ATTACHMENT 3

Data Validation Reports



LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119 ATTN: Ms. Marina Mitchell April 30, 2010

SUBJECT: Lower Duwamish Waterway Group, Data Validation

Dear Ms. Mitchell,

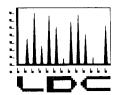
Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on January 15, 2010. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 22400:

SDG#	<u>Fraction</u>
QB98/QC15, QC19 QB99	Semivolatiles, Polychlorinated Biphenyls, Metals, Wet Chemistry

The data validation was performed under EPA Level III & IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005
- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005, Dioxin/Furan Addendum, December 2009
- USEPA, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008
- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, October 2004
- 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



Please feel free to contact us if you have any questions.

Sincerely,

Stella S. Cuenco

Data Validation Operations Manager/Senior Chemist

Attachment 1

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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
Α	QB98/QC15	01/15/10	02/05/10	<u> </u>			-	-	-	0	24	0	24	0	24					<u> </u>															
В	QC19	01/15/10	02/05/10	1	0	1	0	1	0	0	6	0 ,	6	0	6					<u> </u>															\blacksquare
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Lower Duwamish Waterway Group Data Validation Reports LDC #22400

Semivolatiles



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: December 17, 2009

LDC Report Date: April 29, 2010

Matrix: Water

Parameters: Semivolatiles

Validation Level: EPA Level III

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): QC19

Sample Identification

LDW-SS527-RB LDW-SS527-RBRE

Introduction

This data review covers 2 water samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8270D for Semivolatiles.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008) as there are no current guidelines for the method stated above.

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

1. Technical Holding Times

All technical holding time requirements were met with the following exceptions:

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
LDW-SS527-RBRE	All TCL compounds	11	7	J (all detects) UJ (all non-detects)	А

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

In the case where %RSD was greater than 15.0%, the laboratory used a calibration curve to evaluate the compound. All coefficients of determination (r^2) were greater than or equal to 0.990.

For the purposes of technical evaluation, all compounds were evaluated against the 30.0% (%RSD) National Functional Guideline criteria. Unless noted above, all compounds were within the validation criteria.

Average relative response factors (RRF) for all semivolatile target compounds and system performance check compounds (SPCCs) were greater than or equal to 0.05 as required.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

Percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were within the method criteria of less than or equal to 20.0% for calibration check compounds (CCCs).

For the purposes of technical evaluation, all compounds were evaluated against the 25.0% (%D) National Functional Guideline criteria. Unless noted above, all compounds were within the validation criteria with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P	
12/24/09	2,4-Dinitrophenol 4-Nitrophenol N-Nitrosodiphenylamine 4-Bromophenyl-phenyl ether	33.3 29.8 33.6 32.8	LDW-SS527-RB MB-122309	J (all detects) UJ (all non-detects)		
12/29/09	Dibenz(a,h)anthracene	25.8	LDW-SS527-RBRE MB-122809	J (all detects) UJ (all non-detects)	А	

All of the continuing calibration RRF values were greater than or equal to 0.05.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No semivolatile contaminants were found in the method blanks.

VI. Surrogate Spikes

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Flag	A or P
LCS/D-122309 (LDW-SS527-RB MB-122309)	Aniline		0 (28-126)	200 (≤40)	J (all detects) R (all non-detects)	Р
LCS/D-122309 (LDW-SS527-RB MB-122309)	N-Nitrosodimethylamine	-	-	47.9 (≤40)	J (all detects) UJ (all non-detects)	Р

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

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

XI. Target Compound Identifications

Raw data were not reviewed for this SDG.

XII. Compound Quantitation and CRQLs

Raw data were not reviewed for this SDG.

XIII. Tentatively Identified Compounds (TICs)

Raw data were not reviewed for this SDG.

XIV. System Performance

Raw data were not reviewed for this SDG.

XV. Overall Assessment

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
LDW-SS527-RB	Benzyl alcohol 4-Chloroaniline 3-Nitroaniline Aniline N-Nitrosodimethylamine	R R R R R	А
LDW-SS527-RBRE	All TCL compounds except Benzyl alcohol 4-Chloroaniline 3-Nitroaniline Aniline N-Nitrosodimethylamine	R	А

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

No field duplicates were identified in this SDG.

XVII. Field Blanks

Sample LDW-SS527-RB was identified as a rinsate blank. No semivolatile contaminants were found in this blank with the following exceptions:

Rinsate ID	Compound	Concentration (ug/L)
LDW-SS527-RB	Benzyl alcohol 4-Chloroaniline 3-Nitroaniline Aniline N-Nitrosodimethylamine	8.0 60 16 55 6.4

Lower Duwamish Waterway Group Semivolatiles - Data Qualification Summary - SDG QC19

SDG	Sample	Compound	Flag	A or P	Reason
QC19	LDW-SS527-RBRE	All TCL compounds	J (all detects) UJ (all non-detects)	А	Technical holding times
QC19	LDW-SS527-RB	2,4-Dinitrophenol 4-Nitrophenol N-Nitrosodiphenylamine 4-Bromophenyl-phenyl ether	J (all detects) UJ (all non-detects)	А	Continuing calibration (%D)
QC19	LDW-SS527-RBRE	Dibenz(a,h)anthracene	J (all detects) UJ (all non-detects)	А	Continuing calibration (%D)
QC19	LDW-SS527-RB	Aniline	J (all detects) R (all non-detects)	Р	Laboratory control samples (%R)(RPD)
QC19	LDW-SS527-RB	N-Nitrosodimethylamine	J (all detects) UJ (all non-detects)	Р	Laboratory control samples (RPD)
QC19	LDW-SS527-RB	Benzyl alcohol 4-Chloroaniline 3-Nitroaniline Aniline N-Nitrosodimethylamine	R R R R	А	Overall assessment of data
QC19	LDW-SS527-RBRE	All TCL compounds except Benzyl alcohol 4-Chloroaniline 3-Nitroaniline Aniline N-Nitrosodimethylamine	R	А	Overall assessment of data

Lower Duwamish Waterway Group Semivolatiles - Laboratory Blank Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

LDC #: 22400B2 VALIDATION COMPLETENESS WORKSHEET Date: 3	<u> </u>
SDG #: QC19 LeveLIV 11 Page: _/of_	
Laboratory: Analytical Resources, Inc. Reviewer:	=7
2nd Reviewer:	_

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
l.	Technical holding times	SW	Sampling dates: \2 \7 \0 9
H.	GC/MS Instrument performance check	A	(' (
111.	Initial calibration	۵	% PD. 12
IV.	Continuing calibration/ICV	3	ICV = 25
V.	Blanks	Δ	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	2	client specified
VIII.	Laboratory control samples	ςw	Les ID
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	
XI.	Target compound identification	N	
XII.	Compound quantitation/CRQLs	N	
XIII.	Tentatively identified compounds (TICs)	DA N	
XIV.	System performance	N	
XV.	Overall assessment of data	SW	
XVI.	Field duplicates	D	
XVII.	Field blanks	SW	RB =

Note:	A = Acceptable	ND = No compounds detected	D = Duplicate
	N = Not provided/applicable	R = Rinsate	TB = Trip blank
	SW = See worksheet	FB = Field blank	EB = Equipment blank
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₁ †	LDW-SS527-RB	11	MB-122309	21	31	
2	#1RE	12	MB- 122809	22	32	
3		13		23	33	
4		14		24	 34	
5		15		25	35	
6		16		26	36	
7		17		27	 37	
8		18		28	38	
9		19		29	39	
10		20		30	40	

VALIDATION FINDINGS WORKSHEET

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

A. Phenoi**	P. Bls(2-chloroethoxy) methane	EE. 2,6-Dinitrotoluene	TT. Pentachiorophenoi**	III. Benzo(a)pyrene**
B. Bis (2-chloroethyl) ether	G. 2,4-Dichlerophenoi**	FF. 3-Nitroaniline	UU. Phenanthrene	JJJ. Indeno(1,2,3-od)pyrene
C. 2-Chlorophenol	R. 1,2,4-Trichlorobenzene	QQ. Acenaphthene**	W. Anthracene	KKK. Dibenz(a,h)anthracene
D. 1,3-Dichlorobenzene	S. Naphthalene	HH. 2,4-Dinitrophenol*	WW. Carbazole	LLL. Benzo(g,h,i)perylene
E. 1,4-Dichlorobenzene**	T. 4-Chloroaniline	II. 4-Nitrophenol*	XX. Di-n-butylphthalate	MMM. Bis(2-Chloroisopropyl)ether
F. 1,2-Dichlorobenzene	U. Hexachlorobutadiene**	JJ. Dibenzofuran	YY. Fluoranthene**	NNN. Antiine
Q. 2-Methylphenol	V. 4-Chlore-3-methylphenol**	KK. 2,4-Dinitrotoluene	ZZ. Pyrene	OOO. N-Nitrosodimethylamine
H. 2,2'-Oxybis(1-chloropropane)	W. 2-Methylnaphthalene	LL. Diethylphthalate	AAA. Butylbenzylphthalate	PPP. Benzoic Acid
I. 4-Methylphenol	X. Hexachiorocyclopentadiene*	MM. 4-Chlorophenyl-phenyl ether	BBB. 3,3'-Dichlorobenzidine	QQQ. Benzyi alcohol
J. N-Nitroso-di-n-propylamins*	Y, 2,4,6-Trichlorophenoi**	NN. Fluorene	CCC. Benzo(a)anthracene	RRR. Pyridine
K. Hexachioroethane	Z. 2,4,5-Trichlorophenoi	OO. 4-Nitroaniline	DDD. Chrysens	SSS. Benzidine
L. Nitrobenzene	AA. 2-Chloronaphthalene	PP. 4,8-Dinitro-2-methylphenol	EEE. Bis(2-ethylhexyl)phthalate	π.
M. leophorone	BB. 2-Nitroaniline	QQ. N-Nitrosodiphenylamine (1)**	FFF. Di-n-octylphthalate**	ບບບ.
N. 2-Nitrophenoi**	CC. Dimethylphthalate	RR. 4-Bromophenyl-phenylether	GGG. Benzo(b)fluoranthene	w.
O. 2,4-Dimethylphenol	DD, Acenaphthylene	SS. Hexachlorobenzene	HHH. Benzo(k)fluoranthene	www.

SDG	#:	800	

Technical Holding Times

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2nd	Review	ver	:	,	_	_

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

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qua
2	water		12/17/09	12/28/09	12/29/09	11	1/4
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TECHNICAL HOLDING TIME CRITERIA

Water:

Extracted within 7 days, analyzed within 40 days.

Soil:

Extracted within 14 days, analyzed within 40 days.

~/TU62 LDC #:__

Y N-N/A

VALIDATION FINDINGS WORKSHEET **Continuing Calibration**

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

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Reviewer:	` Ft
2nd Reviewer:	A .

SDG #: See cover METHOD: GC/MS BNA (EPA SW 846 Method 8270)

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

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

#	Date	Standard ID	Compound	Finding %D (Limit: ≤25.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	12/24/09	cev	H H	33.3	(Limit: <u>2</u> 0.00)	MB - 12 2309, 1	ALULL
	0758	cev	II	29.8		1 1 2 301, 1	1 2 2 2 2 2
	0 190			33.6	<u> </u>		
			QQ RR	32.8			
	 		555			.,	
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	12 29 09	cev	KKK	25.8		MB-1228091,2	A) LN/L
	12/29/09		KKK SSS	364			
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METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Surrogate Recovery

2nd Reviewer

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?

If 2 or more base neutral or acid surrogates were 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?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		1	TPH	144 (11-132)	
			PHI	10-10U	no qual
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* QC limits are advisory S1 (NBZ) = Nitrobenzene-d5 S2 (FBP) = 2-Fluorobiphenyl S3 (TPH) = Terphenyl-d14 S4 (PHL) = Phenol-d5		QC Limits (Water) 35-114 43-116 33-141 10-94	S5 (2FP) = 2-Fluorophenol S6 (TBP) = 2,4,6-Tribromophenol S7 (2CP) = 2-Chlorophenol-d4 S8 (DCR) = 1,2-Dichlorophenol-d4	QC Limits (Soil) 25-121 19-122 20-130*	•	QC Limits (Water) 21-100 10-123 33-110*
S4 (PHL) = Phenoi-d5	24-113	10-94	S8 (DCB) = 1,2-Dichlorobenzene-d4	20-130*	•	16-110*

LDC #:_	22 400B2	
SDG #·	see cover	

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page:	<u></u>
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". YN N/A Was a LCS required?

