified
Total Solids by Puget Sound Estuary Protocols (PSEP)

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

All sample result verifications were acceptable 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.

Port of Portland, T4
Wet Chemistry - Data Qualification Summary - SDG A9I0309

No Sample Data Qualified in this SDG

Port of Portland, T4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG A9I0309

No Sample Data Qualified in this SDG

LDC #: 46182B6 **VALIDATION COMPLETENESS WORKSHEET** Date: 10/16/19

SDG #: ~~A10309~~ A9I0309 Stage 2B/4 Page: 1 of 1

Laboratory: Apex Laboratories, LLC Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: (Analyte) TOC (EPA SW 846 9060A Modified), Total Solids (PSEP 1986)

The samples listed below were reviewed for 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	Frozen
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	A	Not reviewed for Stage 2B validation
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:

**Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	T4-PDI2019-SC26-190530-01-02**	A9I0309-01**	Sediment	05/30/19
2	T4-PDI2019-SC26-190530-02-2.27	A9I0309-02	Sediment	05/30/19
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes:

4618286

VALIDATION FINDINGS CHECKLIST

Reviewer: 02
2nd Reviewer: HR

Method: Inorganics (EPA Method Seeover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			✓	
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.			✓	
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 46182B36

VALIDATION FINDINGS CHECKLIST

Reviewer: a
2nd Reviewer: KK

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target analytes were detected in the field duplicates.			✓	
X. Field blanks				
Field blanks were identified in this SDG.		✓		✓
Target analytes were detected in the field blanks.			✓	

LDC #: 46182B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: KW

All circled methods are applicable to each sample.

Sample ID	Parameter
1,2	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TS
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC #: 46182B6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: Inorganics, Method See case

The correlation coefficient (r) for the calibration of TOC was recalculated. Calibration date: 2/2/18

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found X 100 / True

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (C)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	TOC	s1	0.5	1.38	NA (4th order)	NA	Y
		s2	1	15.6			
		s3	5	46.83			
		s4	10	129.37			
		s5	15	283.5			
		s6	20	352.23			
		s7	50	403.87			
		s8	75	438.7			
		s9	100	475.5			
		s10	150	504.23			
		s11	200	533.07			
Calibration verification		ICV	10000	10428	104	104	
Calibration verification		CCV		10388	104	104	
Calibration verification							

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 46182B6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: Inorganics, Method See cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	TOC	10424	10000	104	104	Y
	Matrix spike sample		(SSR-SR)				
	Duplicate sample						

Comments:

TOTCLC.6

LDC #: 46182B36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: CL
2nd reviewer: [illegible]

METHOD: Inorganics, Method see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for TOC reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\left(\frac{C}{Wt}\right)$ Average

Recalculation:

$$\frac{\frac{611.44}{10.1} + \frac{684.29}{11.1}}{2(10000)} \times 1000 = 6.1\%$$

#	Sample ID	Analyte	Reported Concentration (%)	Calculated Concentration (%)	Acceptable (Y/N)
	1	TOC	5.9	6.1	Y
		TS	65.3	65.3	Y

Note:

RECALC.6

LDC #: 46182

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 10/23/19

Page: 1 of 1

2nd Reviewer: [illegible]

The LDC job number listed above was entered by FM.

Entered from Body or Summary

	EDD Process	Y/N	Initial	Comments/Action
I.	EDD Completeness	-	FM	
Ia.	- All methods present?	Y	↓	
Ib.	- All samples present/match report?	Y	↓	
Ic.	- All reported analytes present?	Y	↓	
Id.	- 10% or 100% verification of EDD?	Y	↓	
II.	EDD Preparation/Entry	-	FM	
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y	↓	
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	—	↓	
III.	Reasonableness Checks	-	FM	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y	↓	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y	↓	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y	↓	
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—	↓	
IIIe.	- Is the detect flag set to "N" for all "U" qualified blank results?	—	↓	
IIIf.	- Were there multiple results due to dilutions/reanalysis? If so, were results qualified appropriately?	—/—	↓	
IIIg.	-Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y	↓	
IIIh.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	—/—	↓	
IIIi.	-Are there any discrepancies between the data packet and the EDD?	N	↓	

Notes: *see discrepancy sheet