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

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	T	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		105/D-122309	777	()	0 (28-126)	200 (? 40)	MB-122309, 1	J/R/P
			000	()	()	47.9 (2 40)		3/R/P 3/US P
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SDG #: ec crome

Overall Assessment of Data

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Reviewer:	
2nd Reviewer:	

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

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

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

VN N/A Was the overall quality and usability of the data acceptable?

#	Date	Co vmp al Sample ID	Finding	Associated Samples	Qualifications
		ada, T, FF, NNN,	possible false stut		P/A
		400			
		All except about			
		All except above	extracted outside H.T.		P.A
				·	
				·	

SDG #: pu come		V ALIU	. 2nd	Reviewer: 7 2nd Reviewer: 1			
	lanks identific	ed in this SDG? detected in the field bla	anks?				
Field blank type: (circle on	e) Field Blank	k / Rinsate / Other:	RB\ Assoc	ciated Samples:	m		
Compound	Blank ID			Sample Identifica	tion		
Diethylphthalate &QQ	8.0				₹22°		
Di-n-butylphthalate T	60				6		
Bis(2-ethylhexyl)phthalate, FF	16			X 6	9		
ทุพท	55			6 80 D			
660	6.4			KIL			
				,			
CRQL							
Blank units: As Sampling date: Field blank type: (circle one		mple units:	Assoc	ciated Samples:			
Compound	Blank ID	Sample Identification					
				·			
Diethylphthalate							
Di-n-butylphthalate							
Bis(2-ethylhexyl)phthalate							
						·	
H.	I	1 1	1 1				

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 field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

CROL

Lower Duwamish Waterway Group Data Validation Reports LDC #22400

Polychlorinated Biphenyls



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Lower Duwamish Waterway Group

Collection Date:

December 17, 2009

LDC Report Date:

April 29, 2010

Matrix:

Water

Parameters:

Polychlorinated Biphenyls

Validation Level:

EPA Level III

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): QC19

Sample Identification

LDW-SS527-RB

Introduction

This data review covers one water sample listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8082 for Polychlorinated Biphenyls.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008) as there are no current guidelines for the method stated above.

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

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/ECD Instrument Performance Check

Instrument performance was acceptable unless noted otherwise under initial calibration and continuing calibration sections.

III. Initial Calibration

Initial calibration of multicomponent compounds was performed for the primary (quantitation) column as required by the method.

The percent relative standard deviations (%RSD) 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) of calibration factors in continuing standard mixtures were within the 20.0% QC limits.

The percent difference (%D) of the second source calibration standard were less than or equal to 20.0% for all compounds.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated biphenyl contaminants were found in the method blanks.

VI. Surrogate Spikes and Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Pesticide Cleanup Checks

a. Florisil Cartridge Check

Florisil cleanup was not required and therefore not performed in this SDG.

b. GPC Calibration

GPC cleanup was not required and therefore not performed.

XI. Target Compound Identification

Raw data were not reviewed for this SDG.

XII. Compound Quantitation and CRQLs

Raw data were not reviewed for this SDG.

XIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

Sample LDW-SS527-RB was identified as a rinsate blank. No polychlorinated biphenyl contaminants were found in this blank.

Lower Duwamish Waterway Group Polychlorinated Biphenyls - Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

Lower Duwamish Waterway Group Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

_DC #: 22400B3b V	ALIDATION COMPLETENESS WORKSHEET	Date:
SDG #:QC19	Level W W	Page:/
_aboratory: <u>Analytical Resources,</u>	Inc.	Reviewer:
		2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW 846 Method 8082)

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

	Validation Area		Comments
I.	Technical holding times	۵	Sampling dates: \2\17\09
1).	GC/ECD Instrument Performance Check	NA	` '
III.	Initial calibration	Δ	
IV.	Continuing calibration/ICV	A	1CV = 20
V.	Blanks	٨	
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	client specified
VIII.	Laboratory control samples	Δ	LOSID
IX.	Regional quality assurance and quality control	N	
Xa.	Florisil cartridge check	N	
Xb.	GPC Calibration	N	
XI.	Target compound identification	N	
XII.	Compound quantitation and reported CRQLs	N	
XIII.	Overall assessment of data	۵	Acceptable Internal stand.
XIV.	Field duplicates	7	1
XV.	Field blanks	NO	RB= 1

Note: A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

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

EB = Equipment blank

Validated Samples:

MB - 122209 LDW-SS527-RB

Lower Duwamish Waterway Group Data Validation Reports LDC #22400

Metals



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Lower Duwamish Waterway Group

Collection Date:

December 17, 2009

LDC Report Date:

April 29, 2010

Matrix:

Water

Parameters:

Metals

Validation Level:

EPA Level III

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): QC19

Sample Identification

LDW-SS527-RB LDW-SS527-RBMS LDW-SS527-RBDUP

Introduction

This data review covers 3 water samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 200.8 and EPA SW 846 Method 7000 for Metals. The metals analyzed were Antimony, Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Molybdenum, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

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

Blanks are summarized in Section IV.

Field duplicates are summarized in Section XIV.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. ICPMS Tune

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

III. Calibration

An initial calibration was performed.

The frequency and analysis criteria of the initial calibration verification (ICV) and continuing calibration verification (CCV) were met.

IV. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks.

V. ICP Interference Check Sample (ICS) Analysis

The frequency of analysis was met.

The criteria for analysis were met.

VI. Matrix Spike Analysis

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

IX. Internal Standards

All internal standard percent recoveries (%R) were within QC limits.

X. Furnace Atomic Absorption QC

Graphite furnace atomic absorption was not utilized in this SDG.

XI, ICP Serial Dilution

ICP serial dilution was not performed for this SDG.

XII. Sample Result Verification

Raw data were not reviewed for this SDG.

XIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

Sample LDW-SS527-RB was identified as a rinsate blank. No metal contaminants were found in this blank.

Lower Duwamish Waterway Group Metals - Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

Lower Duwamish Waterway Group Metals - Laboratory Blank Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

SDG :	#: 22400B4 #: QC19 atory: Analytical Resourc			LETENE .evel ₩ 9m#	ESS WORKSHE	ET	Date: 1-25-10 Page: 1 of 1 Reviewer: MG 2nd Reviewer: V
Γhe s	HOD: Metals (EPA Methor amples listed below were tion findings worksheets	e reviewed for e		·	alidation areas. Valid	ation find	ings are noted in attached
	Validation	Area			Co	mments	
ł.	Technical holding times		A	Sampling d	ates: 13-17-	9	
II.	ICP/MS Tune		A				
III.	Calibration		A.		(CRDL sto	70-	130
IV.	Blanks		A				,
V,	ICP Interference Check Sa	mple (ICS) Analysis	A				
VI.	Matrix Spike Analysis		A	MS			
VII.	Duplicate Sample Analysis		A	DUP			
VIII.	Laboratory Control Sample	s (LCS)	A	LCS			
IX.	Internal Standard (ICP-MS)	 	A				
Χ.	Furnace Atomic Absorption	QC	N	ten	utilized		
XI.	ICP Serial Dilution		N	not	performed		
XII.	Sample Result Verification		N				·
XIII.	Overall Assessment of Dat	a	A				
XIV.	Field Duplicates		N				
χv	Field Blanks		ND	RB	= (
Note: √alidat	A = Acceptable N = Not provided/applicabl SW = See worksheet red Samples: いるナミケ	e R=F	No compound Rinsate Field blank	s detected	D = Duplicate TB = Trip blank EB = Equipment	blank	
1	LDW-SS527-RB	11		21		31	
2	LDW-SS527-RBMS	12		22		32	
3	LDW-SS527-RBDUP	13		23		33	
4	PBW	14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

LDC #: 22400B4 SDG #: 0C19

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page:_	of
Reviewer:	MG
2nd reviewer:	1~

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
	W	Al, Sb, As Ba, Be, Cd, Ca, Cr, Co, Cu Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag) Na, Ti, V, Zn, Mo B, Si, CN,
QC 2,3	7	Al, (b), As Ba, Be, (cd) Ca, (cr., Co, Cu) Fe, (Pb) Mg, Mn, (Hg, Ni) K, (Se, Ag, Nia, (1, V, Zn, Mo) B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		ЛІ, Sb, Лs, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN,
		Al. Sb. As. Ba. Be. Cd. Ca. Cr. Co. Cu. Fe. Pb. Mg. Mn. Hg. Ni. K, Se. Ag. Na. Ti, V, Zn. Mo. B, Si. CN.
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
	:	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Analysis Method
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
ICP Trace		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN,
ICP-MS	W	AI, Sb, As Ba, Be, Cd Ca, Cr, Co, Cu Fe, Pb Mg, Mn, Hg, Ni) K, Se, Ag Na, TI, V, Zn, Mo B, Si, CN,
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,

Comments: Mercury by CVAA if performed	<u> </u>

Lower Duwamish Waterway Group Data Validation Reports LDC #22400

Wet Chemistry



Laboratory Data Consultants, Inc. **Data Validation Report**

Project/Site Name: Lower Duwamish Waterway Group

December 15 through December 17, 2009 **Collection Date:**

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Wet Chemistry

Validation Level: **EPA Level III**

Analytical Resources, Inc. Laboratory:

Sample Delivery Groups (SDG): QB98/QC15

Sample Identification

LDW-SS508-010 LDW-SS537-010 LDW-SS523-010 LDW-SS538-010 LDW-SS601-010 LDW-SS539-010 LDW-SS540-010 LDW-SS530-010 LDW-SS509-010 LDW-SS508-010MS LDW-SS501-010 LDW-SS508-010DUP LDW-SS504-010DUP LDW-SS504-010 LDW-SS504-010TRP LDW-SS505-010 LDW-SS511-010DUP LDW-SS506-010 LDW-SS507-010 LDW-SS511-010TRP LDW-SS510-010 LDW-SS527-010DUP LDW-SS512-010 LDW-SS508-010TRP

LDW-SS511-010 LDW-SS527-010TRP LDW-SS513-010

LDW-SS524-010

LDW-SS527-010

LDW-SS532-010

LDW-SS534-010

LDW-SS535-010

LDW-SS536-010

Introduction

This data review covers 33 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per the Plumb Method for Total Organic Carbon, PSEP Method for Particle Size, and EPA Method 160.3 for Percent Solids.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

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

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

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

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks.

IV. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

V. Duplicates/Triplicates

Duplicate (DUP) and triplicate (TRP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VII. Sample Result Verification

Raw data were not reviewed for this SDG.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

IX. Field Duplicates

Samples LDW-SS523-010 and LDW-SS601-010, samples LDW-SS507-010 and LDW-SS602-010 (from SDG QB99), and samples LDW-SS527-010 and LDW-SS603-010 (from SDG QC19) were identified as field duplicates. No contaminant concentrations were detected in any of the samples with the following exceptions:

	Concent		
Analyte	LDW-SS523-010	LDW-SS601-010	RPD
Total solids	76.70	77.80	1
Total organic carbon	0.982	0.906	8

	% Finer		
Phi Size	LDW-SS601-010	LDW-SS523-010	RPD
-2	96.8	97.7	1
-1	91.3	93.2	2
0	85.6	88.1	3
1	68.3	70.9	4
2	39.4	41.5	5
3	22.2	24.0	8
4	12.3	13.8	11
5	8.4	8.5	1
6	6.6	6.7	2
7	4.9	5.0	2
8	3.4	3.7	8
9	2.2	2.4	9
10	1.1	1.3	17

	Concentration (%)		
Analyte	LDW-SS507-010	LDW-SS602-010	RPD
Total solids	47.20	47.00	0
Total organic carbon	1.79	1.97	10

	% F	% Finer		
Phi Size	LDW-SS602-010	LDW-SS507-010	RPD	
-1	100.0	99.6	0	
0	98.5	99.0	1	
1	96.6	97.9	1	
2	94.1	96.4	2	
3	90.3	93.2	3	
4	84.1	87.1	4	
5	75.8	76.6	1	
6	62.1	63.8	3	
7	45.4	47.4	4	
8	31.0	32.6	5	
9	20.1	22.2	10	
10	12.6	13.8	9	

	Concentration (%)		
Analyte	LDW-SS527-010	LDW-SS603-010	RPD
Total solids	46.60	47.40	2
Total organic carbon	2.35	2.43	3

	% Finer		
Phi Size	LDW-SS603-010	LDW-SS527-010	RPD
-1	99.6	98.9	1
0	96.8	98.7	2
1	94.8	97.7	3
2	92.3	96.4	4
3	87.8	94.2	7
4	74.9	85.3	13
5	57.9	67.1	15

	% Finer			
Phi Size	LDW-SS603-010	LDW-SS527-010	RPD	
6	39.8	43.9	10	
7	23.9	25.2	5	
8	13.8	13.7	1	
9	9.3	8.7	7	
10	6.3	6.1	3	

X. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Wet Chemistry - Data Qualification Summary - SDG QB98/QC15

No Sample Data Qualified in this SDG

Lower Duwamish Waterway Group Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG QB98/QC15

No Sample Data Qualified in this SDG

LDC #: 22400A6	VALIDATION COMPLETENESS WORKSHEET	Date: 1- 25-10
SDG #: QB98/QC15	Level Ⅳ 111	Page: <u> </u> of <u> </u>
Laboratory: Analytical Resource	es, Inc. 9n4	Reviewer: MG 2nd Reviewer: 4

METHOD: TOC (Plumb Method), Particle Size (PSEP Method), Percent Solids (EPA Method 160.3)

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

	Validation Area		Comments
l.	Technical holding times	A	Sampling dates: 12-15-09 through 12-17-09
IIa.	Initial calibration	A	0
IIb.	Calibration verification	A	
111.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	A	Ms
V	Duplicates	A	DUP/TRP
VI.	Laboratory control samples	A	LC5
VII.	Sample result verification	N	(SDG: QB99)
VIII.	Overall assessment of data	A	D=10+LDW-55600-010
IX.	Field duplicates	SW	D=2+3, D=16 + LDW-55603-010
х	Field hlanks	7	(SDG: QC19)

Note:

A = Acceptable

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

R = Rinsate

D = Duplicate

TB = Trip blank

See worksheet FB = Field blank

EB = Equipment blank

Validated Samples:

	all sedimen	<u>+</u>					
1	LDW-SS508-010	11	LDW-SS510-010	21	LDW-SS537-010	31	LDW-SS527-010DUP
2	LDW-SS523-010	12	LDW-SS512-010	22	LDW-SS538-010	32	LDW-55508-010 TRP
3	LDW-SS601-010	13	LDW-SS511-010	23	LDW-SS539-010	33	LDW-55507-010 TRP
4	LDW-SS530-010	14	LDW-SS513-010	24	LDW-SS540-010	34	PBSI
5	LDW-SS509-010	15	LDW-SS524-010	25	LDW-SS508-010MS	35	PB 52
6	LDW-SS501-010	16	LDW-SS527-010	26	LDW-SS508-010DUP	36	PBS3
7	LDW-SS504-010	17	LDW-SS532-010	27	LDW-SS504-010DUP	37	
8	LDW-SS505-010	18	LDW-SS534-010	28	LDW-SS504-010TRP	38	
9	LDW-SS506-010	19	LDW-SS535-010	29	LDW-SS511-010DUP	39	
10	LDW-SS507-010	20	LDW-SS536-010	30	LDW-SS511-010TRP	40	

Notes:		

SDG # QB98/QC15

VALIDATION FINDINGS WORKSHEET Sample Specific Analysis Reference

Page: __of_ Reviewer: __\(\subseteq \) 2nd reviewer: __\(\subseteq \)

All circled methods are applicable to each sample.

Sample ID	Matrix	Downward and
1 -> 24	sed	PH Br CLE NO NO SO O DO CIO FOR ON ANY THE PROPERTY OF THE PRO
QC 25,26, 31 → 33	1	PH Br CI F NO. NO. SO. O.PO. CIO. TOO CN NH3 TKN CEC S Cr6+
		PH Br CI F NO, NO, SO, O-PO, CIO, TOC) CN NH, TKN CEC S Cr6+
		pH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		PH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr8+
		pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cret
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr8+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr5+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁵⁺
		TRN CEC S CF
1-> 24		Moisture Density Porosity Organic Solids Gravity Particle size (Solid)
2c 26, 1 3(→33		
27→30		Moisture Density Porosity Organic Solids Gravity Particle size
	<u>V</u>	Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size

Comments:	
Comments.	

				,	
SDG	#:_	QB	78/	QC	15

Field Duplicates

Reviewer: MG

2nd reviewer: _____

METHOD: Inorganics, Method See cover

YN N/A YN N/A Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentration (7。		·	
Analyte	2	3	RPD (Limit)	Difference (Limit)	Qualifier
Total Solids	76.70	77.80	1		
Toc	0.982	0.906	8		

	Concentration ((%)			
Analyte	10	LDW-55602-	Pro RPD (Limit)	Difference (Limit)	Qualifier
Total Solids	47.20	47.00	0		
Toc	1-79	1-97	10		
				:	

ų	Concentration	(%)			
Analyte	16	LDW-55603-01	O RPD (Limit)	Difference (Limit)	Qualifier
Total Solids	46.60	47.40	2	·	
Toc	2.35	2.43	3		
				·	

Analyte	Concentration ()	RPD (Limit)	Difference (Limit)	Qualifier

LDC#: 77400A6 SDG#: Q898/QC15

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: / of 3
Reviewer: MG
2nd Reviewer:

Grain Size, Method PSEP

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

	% Fin	ner (%)		
Phi Size	3	2	RPD	
-2	96.8	97.7	1	
-1	91.3	93.2	2	
0	85.6	88.1	3	
1	68.3	70.9	4	****
2	39.4	41.5	5	
3	22.2	24.0	8	
4	12.3	13.8	11	
5	8.4	8.5	1	
6	6.6	6.7	2	
7	4.9	5.0	2	
8	3.4	3.7	8	
9	2.2	2.4	9	
10	1.1	1.3	17	

V:\FIELD DUPLICATES\FD_inorganic\22400A6.wpd

	% Finer			
Phi Size	LDW-SS602-010	10	RPD	
-1	100.0	99.6	0	
0	98.5	99.0	1	
1	96.6	97.9	1	

LDC#: 77400A6 SDG#: 0898/0015

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 2 of 3
Reviewer: MG
2nd Reviewer:

Grain Size, Method PSEP

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

	% Fin			
Phi Size	LDW-SS602-010	10	RPD	
2	94.1	96.4	2	
3	90.3	93.2	3	
4	84.1	87.1	4	
5	75.8	76.6	1	
6	62.1	63.8	3	
7	45.4	47.4	4	
8	31.0	32.6	5	
9	20.1	22.2	10	
10	12.6	13.8	9	

V:\FIELD DUPLICATES\FD_inorganic\22400A6.wpd

	% Fin			
Phi Size	LDW-SS603-010	16	RPD	
-1	99.6	98.9	1	
0	96.8	98.7	2	
1	94.8	97.7	3	
2	92.3	96.4	4	
3	87.8	94.2	7	
4	74.9	85.3	13	
5	57.9	67.1	15	

LDC#: 27400A6 SDG#: QB98/QC15

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 3 of 3
Reviewer: MG
2nd Reviewer:

Grain Size, Method PSEP

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

	% Fir	ner (%)		
Phi Size	LDW-SS603-010	16	RPD	
6	39.8	43.9	10	
7	23.9	25.2	5	
8	13.8	13.7	1	
9	9.3	8.7	7	
10	6.3	6.1	3	

V:\FIELD DUPLICATES\FD_inorganic\22400A6.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Lower Duwamish Waterway Group

Collection Date:

December 17, 2009

LDC Report Date:

April 29, 2010

Matrix:

Sediment

Parameters:

Wet Chemistry

Validation Level:

EPA Level IV

Laboratory:

Analytical Resources, Inc.

Sample Delivery Groups (SDG):

QC19

Sample Identification

LDW-SS541-010

LDW-SS542-010

LDW-SS543-010

LDW-SS545-010

LDW-SS546-010

LDW-SS603-010

Introduction

This data review covers 6 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per the Plumb Method for Total Organic Carbon, PSEP Method for Particle Size, and EPA Method 160.3 for Percent Solids.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

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

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

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

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks.

IV. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) analyses were not required by the method.

V. Duplicates/Triplicates

Duplicate (DUP) and triplicate (TRP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VII. Sample Result Verification

All sample result verifications were acceptable.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

IX. Field Duplicates

Samples LDW-SS603-010 and LDW-SS527-010 (from SDG QB98/QC15) were identified as field duplicates. No contaminant concentrations were detected in any of the samples with the following exceptions:

	Concent		
Analyte	LDW-SS603-010	LDW-SS527-010	RPD
Total solids	47.40	46.60	2
Total organic carbon	2.43	2.35	3

	%	Finer.	
Phi Size	LDW-SS603-010	LDW-SS527-010	RPD
-1	99.6	98.9	1
0	96.8	98.7	2
1	94.8	97.7	3
2	92.3	96.4	4
3	87.8	94.2	7
4	74.9	85.3	13
5	57.9	67.1	15
6	39.8	43.9	10
7	23.9	25.2	5
8	13.8	13.7	1
9	9.3	8.7	7
10	6.3	6.1	3

X. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Wet Chemistry - Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

Lower Duwamish Waterway Group Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG QC19

No Sample Data Qualified in this SDG

he sa	IOD: TOC (Plumb Meth		: 22400B6 VALIDATION COMPLETENESS WORKSHEET t: QC19 Level IV atory: Analytical Resources, Inc.						Page: <u>I</u> of_ Reviewer: <u>MG</u> 2nd Reviewer: <u>V</u>
anaat	amples listed below wer tion findings worksheets	e revie			·				0.3) dings are noted in attach
	Validation	. Area					C	omments	
1.	Technical holding times			A	Sampling	dates:	12-17-0)9	
lla.	Initial calibration			A					
IIb.	Calibration verification			À					
III.	Bianks			Α					
IV	Matrix Spike/Matrix Spike Duplicates		s	7	not	requ	<i>uived</i>		
V	Duplicates		Α	DUP/TRP (SDG: QCIS))		
VI.	Laboratory control samples		A	LCS					
VII.	Sample result verification			A					
VIII.	Overall assessment of data	a		A					
IX.	Field duplicates			SW	D=6	+ L	DW-5557	7-010	(SDG: QB98/QCIE
Х	Field blanks			N					
lote:	A = Acceptable ND = N N = Not provided/applicable R = Rin		R = Rin	o compound sate eld blank	ls detected		D = Duplicate TB = Trip blank EB = Equipmer		
alidate	ed Samples: 311 Sediment								
1	LDW-SS541-010	11			21	<u> </u>		31	<u></u>
2	LDW-SS542-010	12			22	$oxed{oxed}$		32	
3	LDW-SS543-010	13			23			33	
4	LDW-SS545-010	14	,		24			34	
5	LDW-SS546-010	15			25	<u> </u>		35	
6	LDW-SS603-010	16			26			36	
, I.	LDW-88545-018DUP	17			27			37	
		1 1			1	1		1 1	i e e e e e e e e e e e e e e e e e e e

40

Notes:

Method: Inorganics (EPA Method See cover)

IMethod:Inorganics (EPA Method 300 2000)			T	
Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
II. Calibration 3.8				
Were all instruments calibrated daily, each set-up time?				
Were the proper number of standards used?	/	<u> </u>		
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)	<u> </u>			
III Blanks is 5.				
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 DWater.		/		
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) \leq 20% for waters and \leq 35% for soil samples? A control limit of \leq CRDL(\leq 2X CRDL for soil) was used for samples that were \leq 5X the CRDL, including when only one of the duplicate sample values were \leq 5X the CRDL.	1			
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 (PF) samples within the acceptance limits?			/	

LDC #: 0019

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer:

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 date				
Overail 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.				

SDG #: QC19

Sample Specific Analysis Reference

Page: ___of __ Reviewer: __MG__ 2nd reviewer: _____

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1->6	sed	pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOO CN NH3 TKN CEC S Cr8+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br CI F NO, NO, SO, O-PO, CIO, TOC CN NH, TKN CEC S Cr6+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr5+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
1-76	d	Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
·		

(Comments:
_	

TALIPATION I NABULA MANAGEMENT

SDG #: OC19

Field Duplicates

rage:_	
Reviewer:	MG
2nd reviewer:	

METHOD: Inorganics, Method See cover

Y)N N/A Y)N N/A Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentration	(%)		·	
Analyte	6	LDW-55507-010	RPD (Limit)	Difference (Limit)	Qualifier
Total Solids	47.40	46.60	2		
Toc	2.43	2.35	3		

	Concentration ()			
Analyte		RPD (Limit)	Difference (Limit)	Qualifier
A				

-74	Concentration ()			
Analyte		RPD (Limit)	Difference (Limit)	Qualifier
			AND	

	Concentration ()			
Analyte		RPD (Limit)	Difference (Limit)	Qualifier
				#_

LDC#:_	22400B6
SDG#:	QC19

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	1 of 1
Reviewer:	MG
2nd Reviewer:	\sim

Grain Size, Method PSEP

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

	% Fir	ner (%)		
Phi Size	6	LDW-SS527-010	RPD	
-1	99.6	98.9	1	
0	96.8	98.7	2	
1	94.8	97.7	3	
2	92.3	96.4	4	
3	87.8	94.2	7	
4	74.9	85.3	13	
5	57.9	67.1	15	
6	39.8	43.9	10	
7	23.9	25.2	5	
8	13.8	13.7	1	
9	9.3	8.7	7	
10	6.3	6.1	3	

V:\FIELD DUPLICATES\FD_inorganic\22400B6.wpd

LDC #:_	22400B6
SDG #:	QC19

VALIDATION FINDINGS WORKSHEET Initial and Continuing Calibration Calculation Verification

	Page:_	Ĺ	of_	1
	Reviewer:		40	9
2nd	Reviewer:		~	

METHOD: Inorganics, Method See Cover	
The correlation coefficient (r) for the calibration of 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 = Found x 100 Where, Found = concentration of each analyse measured in the analysis of the ICV or CCV solution	

%R = <u>Found</u> x 100 True	Where,	Found = concentration of each analyte $\underline{\text{measured}}$ in the analysis of the ICV or CCV solution True = concentration of each analyte in the ICV or CCV source

					Recalculated	Reported	
Type of Analysis	Analyte	·	mass (units)	Area (units)	r or %R	r or %R	Acceptable (Y/N)
Initial calibration		Blank	0 (ug)	58147			
Calibration verification		Standard 1	8 (1)	1770583			·
		Standard 2	20 ()	4611982		·	
	Toc	Standard 3	40 ()	9454085	v2	r 2=0.99943	
		Standard 4	100 (1)	24563398	r 2=0.99965	-0.11943	Y
	•	Standard 5	_	_			İ
		Standard 6	-			-	
		Standard 7	-	_			
Calibration verification							
	Toc	ICV	1014. (mg/L)	1000. (mg/)	101.4	101.40	
Calibration verification			, , ,	/ /			
	Toc	CCVI	983. (mg/L)	1000. (mg/L)	98.3	98.30	J
Calibration verification							
					_	-	

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

LDC #:_	22400BG
SDG #:	QC19

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

	Page:_	1 of [
	Reviewer:	MG
2nd	Reviewer:_	1

METHOD: Inorganics, Metho	d see cover	
Percent recoveries (%R) for	a laboratory control san	nple and a matrix spike sample were recalculated using the following formula:
%R = Found x 100 Whe	re, Found =	concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation,
ilue	True =	Found = SSR (spiked sample result) - SR (sample result). concentration of each analyte in the source.
A sample and duplicate relat	ive percent difference (RPD) was recalculated using the following formula:
$RPD = \underbrace{[S-D]}_{[S-D]} \times 100 \text{ Whe}$		Original sample concentration
(S+D)/2	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	0.1014 (%)	0.100 (%)	101.4	101.0	Y
_	Matrix spike sample		(SSR-SR)		· · · · · · · · · · · · · · · · · · ·		
W-55527-010	Duplicate sample	Total Solids	Tip1 46.60 (%)	Tripa 47.50 (%)	Tr:p3	RSD RSD report	ed Y

Comments: results.	Refer to appropriate	worksheet for	list of qualification	ns and associated sa	amples when reported	results do not agree v	vithin 10.0% of the	ne recalculated
				,				
***************************************	·							

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LDC #: 22400B6 SDG #: QC19

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page: ___of __ Reviewer: ______ 2nd reviewer: ____

1.07

Please N N N N Compo	see qualifications beloward by the second sec	ow for all questions answere been reported and calculatithin the calibrated range of tion limits below the CRQL? or #1, TOC and the following equation:	ed correctly? the instrume	ents?	re identified as " ted with a positiv	
Concen	tration =	Recalculat	tion:			
y= m;	(+6	607	18512 = 2	746372(x mgc)	+ O	
where	m = 246372	·	24.672 M	gc = x ` ' '	(dry wt)	
	dil= 1x m/;	60- but zero is used) 9.3 mg burn wt.	then	74.672 Mg	= 10727	ug/o-mg/kg
#	Sample ID	Analyte		Reported Concentration (%)	Calculated Concentration (%)	Acceptable (Y/N)
	<u> </u>	Total So	lide	69.90	69.91	Y
		TOC		1.10	1.07	
		Particle S	Size	% finer	% finer	
<u> </u>		4750.(uv	м	100.0	100.0	
		2000.()	99.9	99.9	
		1000. ()	99.7	99.7	
		500. ()	98.3	98.3	
ļ	**************************************	250. ()	78.9	78.9	
		125. ()	30.4	30.4	
		63. ()	21.3	21.3	
		31.0 ()	14.2	14.2	
		15.6 ()	10.3	10.3	
		7.8 ()	7.0	7.0	
		3.9 ()	4.6	4,6	
		2.0 ()	3.4	3.5	
		1.0 (1)	2.5	2.5	J
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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: December 16, 2009

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Wet Chemistry

Validation Level: EPA Level III

Laboratory: Analytical Resources, Inc.

Sample Delivery Groups (SDG): QB99

Sample Identification

LDW-SS514-010

LDW-SS515-010

LDW-SS516-010

LDW-SS517-010

LDW-SS518-010

LDW-SS519-010

LDW-SS521-010

LDW-SS522-010

LDW-SS525-010

LDW-SS526-010

LDW-SS528-010

LDW-SS602-010

LDW-SS525-010MS

LDW-SS525-010DUP

LDW-SS602-010DUP

LDW-SS602-010TRP

LDW-SS525-010TRP

Introduction

This data review covers 17 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per the Plumb Method for Total Organic Carbon, PSEP Method for Particle Size, and EPA Method 160.3 for Percent Solids.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

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

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

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

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks.

IV. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

V. Duplicates/Triplicates

Duplicate (DUP) and triplicate (TRP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VII. Sample Result Verification

Raw data were not reviewed for this SDG.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

IX. Field Duplicates

Samples LDW-SS602-010 and LDW-SS507-010 (from SDG QB98/QC15) were identified as field duplicates. No contaminant concentrations were detected in any of the samples with the following exceptions:

	Concent		
Analyte	LDW-SS602-010	LDW-SS507-010	RPD
Total solids	47.00	47.20	0
Total organic carbon	1.97	1.79	10

	% F	iner	
Analyte	LDW-SS602-010	LDW-SS507-010	RPD
-1	100.0	99.6	0
0	98.5	99.0	1
1	96.6	97.9	1
2	94.1	96.4	2
3	90.3	93.2	3
4	84.1	87.1	4
5	75.8	76.6	1
6	62.1	63.8	3
7	45.4	47.4	4
8	31.0	32.6	5
9	20.1	22.2	10
10	12.6	13.8	9

X. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Wet Chemistry - Data Qualification Summary - SDG QB99

No Sample Data Qualified in this SDG

Lower Duwamish Waterway Group Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG QB99

No Sample Data Qualified in this SDG

SDG # Labora METH	: 22400C6 :: QB99 atory: Analytical Resource OD: TOC (Plumb Methors)	rces, Ir	article Size	L (PSEP Me	_evel J\ ethod), P	r III ercent	Solids (EPA Meth	od 160.3	Date: 1- 25: Page: 1 of 1 Reviewer: MG 2nd Reviewer: 1
	ion findings worksheet	S.	 	1						3
	<u>Validatio</u>	n Area		1			12-	<u>Comn</u> 16 - 09	nents	
I.	Technical holding times			<u>^</u>	Sampling	dates:	(0-	16-07		
Ila.	Initial calibration			I A						,
IIb.	Calibration verification			I A	<u> </u>					
III.	Blanks			A						
IV	Matrix Spike/Matrix Spike	Duplicat	es	A	MS					
	Duplicates			<u>A</u>	DUP	/TRI	,		·	
VI.	Laboratory control sample	s		A_	LC	ĵ				
VII.	Sample result verification			N						
VIII.	Overall assessment of dat	ta		A						
IX.	Field duplicates			SW	D =	12+	LDW	- 55 50	7-011	0 (SDG: QB98/OC
x	Field blanks			N						
Note: Validate	A = Acceptable N = Not provided/applicate SW = See worksheet d Samples:		R = Rir FB = F	lo compound nsate ield blank	s detected		D = Dup TB = Tri EB = Ec		nk	
1 1	LDW-SS514-010	11	LDW-SS528	-010	21				31	
2 !	LDW-SS515-010	12	LDW-SS602	-010	22				32	
	LDW-SS516-010	13	LDW-SS525	-010MS	23				33	
ll l	LDW-SS517-010	14	LDW-SS525	-010DUP	24				34	
	LDW-SS518-010	15	LDW-SS602	-010DUP	25				35	
	LDW-SS519-010	16	LDW-SS602		26				36	
	LDW-SS521-010	17	LDW-555						37	
	LDW-SS522-010	18	PBS	· · · · · · · · · · · · · · · · · · ·	28				38	
	DW-SS525-010	19			29				39	

30

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LDW-SS526-010

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Notes:_

SDG #: QB99

Sample Specific Analysis Reference

Page: ___of __ Reviewer: __MG 2nd reviewer: ___

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1-12 oc	sed	pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 (TOO) CN NH3 TKN CEC S Cr6+
13		PH Br CI F NO3 NO2 SO4 O-PO4 CIO3 (TOC) CN NH3 TKN CEC S Cr6+
\$ 14,17		pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 (OC) CN NH3 TKN CEC S Cr6+
		ph Br Ci F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr6+
		PH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr8+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
1-712		Moisture Density Porosity Organic Solids Gravity Particle size (Solid)
19,17		Moisture Density Porosity Organic Solids Gravity Particle size
15,16		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
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Comments:	

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SDG #: QB99

Field Duplicates

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Reviewer:_		M6	-
2nd reviewer:	_	1	_

METHOD: Inorganics, Method See cover

Were field duplicate pairs identified in this SDG?

Were target analytes detected in the field duplicate pairs?

	Concentration (%)			·	
Analyte	12	LDW-55507-010	RPD (Limit)	Difference (Limit)	Qualifier
Total Solids	47.00	47.20	0		
TOC	1.97	1. 79	10		
	Concentration	()			
Analyte			RPD (Limit)	Difference (Limit)	Qualifier
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A t - da -	Concentration	()	RPD (Limit)	Difference (Limit)	Qualifier
Analyte					
	Concentration	()			
Analyte			RPD (Limit)	Difference (Limit)	Qualifier
		·			
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LDC#:_	2240066
SDG#:	QB99

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	rof_
Reviewer:	MG
2nd Reviewer:	

Grain Size, Method PSEP

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

	% Finer (%)			
Phi Size	12	LDW-SS507-010	RPD	
-1	100.0	99.6	0	
0	98.5	99.0	1	
1	96.6	97.9	1	
2	94.1	96.4	2	
3	90.3	93.2	3	
4	84.1	87.1	4	
5	75.8	76.6	1	
6	62.1	63.8	3	
7	45.4	47.4	4	
8	31.0	32.6	5	
9	20.1	22.2	10	
10	12.6	13.8	9	

V:\FIELD DUPLICATES\FD_inorganic\22400C6.wpd



LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119 ATTN: Ms. Marina Mitchell April 30, 2010

SUBJECT: Lower Duwamish Waterway Group, Data Validation

Dear Ms. Mitchell,

Enclosed are the revised validation reports for the fraction listed below. These SDGs were received on February 5, 2010. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 22536:

SDG#

Fraction

DPWG31717/WG31355 DPWG31752/WG31593 Dioxins/Dibenzofurans

The data validation was performed under EPA Level IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005
- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005, Dioxin/Furan Addendum, December 2009
- EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin(PCDD) and Polychlorinated Dibenzofuran(PCDF) Data, Revision 2.0, January 1996
- USEPA, Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Diobenzofurans Data Review, September 2005

Please feel free to contact us if you have any questions.

Sincerely,

Stella S. Cuenco

Der Feng

Data Validation Operations Manager/Senior Chemist

Attachment 1

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	EDD 1100 325	LDC #	‡22536	(W	/ind	lwa	rd I	≣nv	iro	nm	ent	al, I			iea:	ttle	W	\	.ov	er l	Du۱	wan	nisl	1 W	ate	rwa	ay (3ro	up)			PO#	Axys	07-04	
LDC	SDG#	DATE REC'D	(3) DATE DUE	Dio:	xins !90)																														
Matr	ix: Water/Sediment		7 A	w		w	s	W	S	W	s	W	s	W	s	w	s	W	S	w	s	w	s	W	Ş	W	S	W	S	W	s	W	s	W	s
	DPWG31717/WG31355																																		
В	DPWG31752/WG31593	02/09/10	03/01/10	0	10																			, .											_
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Total	T/SC			0	27	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	27

Lower Duwamish Waterway Group Data Validation Reports LDC #22536

Dioxins/Dibenzofurans



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: December 16 through December 17, 2009

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Dioxins/Dibenzofurans

Validation Level: EPA Level IV

Laboratory: AXYS Analytical Services Ltd.

Sample Delivery Group (SDG): DPWG31717/WG31355

Sample Identification

LDW-SS526-010

LDW-SS528-010

LDW-SS511-010

LDW-SS513-010

LDW-SS524-010

LDW-SS527-010

LDW-SS532-010

LDW-SS535-010

LDW-SS536-010

LDW-SS537-010

LDW-SS538-010

LDW-SS539-010

LDW-SS540-010

LDW-SS542-010

LDW-SS543-010

LDW-SS545-010

LDW-SS546-010

LDW-SS536-010DUP

Introduction

This data review covers 18 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 1613B for Polychlorinated Dioxins/Dibenzofurans.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data (Revision 2.0, January 31, 1996) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Dibenzofurans Data Review (September 2005) as there are no current guidelines for the method stated above.

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XIV.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
 - J1 Blank Contamination: Indicates possible high bias and/or false positives.
 - J2 Calibration Range exceeded: Indicates possible low bias.
 - J3 Holding times not met: Indicates low bias for most analytes.
 - J4 Other QC parameters outside control limits: bias not readily determined.
 - J5 Other QC parameters outside control limits. The reported results appear to be biased high. The actual value of target compound in the sample may be lower than the value reported by the laboratory.
 - Other QC parameters outside control limits. The reported results appear to be biased low. The actual value of target compound in the sample may be higher than the value reported by the laboratory.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required daily frequency.

Retention time windows were established for all homologues. The chromatographic resolution between ¹³C-2,3,7,8-TCDD and ¹³C-1,2,3,4-TCDD was less than or equal to 25%.

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

III. Initial Calibration

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

Percent relative standard deviations (%RSD) were less than or equal to 20.0% for all native compounds and less than or equal to 35.0% for all labeled compounds.

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

The minimum S/N ratio was technically acceptable.

IV. Routine Calibration (Continuing)

Routine calibration was performed at the required frequencies.

All of the routine calibration concentrations were within the QC limits.

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated dioxin/dibenzofuran contaminants were found in the method blanks.

Method blank results flagged "K" by the laboratory as estimated maximum possible concentration (EMPC) were considered not detected.

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.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VII. Ongoing Precision & Recovery (OPR) and Standard Reference Material (SRM) Samples

Percent recoveries (%R) of the ongoing precision and recovery samples were within QC limits.

Standard reference material samples were analyzed at the required frequency.

VIII. Regional Quality Assurance and Quality Control

Not applicable.

IX. Internal Standards

All internal standard recoveries were within QC limits.

X. Target Compound Identifications

All target compound identifications were within validation criteria.

XI. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31717/WG31355	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	Α

XII. System Performance

The system performance was acceptable.

XIII. Overall Assessment of Data

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31717/WG31355	2,3,7,8-TCDF (from DB-5)	R	А

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Data Qualification Summary - SDG DPWG31717/WG31355

SDG	Sample	Compound	Flag	A or P	Reason
DPWG31717/ WG31355	LDW-SS526-010 LDW-SS528-010 LDW-SS511-010 LDW-SS511-010 LDW-SS524-010 LDW-SS527-010 LDW-SS532-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS540-010 LDW-SS540-010 LDW-SS545-010 LDW-SS545-010 LDW-SS545-010 LDW-SS546-010 LDW-SS546-010 LDW-SS546-010 LDW-SS536-010DUP	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	A	Compound quantitation and CRQLs (EMPC)
DPWG31717/ WG31355	LDW-SS526-010 LDW-SS528-010 LDW-SS511-010 LDW-SS5113-010 LDW-SS524-010 LDW-SS527-010 LDW-SS532-010 LDW-SS535-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS538-010 LDW-SS540-010 LDW-SS540-010 LDW-SS540-010 LDW-SS545-010 LDW-SS545-010 LDW-SS545-010 LDW-SS546-010 LDW-SS536-010DUP	2,3,7,8-TCDF (from DB-5)	R	A	Overall assessment of data

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG DPWG31717/WG31355

No Sample Data Qualified in this SDG

DG #: abora	22536A21 DPWG31717/WG313 tory: AXYS Analytical Se	355 ervices	Ltd.	L	evel IV	ESS WORK	SHEET		Date: 2/0/12 Page: /of / Reviewer: 9 2nd Reviewer: /
he sa	DD: HRGC/HRMS Dioxi mples listed below were on findings worksheets.						Validatio	n findin	gs are noted in attached
	Validation	Area					Comm	ents	
l.	Technical holding times	wa awa		1	Sampling d	ates: 1=/16	<u>- 17</u>	100	7
11.	HRGC/HRMS Instrument pe	rforman	ce check	A				/	
III.	Initial calibration			A	20/	7570			
IV.	Routine calibration			A	De	limits			
V.	Blanks			w					
VI.	Matrix spike/Matrix spike du	plicates	BUP	N/A	< 10	D4.			
VII.	Laboratory control samples			\triangleleft	OPR	. CRM			
VIII.	Regional quality assurance	and qua	lity control	N					
IX.	Internal standards			\blacksquare				·	
Χ.	Target compound identificat	ions		4					
XI.	Compound quantitation and	CRQLs		KW					
XII.	System performance			A					
XIII.	Overall assessment of data			w					
XIV.	Field duplicates			N	D=6	<u> </u>			
XV.	Field blanks	· · · · · · · · · · · · · · · · · · ·						-	
lote: /aljdate	A = Acceptable N = Not provided/applicable SW = See worksheet ad Samples:	•	R = Rir	o compound sate eld blank	s detected	D = Dupli TB = Trip EB = Equ		nk	
M.	seds	20				1.1.2.2.2.		1 1	
1 /	LDW-SS526-010	11/	LDW-SS538	-010	21	W43135	5-10]	31	
2	LDW-SS528-010	124	LDW-SS539	-010	22		<u> </u>	32	
3 '	LDW-SS511-010	135	LDW-SS540	-010	23		<u> </u>	33	
4 7	LDW-SS513-010	145	LDW-SS542	-010	24			34	
5	LDW-SS524-010	15	LDW-SS543	-010	25			35	
6]	LDW-SS527-010	166	LDW-SS545	-010	26_			36	
	LDW-SS532-010	17 5	LDW-SS546	-010	27			37	
	LDW-SS535-010	184	LDW-SS536	-010DUP	28			38	
	LDW-SS536-010	19			29			39	·
204	LDW-SS537-010	20			30		· · · · · · · · · · · · · · · · · · ·	40	, , , , , , , , , , , , , , , , , , ,

DC#: 2253/A2/ DG#: 20 CON

VALIDATION FINDINGS CHECKLIST

Page: /of 3
Reviewer: 9
2nd Reviewer: 4

Method: Dioxins/Dibenzofurans (EPA SW 846 Method 8290) 1613)

		-	\leftarrow	
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?	1	Ī		
Were the retention time windows established for all homologues?				
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers \leq 25% ?	/			
Is the static resolving power at least 10,000 (10% valley definition)?				
Was the mass resolution adequately check with PFK?				
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	17			
III. Initial calibration				
Was the initial calibration performed at 5 concentration levels?				
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled standards and \leq 30% for labeled standards?				
Did all calibration standards meet the Ion Abundance Ratio criteria?				
Was the signal to noise ratio for each target compound \geq 2.5 and for each recovery and internal standard \geq 10?				
IV. Continuing calibration	11	1	1	
Was a routine calibration performed at the beginning and end of each 12 hour period?				
Were all percent differences (%D) \leq 20% for unlabeled standards and \leq 30% for labeled standards?	1			
Did all routine calibration standards meet the Ion Abundance Ratio criteria?	1		_	
V. Blanks	1 1	1	1	
Was a method blank associated with every sample in this SDG?	ГA		T	
Was a method blank performed for each matrix and concentration?	7		-	
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet?	1			
A. Matrix spike/Matrix spike duplicates	1		L	
Nere a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each natrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		7		DUD
Vere the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits?			7	DUD - 10x DC
II. Laboratory control samples				
Vas an LCS analyzed for this SDG?	オ	T	Т	

VALIDATION FINDINGS CHECKLIST

Page: →of → Reviewer: ← 2nd Reviewer: →

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?				
VIII. Regional Quality Assurance and Quality Control			-	
Were performance evaluation (PE) samples performed?				
Were the performance evaluation (PE) samples within the acceptance limits?				
IX. Internal standards				
Were internal standard recoveries within the 40-135% criteria?				
Was the minimum S/N ratio of all internal standard peaks \geq 10?				
X. 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 and labeled standard \geq 2.5?				
Does the maximum intensity of each specified characteristic ion coincide within \pm 2 seconds (includes labeled standards)?				
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?	سر			
Was an acceptable lock mass recorded and monitored?				
XI. Compound: quantitation/CRQLs				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?		1		
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?				
XII. System performance				
System performance was found to be acceptable.				
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.				
XIV. Field duplicates				
Field duplicate pairs were identified in this SDG.				

DC #: 2253682 DG #: 2ee dour

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
Target compounds were detected in the field duplicates.				
XV. Field blanks				
Field blanks were identified in this SDG.				
Target compounds were detected in the field blanks.			/	

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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	a. 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 #: 2253/43/ SDG #: 44 COUCY

VALIDATION FINDINGS WORKSHEET

METHOD; HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 8290) 7/6/3

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

| N/A | N/A | Was a method blank analyzed for each matrix? | N/A | Was the blank contaminated? If yes, please see quali

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

Blank extraction date: 1/4/10 Blank analysis date: 1/5/10 Associated Samples:

Sample Identification Blank analysis date: 0+558184N Blank ID ZM Blank extraction date: Compound

Sample Identification Blank ID Compound

Associated Samples:

Conc. units:

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 #: 2253642/ SDG #: 220 COUNT

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: / of / Reviewer: 9--2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8296)/ \mathcal{L}

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

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

Qualifications	\mathcal{M}									
Associated Samples										
Finding	ZNPC MSULTS	ı	*							
Sample ID	<u> </u> ₩		7							
Date			•							
*										

Comments: See sample calculation verification worksheet for recalculations

LDC #: 22532174 SDG #: 20 CONIN

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page: of/ Reviewer: 2

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) /6/3)

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

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

Was the overall quality and usability of the data acceptable?

*	Date	Sample ID	Finding	Associated Samples	Qualifications	
		41/	H on 68-5	m	R/X	
						_
	-					
						1
Comments:	ents:] !

culation Verification

Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) バメノラブ

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

 $A_x = Area of compound,$ $A_k = Area of associated internal standard <math>C_x = Concentration of compound,$ $C_k = Concentration of internal standard S = Standard deviation of the RRFs, <math>X = Mean of the RRFs$

				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (Initial)	Average RRF (Initial)	RRF (CSS std)	RRF (<>>>std)	%RSD	%RSD
Ŀ	1942	1.1.01.0	2,3,7,8-TCDF (¹ C-2,3,7,8-TCDF)	₹8.0	683	6.83	6.83	2.19	18.0
		60/1/1/	/// // 2,3,7,8-TCDD (10C-2,3,7,8-TCDD)	0.87	18.0	0.84	8.84	4.39	7 38
			1,2,3,8,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	67.0	62.0	0.78	0.78	1.5.1	1.40
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	20.1	1.07	1.13	W ! . !	Nin	3.57
			OCDF ("C-OCDD)	0.78	0.78	0.75	0.75	19.8	20.0
2	1ctc	12/53/09	237.8-TODF ("C.2,3,7,8-TODF)	0.92	0.92	0.91	16.0	4.69	4.56
		///	2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)		-				
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)						
			OCDF (11C-OCDD)						
က			2,3,7,8-TCDF (1°C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (19C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (¹ C-1,2,4,6,7,8,-HpCDD)						
			OCDF ("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.

* SDG #: 20

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET

Page: Reviewer: 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) / イバラ)

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 = $(A_{\mu})(C_{\mu})/(A_{\mu})(C_{\mu})$

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

 $A_{\rm b} = {\rm Area}$ of associated internal standard $C_{\rm b} = {\rm Concentration}$ of internal standard A_x = Area of compound, C_x = Concentration of compound,

L								
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	0%	Q%
-	DXON-DO		2,3,7,8-TCDF (*C-2,3,7,8-TCDF)	0.83	10.5	5.01		!
\bot	5=1/	1/2/10	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	0.87	10.3	0		
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	079	54.0	53.K		
			1,2,3,4,6,7,8-HpCDD (³ C-1,2,4,6,7,8,-HpCDD)	1.0+	45.3	45.4		
			OCDF (*c-OCDD)	0.78	٨	n		
7	DXOM-010	\		0.83	10.4	401		1
I	8:3	10/50/1	2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	0.87	10.0	0:01		
		`	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	67.0	0.86	52.8		
\Box			1,2,3,4,6,7,8-HpCDD (1°C-1,2,4,6,7,8,-HpCDD)	10.	44.8	44.9		
			OCDF (13C-OCDD)	0.78	120	120		
က	DXOM 009		2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.83	10.0	801		
	S=8	01/12/1	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	0.87	4.01	17.2		
\Box			1,2,3,6,7,8-HxCDD (1°C-1,2,3,6,7,8-HxCDD)	0.79	84.8	24.51		
		1	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	45.0	45.2		
			OCDF (1c-OCDD)	0.78	(20	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 #: 2253047

VALIDATION FINDINGS WORKSHEET Routine Calibration Results Verification

Page: ∠of ∋ Reviewer: ○

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) / 6/ ラ

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

% Difference = 100 * (ave. RRF - RRF)/ave. RRF RRF = $(A_{\nu})(C_{\nu})/(A_{\nu})(C_{\nu})$

Where: ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

 A_x = Area of compound, A_y = Area of associated internal standard C_x = Concentration of internal standard

L								
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	8	3
	Dx pld . pot	,	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.83	10 5	10.5		2
	(S =)	1/2/11	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	0.87	10	10.1		\
		\ \	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	079	4.9	245		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	44.9	1 3 //		
			OCDF (1°C-OCDD)	0.78	-12	20		
7	DB0 \$ 020		2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.92	12.	2 2		
	S. 3	1/20/10	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)					
		,	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (°C-1,2,4,6,7,8,-HpCDD)					
			OCDF (*c-OCDD)		•			
ო	DXOM-008	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.83	4.01	701		
	ا بې	01/0=/	2,3,7,8-TCDD ('3C-2,3,7,8-TCDD)	0.87	10.3	707		
	,	`	1,2,3,6,7,8-HxCDD (¹³ C-1,2,3,6,7,8-HxCDD)	67.0	55.5	65.		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	44.1	444		
·			OCDF (1°C-OCDD)	*10	0 1	20		

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.

· SDG #: 264 COUL LDC #: 2253642

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET

Reviewer: Page: 2nd Reviewer:_

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8296) ノムノラ

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 RF = $(A_{\nu})(C_{\nu})/(A_{\nu})(C_{\nu})$

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

 $A_x = Area of compound,$ $C_x = Concentration of compound,$

 $A_{\mathbf{k}}=$ Area of associated internal standard $C_{\mathbf{k}}=$ Concentration of internal standard

					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	Q%	*
-	DXON-OIL		2,3,7,8-TCDF (1°C-2,3,7,8-TCDF)					
	ν,	0/95/1	2,3,7,8-TCDD (1°C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
		•	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF(4c-OCDD)	0.78	0	10		
7	DBOB_015		1 1	0.92	011			
	5:2	1/4/10	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			ocpF (3c-ocpp)					
က	DBOBZ	1001	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	26.0	12.4	50		
	5:2	0/-/	2,3,7,8-TCDD ("C-2,3,7,8-TCDD)					
		-	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (%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.

SDG #: Sec Cour LDC #: 22526/82/

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET

A of A Page: Reviewer: 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)//6/3

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,)(C,)/(A,)(C,)

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

 $A_{\rm s}=$ Area of associated internal standard $C_{\rm k}=$ Concentration of internal standard $A_x = Area$ of compound, $C_x = Concentration of compound,$

L								
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	Q%	0%
-	600 MOXA	\ \ \ \	2,3,7,8-TCDF (*3C-2,3,7,8-TCDF)	0.83	10.5	5.01		
	5:1	01/12/	2,3,7,8-TCDD (°C-2,3,7,8-TCDD)	0.87	(0 2	10.2		
		`	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	079	4.4	S W S		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	44.5	445		
			OCDF (*c-OCDD)	0.78	1<	120		
2			2,3,7,8-TCDF (1°C-2,3,7,8-TCDF)					
		<u> </u>	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (3c-OCDD)					
ო			2,3,7,8-TCDF (1°C-2,3,7,8-TCDF)					
		L!	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
		L	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (3c-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 #: 225-34 API SDG #: 25-6 COUNTY

Laboratory Control Sample Results Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: רמטני. Reviewer:

METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 6290) バムノう

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

LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: M431355-102

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

Spike	Spiked Sami	ole	31	SS	ıcsu	n	US2//CSD	CSD
Concentration (A.S.M.)	1	- Co	Percent Recovery	Recovery	Percent Recovery	ecovery	RPD	O
		I CSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
		×	293	99.3				
g '=5			102	102				
53.7			95.	asi		-		
2.98			93.1	93.0				
511		1	011	_				
	_							

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.

Analyte	HPCDF HPCDF HPCDD HPCDD HPCDD HPCDD HPCDD (S) NCDPE PFK	000F 000D 000D 000D 000D (S) D00PE PFK	
Elemental Composition	C ₂ H ² Cl ₃ 7ClO C ₂ H ² Cl ₃ 7ClO C ₂ H ² Cl ₃ 7Cl ₂ O 13C ₂ H ² Cl ₃ 7ClO C ₄ H ² Cl ₃ 7ClO ₂ C ₄ H ² Cl ₃ 7ClO ₂ C ₄ H ² Cl ₃ 7ClO ₂ 13C ₄ H ² Cl ₃ 7Cl ₂ O C ₄ H ² Cl ₃ 7Cl ₂ O C ₄ H ² Cl ₃ 7Cl ₂ O C ₅ F ₁₇	Cr. 30C; 37CiO Cr. 30C; 37CiO Cr. 30C; 37CiO Cr. 20C; 37CiO 13C; 20C; 37CiO 13C; 20C; 37CiO 13C; 20C; 37CiO Cr. 20C; 37CiO Cr. 20C; 37CiO Cr. 20C; 37CiO Cr. 20C; 37CiO	
Ol nol	M+2 M+4 M+2 M+2 M+4 M+4 M+4 COCK	M + 4 2 M + 4 2 M + 4 2 M + 4 4 2 M + 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
Accurate Mass ^(a)	407.7818 409.7788 417.8250 419.8220 423.7767 425.7737 435.8169 437.8140 479.7165 [430.9728]	441.7428 443.7399 457.7377 459.7348 469.7780 471.7750 513.6775	
Descriptor	4	ري د	
Analyte	TCDF TCDF (\$) TCDF (\$) TCDD TCDD TCDD (\$) TCDD (\$) HXCDPE	Pecde Pecde Pecde (S) Pecdd Pecdd Pecdd (S) Pecdd (S) Pecdd (S) Pecdd (S)	HXCDF HXCDF (S) HXCDF (S) HXCDD HXCDD HXCDD (S) HXCDD (S) OCDPE PFK
Elemental Composition	C ₁₂ H, acl, O C ₁₂ H, acl, O	C,2H,3°C1,3°C1O C,2H,3°C1,3°C1O 13°C,2H,3°C1,3°C1O 13°C,2H,3°C1,3°C1O 13°C,2H,3°C1,3°C1O ₂ 13°C,2H,3°C1,3°C1O ₂ 13°C,2H,3°C1,3°C1O ₂ C,2H,3°C1,3°C1O C,5F ₁₃	C, H, 20Cl, 27ClO C, H, 20Cl,
Ol nol	C	M M M H + + 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4	M + 2 2 2 W + 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
Accurate mass ^(a)	303,9016 305,8987 315,9419 317,9389 319,8965 321,8966 331,9368 333,9338 375,8364 [354,9792]	339.8597 341.8567 351.9000 353.8970 355.8546 357.8516 367.8949 369.8919 409.7974 [354.9792]	373.8208 375.8178 383.8639 385.8610 389.8156 391.8127 401.8559 403.8529 445.7555
Descriptor	-	α	e0

(a) The following nuclidic masses were used:

O = 15.994915 $^{36}Cl = 34.968853$ $^{37}Cl = 36.965903$

S = internal/recovery standard

LDC #: 22536 A2 SDG #: Zer cover

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page:	_/of /
Reviewer:_	9-
2nd reviewer:	a/

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)-1613)

K	N	N/A
(Y)	N	N/A

Were all reported results recalculated and verified for all level IV samples?

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

Concent	ration	$= \frac{(A_{\bullet})(I_{\bullet})(DF)}{(A_{\bullet})(RRF)(V_{\circ})(\%S)}$
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:
Conc. = $(3.9463)(2000)(1.6566)(0.87)(10.5)(10.$
= 0.5=3 NS/ES

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification
			-4		
				, p	
·			·		

Laboratory Data Consultants, Inc. **Data Validation Report**

Lower Duwamish Waterway Group **Project/Site Name:**

Collection Date: December 15 through December 17, 2009

April 29, 2010 LDC Report Date:

Matrix: Sediment

Parameters: Dioxins/Dibenzofurans

Validation Level: **EPA Level IV**

Laboratory: AXYS Analytical Services Ltd.

Sample Delivery Group (SDG): DPWG31752/WG31593

Sample Identification

LDW-SS508-010

LDW-SS504-010

LDW-SS506-010

LDW-SS512-010

LDW-SS518-010

LDW-SS519-010

LDW-SS521-010 LDW-SS522-010

LDW-SS534-010

LDW-SS541-010 LDW-SS534-010DUP

Introduction

This data review covers 11 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 1613B for Polychlorinated Dioxins/Dibenzofurans.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data (Revision 2.0, January 31, 1996) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Dibenzofurans Data Review (September 2005) as there are no current guidelines for the method stated above.

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XIV.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
 - J1 Blank Contamination: Indicates possible high bias and/or false positives.
 - J2 Calibration Range exceeded: Indicates possible low bias.
 - J3 Holding times not met: Indicates low bias for most analytes.
 - J4 Other QC parameters outside control limits: bias not readily determined.
 - Other QC parameters outside control limits. The reported results appear to be biased high. The actual value of target compound in the sample may be lower than the value reported by the laboratory.
 - Other QC parameters outside control limits. The reported results appear to be biased low. The actual value of target compound in the sample may be higher than the value reported by the laboratory.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required daily frequency.

Retention time windows were established for all homologues. The chromatographic resolution between ¹³C-2,3,7,8-TCDD and ¹³C-1,2,3,4-TCDD was less than or equal to 25%.

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

III. Initial Calibration

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

Percent relative standard deviations (%RSD) were less than or equal to 20.0% for all native compounds and less than or equal to 35.0% for all labeled compounds.

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

The minimum S/N ratio was technically acceptable.

IV. Routine Calibration (Continuing)

Routine calibration was performed at the required frequencies.

All of the routine calibration concentrations were within the QC limits.

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated dioxin/dibenzofuran contaminants were found in the method blanks with the following exceptions:

Method Blank ID	Extraction Date	Compound	Concentration	Associated Samples
WG31593-101	1/25/10	1,2,3,4,6,7,8-HpCDD OCDD Total HpCDD	0.059 ng/Kg 0.080 ng/Kg 0.059 ng/Kg	All samples in SDG DPWG31752/WG31593

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

Method blank results flagged "K" by the laboratory as estimated maximum possible concentration (EMPC) were considered not detected.

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.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LDW-SS534-010DUP (LDW-SS534-010 LDW-SS534-010DUP)	1,2,3,4,7,8-HxCDF	55.4 (≤50)	J (all detects)	А

VII. Ongoing Precision & Recovery (OPR) and Standard Reference Material (SRM) Samples

Percent recoveries (%R) of the ongoing precision and recovery samples were within QC limits.

Standard reference material samples were analyzed at the required frequency.

VIII. Regional Quality Assurance and Quality Control

Not applicable.

IX. Internal Standards

All internal standard recoveries were within QC limits.

X. Target Compound Identifications

All target compound identifications were within validation criteria.

XI. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31752/WG31593	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	A

XII. System Performance

The system performance was acceptable.

XIII. Overall Assessment of Data

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
LDW-SS504-010 LDW-SS506-010 LDW-SS512-010 LDW-SS518-010 LDW-SS519-010 LDW-SS521-010 LDW-SS522-010 LDW-SS534-010 LDW-SS541-010 LDW-SS534-010UP	2,3,7,8-TCDF (from DB-5)	R	A

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Data Qualification Summary - SDG DPWG31752/WG31593

SDG	Sample	Compound	Flag	A or P	Reason
DPWG31752/ WG31593	LDW-SS534-010 LDW-SS534-010DUP	1,2,3,4,7,8-HxCDF	J (all detects)	А	Duplicate sample analysis (RPD)
DPWG31752/ WG31593	LDW-SS508-010 LDW-SS504-010 LDW-SS506-010 LDW-SS512-010 LDW-SS518-010 LDW-SS519-010 LDW-SS521-010 LDW-SS521-010 LDW-SS534-010 LDW-SS534-010 LDW-SS534-010DUP	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	А	Compound quantitation and CRQLs (EMPC)
DPWG31752/ WG31593	LDW-SS504-010 LDW-SS506-010 LDW-SS512-010 LDW-SS518-010 LDW-SS519-010 LDW-SS521-010 LDW-SS521-010 LDW-SS534-010 LDW-SS534-010 LDW-SS534-010DUP	2,3,7,8-TCDF (from DB-5)	R	А	Overall assessment of data

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG DPWG31752/WG31593

No Sample Data Qualified in this SDG

	ion findings workshe	ets.						
	Validati	ion Area			C	omments		
1.	Technical holding times		1	Sampling dates:		-17/0	9	
I.	HRGC/HRMS Instrume		14		/	,		
II.	Initial calibration		1	20/35	70			
/.	Routine calibration		4	RC L	imits.			
<i>'</i> .	Blanks		w					
1.	Matrix spike/Matrix spik	e duplicates / DV+	N/AX	iv				
II.	Laboratory control sam	/	A	OPR. C	=RM			
II.	Regional quality assura	nce and quality control	N					
(.	Internal standards		4					
ζ.	Target compound ident	ifications	A					
J	Compound quantitation	and CRQLs	M/				***	
II.	System performance		A					
II.	Overall assessment of	data	W					
V.	Field duplicates		1	.:				
v.	Field blanks						·	
	A = Acceptable N = Not provided/applic SW = See worksheet ad Samples:	cable R = R	No compound insate Field blank	s detected	D = Duplicate TB = Trip blant EB = Equipme			1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
7	LDW-SS508-010	11 LDW-SS53	4-010DUP	21 1/4	£31593-	10/31		
71	LDW-SS504-010	12	10.000	22		32		
	LDW-SS506-010	13		23		33		
	LDW-SS512-010	/14		24		34	·	
П	LDW-SS518-010	15		25		35		
	LDW-SS519-010	16		26		36		
zΓ	LDW-SS521-010	17		27		37		
	LDW-SS522-010	18		28		38		
	LDW-SS534-010	19		29		39		1.
	LDVV-55534-010	1131						

Level IV

LDC #: 22536B21 VALIDATION COMPLETENESS WORKSHEET

SDG #: DPWG31752/WG31593

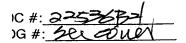
DC #: 22536B2 DG #: <u>see coue</u>

VALIDATION FINDINGS CHECKLIST

Page: /of 3
Reviewer: 0
2nd Reviewer:

Method: Dioxins/Dibenzofurans (EPA SW 846 Method 8290) 161 ろ)

Validation Area	Yes	No	NA	Findings/Comments
f: Technical holding times		1		
All technical holding times were met.	1/			
Cooler temperature criteria was met.	17			
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?	1			
Were the retention time windows established for all homologues?	-	-		
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers \leq 25% ?				
Is the static resolving power at least 10,000 (10% valley definition)?				
Was the mass resolution adequately check with PFK?	/			
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?				
III. Initial calibration				
Was the initial calibration performed at 5 concentration levels?				
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled standards and \leq 30% for labeled standards?		-		
Did all calibration standards meet the Ion Abundance Ratio criteria?				
Was the signal to noise ratio for each target compound \geq 2.5 and for each recovery and internal standard \geq 10?	1			
IV. Continuing calibration	11			
Was a routine calibration performed at the beginning and end of each 12 hour period?				
Were all percent differences (%D) <20% for unlabeled standards and 30% for labeled standards weet RC UWHS?	7			
Did all routine calibration standards meet the Ion Abundance Ratio criteria?	7			
V. Blanks				
Was a method blank associated with every sample in this SDG?	\overline{A}			
Was a method blank performed for each matrix and concentration?	7			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet?	1			
VI. Matrix spike/Metrix spike duplicates				
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.		7		DUP
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			7	
Al. Laboratory control samples				
Nas an LCS analyzed for this SDG?	7		T	



VALIDATION FINDINGS CHECKLIST

Page: →of 3 Reviewer: ← 2nd Reviewer: ______

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?		-		
VIII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?				
Were the performance evaluation (PE) samples within the acceptance limits?				
IX: Internal standards				
Were internal standard recoveries within the 40-135% criteria?			L	
Was the minimum S/N ratio of all internal standard peaks \geq 10?				
X. 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 and labeled standard \geq 2.5?				
Does the maximum intensity of each specified characteristic ion coincide within \pm 2 seconds (includes labeled standards)?	/			
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?				
Was an acceptable lock mass recorded and monitored?				
XI. Compound quantitation/CRQLs				
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. System performance				
System performance was found to be acceptable.				
XIII. Overall assessment of data	Γ	r —	ı	
Overall assessment of data was found to be acceptable.				
XIV. Field duplicates				
Field duplicate pairs were identified in this SDG.				

)C#: 22536B2)G#: Ser conel

VALIDATION FINDINGS CHECKLIST

Page: 3of 3 Reviewer: 4

Validation Area	Yes	No	NA	Findings/Comments
Target compounds were detected in the field duplicates.				
XV. Field blanks				
Field blanks were identified in this SDG.				,
Target compounds were detected in the field blanks.			/	

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290).

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. 12.3.6.7.8-HxCDD	1, 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:

SDG #: 46, CONN LDC #: 2253/B

VALIDATION FINDINGS WORKSHEET Blanks

2nd Reviewer:_ Page: Reviewer:_

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 8298)- ノ*る*バろ_、

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

Were all samples associated with a method blank?

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

Associated Samples: Was the blank contaminated? If yes, please see qualification below. Blank extraction date: 1/29/10 Blank analysis date: 1/29/10 Conc. units: NS/FS

						· c	
tion							
Sample Identification							
Š							
				-			
	/						
Blank ID	81593-10	920.0	0.080	6500			
ō							
Compound	,	Ŧ	4	71			

Blank extraction date	Blank analysis date:	
Conc. units:	ASS	Associated dariiples.

Compound	Blank ID			Sa	Sample Identification	tion		
							-	
		-						

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".

1C#: 225 3/84

VALIDATION FINDINGS WORKSHEET Duplicate Analysis

Page:_

ETHOD: GC_ HPLC (EPA_Llestlad 1613)

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

NAN/A. Was a duplicate sample analyzed for each matrix in this SDG?

NE NA WE AN X

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duolicate ID	Matrix	Compound	RPD (I imits)	Associated Samples	Qualifications
I —			sed	Y	4.5.4	91	Mats/A
1				41	43.4		7
<u> </u>							
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V//Validation Markehaate\C\\\)IID C\

LDC #: 2253/BY SDG #: 20c CONL

Compound Quantitation and Reported CRQLs VALIDATION FINDINGS WORKSHEET

2nd Reviewer:

Page: Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) ノダノ 多入

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

Y N N N

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

*	Date	Sample ID	Finding	Associated Samples	Qualifications
		ad	ZMPC results	nd	7
		4			
	٠		,		
	,				

Comments: See sample calculation verification worksheet for recalculations

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

VALIDATIO

LUC #: <u>doingo</u>

Page: /of / Reviewer: O

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method-8290) / 6/3/

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

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

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

*	Date	Sample ID	Finding	Associated Samples	Qualifications
	-	- ' \	H ON JB-5		#\#
]		-			
Comn	Comments:				

2nd Reviewer:_ Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) /ん/ ろ₎

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 = $(A_u)(C_u)/(A_u)(C_v)$ 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,

 $A_{\bf k}$ = Area of associated internal standard $C_{\bf k}$ = Concentration of internal standard X = Mean of the RRFs

L				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Average RRF (Initial)	RRF (CSS std)	RRF (<>>>std)	%RSD	%RSD
٠	1942	1.1.01.2	2,3,7,8-TCDF (¹ 0-2,3,7,8-TCDF)	₹8.0	0.83	6.83	6.83	2.19	18.0
		ho/1 //1/	/// // 23,7,8-TCDD (*C-2,3,7,8-TCDD)	0.87	18.0	0.84	8.84	4.39	2.2
			1,2,3,6,7,8-HxCDD (1°C-1,2,3,6,7,8-HxCDD)	67.0	67.0	0.T8	0.78	1.5.1	1.48
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)	20.1	1.07	1.13	1.1%	12×	3.57
			OCDF (18c-OCDD)	0.78	0.78	0.75	0.75	19.8	20.0
8	1ctc	12/53/09	7,8-TCDF)	0.92	0.92	0.91	16.0	4.69	4.56
		///	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)		-				
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
			ocpf ("c-ocpp)						
ღ			2,3,7,8-TCDF (*0-2,3,7,8-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 (45-0CDD)						

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.

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET

, SDG #: 264

Page: 2nd Reviewer: Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) $/ \mathscr{L} / \mathscr{S} / \mathscr{S} / \mathscr{L}$

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,)(C,)/(A,)(C,)

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

 $A_{\mathbf{k}} = \text{Area of associated internal standard } C_{\mathbf{k}} = \text{Concentration of internal standard}$ $A_x = Area of compound,$ $C_x = Concentration of compound,$

L								
					Reported	Recalculated	Reported	Recalculated
	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	%D	0%
	12×04-012 15-41	1881	2,3,7,8-TCDF (*C-2,3,7,8-TCDF)	0.83	5.01	701		
	5=1	1	2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	780	(0.3	100		
		_	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	P.79	N. K.	1 18		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	44.6	44.8		
			OCDF (*c-OCDD)	0.78	8/	#3//		
7	DEOBOSIA		2,3,7,8-TCDF (1°C-2,3,7,8-TCDF)	6.93	7.11	ト・!		
	5:2		2,3,7,8-TCDD (3C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (13C-OCDD)					
ဗ	DXOM-02	101	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	6.83	9.01	10.6		
	N: 14	01/20/	2,3,7,8-TCDD (1°C-2,3,7,8-TCDD)	12.04	102	101		
$oxed{\int}$			1,2,3,6,7,8-HxCDD (°C-1,2,3,6,7,8-HxCDD)	0.79	4.4	ノルン		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	70.1	740	44.6		
			OCDF (4c-OCDD)	0.18	1	111		

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 #: 22534 B2

VALIDATION FINDINGS WORKSHEET Routine Calibration Results Verification

Page: ∠of∠ Reviewer: ✓ 2nd Reviewer: ⋌

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8299) / ムノシ)

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

% Difference = 100 * (ave. RRF - RRF)/ave. RRF RRF = (A,)(C,)/(A,)(C,)

Where: ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

 $A_{\kappa}=$ Area of compound, $A_{\kappa}=$ Area of associated internal standard $C_{\kappa}=$ Concentration of internal standard

L_					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	0%	0%
	DXOM-013	1/6	2,3,7,8-TCDF (¹⁸ C-2,3,7,8-TCDF)	0.83	10.1	701		
	N	01/1/	2,3,7,8-TCDD (1ºC-2,3,7,8-TCDD)	187	10.0	0.01		
			1,2,3,6,7,8-HxCDD (³ C-1,2,3,6,7,8-HxCDD)	0.79	2,8	54.5		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	433	43.4		
			OCDF (%C-OCDD)	0.78	211			
7			2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (°C-OCDD)					
က			2,3,7,8-TCDF (°C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (1°C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
		-	OCDF (%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.

SDG #: Les GOUN LUC #: ASSOCIA

Laboratory Control Sample Results Verification VALIDATION FINDINGS WORKSMEET

707 2nd Reviewer: ___ Reviewer:__ Page:

METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 8290) ノ*≤*ィろ)

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

LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: WE315/3-10 (DF

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

	ຮ	ike	Spiked S	ample	SOI	8	ICSD	, di	I CS/I CSD	CSD
Compound	Ad (M)	Added (NSM)	Concentration (M 5 m)	tration	Percent Recovery	есочегу	Percent Recovery	ecovery	RPD	O
	SOI	1 CSD	SUL	1 CSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	10.6	λN	9.72	₩	91.7	91.7				
1,2,3,7,8-PeCDD	3.95		19.6		87.6	876				
1,2,3,4,7,8-HxCDD	2.65		52.4		88.5	588				
1,2,3,4,7,8,9-HpCDF	0.00		44.2		884	88.4				
OCDF	109	//	118		109	108				
				•		:				
						*				
								:		
	-					-				

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.

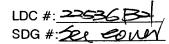
Analyte	HPCDF HPCDF (S) HPCDF (S) HPCDD HPCDD HPCDD (S) NCDPE (S)	000F 000D 000D 000D (8) 000D (8) PFK	
Elemental Composition	C ₁₂ H ³⁶ Cl ₃ 7ClO C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O 3C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O 3C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O 3C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O 3C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O 3C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O C ₁₂ H ³⁶ Cl ₃ 7Cl ₂ O	C, 301,37010 C, 301,37010 C, 301,37010, C, 301,37010, C, 301,37010, C, 301,3701,0, C, 301,3701,0,	
Ol nol	M M M M M M M M M M M M M M M M M M M	M M M M M M M M M M M M M M M M M M M	
Accurate Mass ^(a)	407.7818 409.7788 417.8250 419.8220 423.7767 425.7737 435.8169 437.8140 479.7165 [430.9728]	441.7428 443.7399 457.7377 459.7348 469.7780 513.6775 [422.9278]	
Descriptor	4	ഗ	
Analyte	TCDF TCDF (S) TCDP (S) TCDD TCDD (S) TCDD (S) HXCDPE	Pecdr Pecdr Pecdr (s) Pecdr (s) Pecdd Pecdd (s) Pecdd (s) Pecdd (s) Pecdd (s)	HKCDF HKCDF (S) HKCDF (S) HKCDD HKCDD HKCDD (S) HKCDD (S) OCDPE
Elemental Composition	C ₁₂ H ₂ *Cl ₂ O C ₁₂ H ₂ *Cl ₃ O 1°C ₂ H ₂ *Cl ₃ O 1°C ₂ H ₂ *Cl ₃ O C ₁₂ H ₂ *Cl ₃ O C ₁₂ H ₂ *Cl ₃ O 1°C ₂ H ₂ *Cl ₃ O 1°C ₂ H ₂ *Cl ₃ O C ₁₂ H ₂ *Cl ₃ OCl ₂ C ₁₂ H ₂ *Cl ₃ OCl ₂ C ₁₂ H ₂ *Cl ₃ OCl ₂	C ₁₂ H ₂ C ₁₃ TClO C ₁₂ H ₂ C ₁₃ TClO C ₁₂ H ₂ C ₁₃ TCl ₂ O C ₁₂ H ₂ C ₁₃ TCl ₂ O C ₁₂ H ₂ C ₁₃ TCl ₂ O C ₁₂ H ₂ C ₁₃ TCl ₂ O ₂ C ₁₂ H ₃ C ₁₃ TCl ₂ O ₂ C ₁₃ H ₂ C ₁₃ TCl ₂ O ₂ C ₁₅ H ₂ C ₁₃ TCl ₂ O ₂ C ₂ H ₃ C ₁₃ TCl ₂ O ₂ C ₂ H ₃ C ₁₃ TCl ₂ O ₂ C ₂ H ₃ C ₁₃ TCl ₂ O ₂ C ₂ F ₁₃	C ₁ 2H ₂ 3Cl ₃ 7ClO C ₁ 2H ₂ 3Cl ₄ 7Cl ₂ O 13C ₁ 2H ₂ 3Cl ₄ 7Cl ₂ O 13C ₁ 2H ₂ 3Cl ₃ 7ClO C ₁ 2H ₂ 3Cl ₃ 7ClO C ₁ 2H ₂ 3Cl ₃ 7ClO ₂ C ₁ 3H ₂ 3Cl ₃ 7ClO ₂ C ₁ 3H ₂ 3Cl ₃ 7ClO ₂ C ₁ 2H ₂ 3Cl ₃ 7Cl ₂ O C ₁ 2H ₂ 3Cl ₃ 7Cl ₂ O C ₁ 2H ₂ 3Cl ₃ 7Cl ₂ O C ₁ 2H ₂ 3Cl ₃ 7Cl ₂ O
Ol nol	M A 2 M A 2 M A 2 M A 2 M A 4	M M M M M M M M M M M M M M M M M M M	M+2 M+2 M+2 M+4 M+4 M+4
Accurate mass ^(a)	303.9016 305.8987 315.9419 317.9389 319.8965 321.8936 331.9368 333.9338 375.8364 [354.9792]	339.8597 341.8567 351.9000 353.8970 355.8546 357.8516 367.8519 369.8919 409.7974 [354.9792]	373.8208 375.8178 383.8639 385.8610 389.8156 391.8127 401.8559 403.8529 445.7555 [430.9728]
Descriptor	-	a	හ

(a) The following nuclidic masses were used:

H = 1.007825	C = 12.000000	13 C = 13,003355	F = 18.9984

O = 15.994915 $^{36}Cl = 34.968853$ $^{37}Cl = 36.965903$

S = internal/recovery standard



VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page:_	/of_/
Reviewer:	9
2nd reviewer:	\mathcal{A}
•	/ (

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)) (1) ろ)

Y N N/A N N/A Were all reported results recalculated and verified for all level IV samples?

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

Concentration = (A,)(I,)(DF) $(A_{is})(RRF)(V_o)(%S)$ Area of the characteristic ion (EICP) for the compound to be measured Area of the characteristic ion (EICP) for the specific internal standard Amount of internal standard added in nanograms (ng) ٧ Volume or weight of sample extract in milliliters (ml) or grams (g). RRF Relative Response Factor (average) from the initial calibration Df Dilution Factor. Percent solids, applicable to soil and solid matrices %S

Example:
Sample I.D.
Conc. = (3.74e3) (2000)(4.46e5) (1.07)(11.6)(
4.4605) (1.07)(10.6)
= 1.48 ns/kg

T			Reported	Calculated	
	Commis ID	Compound	Reported Concentration ()	Concentration (Qualification
#	Sample ID	Compound	()	,	Quantication
					.
	·				



LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119 ATTN: Ms. Marina Mitchell April 30, 2010

SUBJECT: Lower Duwamish Waterway Group, Data Validation

Dear Ms. Mitchell,

Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on February 10, 2010. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 22575:

SDG#

Fraction

QF92, QG62

Semivolatiles, Polynuclear Aromatic Hydrocarbons, Polychlorinated Biphenyls, Metals, Wet Chemistry

The data validation was performed under EPA Level III & IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005
- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005, Dioxin/Furan Addendum, December 2009
- USEPA, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008
- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, October 2004
- 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

Please feel free to contact us if you have any questions.

Sincerely,

Stella S. Cuenco

Per Feng du

Data Validation Operations Manager/Senior Chemist

Attachment 1

.DC	SDG#	DATE REC'D	(3) DATE DUE	SV (827		SV((827 SII	'0D-	PA (827 SII	0D-	PC (80	Bs 82)	Met (SW	als 846)	A: (200	s 0.8)	TO (Plui	C mb)	To: Sol (160	ids	Pa Siz (PS	ze														
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	Ľ
Α	QF92	02/10/10	03/04/10	-	-	-	-	-	-	-	-	-	-	-	-	0	8	0	8	0	8														L
В	QG62	02/10/10	03/04/10	0	2	0	2	0	12	0	12	0	2	0	10	-	-	_		-	-														L
В	QG62	02/10/10	03/04/10	0	1	0	1	0	3	0	3	0	1	0	2	-	-	-	-	-	-												\dashv		├
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Γotal	A/SC			0	3	0	3	0	15	0	15	0	3		10	0	8	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	+

Lower Duwamish Waterway Group Data Validation Reports LDC #22575

Semivolatiles



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Lower Duwamish Waterway Group

Collection Date:

December 17, 2009 through January 11, 2010

LDC Report Date:

April 29, 2010

Matrix:

Sediment

Parameters:

Semivolatiles

Validation Level:

EPA Level III & IV

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): QG62

Sample Identification

LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010

^{**}Indicates sample underwent EPA Level IV review

Introduction

This data review covers 3 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8270D for Semivolatiles.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008).

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

Samples indicated by a double asterisk on the front cover underwent EPA Level IV review. EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by EPA Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 30.0% for all compounds.

In the case where %RSD was greater than 15.0%, the laboratory used a calibration curve to evaluate the compound. All coefficients of determination (r^2) were greater than or equal to 0.990.

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

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

Percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were within the method criteria of less than or equal to 20.0% for calibration check compounds (CCCs) and 25.0% for all other compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
1/28/10	Hexachlorocyclopentadiene	26.0	All samples in SDG QG62	J (all detects) UJ (all non-detects)	Α
	2,4-Dinitrophenol	31.2		J (all detects) UJ (all non-detects)	

The percent differences (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No semivolatile contaminants were found in the method blanks.

VI. Surrogate Spikes

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

VII. Matrix Spike/Matrix Spike Duplicates

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

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Flag	A or P
LCS/LCSD-012610 (All samples in SDG QG62)	4-Chloroaniline 3,3'-Dichlorobenzidine Aniline	32.7 (40-130) 38.4 (40-130) 25.2 (40-130)	- - -	54.7 (≤50) - 57.6 (≤50)	J (all detects) UJ (all non-detects)	P

Standard reference material was analyzed at the required frequency.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

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

XI. Target Compound Identifications

All target compound identifications were within validation criteria for samples on which EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by EPA Level III criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Finding	Flag	A or P
All samples in SDG QG62	Benzo(b)fluoranthene Benzo(k)fluoranthene	Due to lack of resolution between these compounds in the samples, the laboratory performed the quantitation using the total peak area and reported the average concentration for both compounds.	J (all detects) J (all detects)	А

The actual values of these compounds may be lower or higher than the values reported by the laboratory.

Raw data were not evaluated for the samples reviewed by EPA Level III criteria.

XIII. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not reported by the laboratory.

XIV. System Performance

The system performance was acceptable for samples on which EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XV. Overall Assessment

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

Samples LDW-SS527-010** and LDW-SS603-010 were identified as field duplicates. No semivolatiles were detected in any of the samples with the following exceptions:

	Concentrat	ion (ug/Kg)	
Compound	LDW-SS527-010**	LDW-SS603-010	RPD
Phenol	21	20	5
Benzoic acid	48	62	25
Acenaphthene	11	. 11	0
Fluorene	11	11	0
Phenanthrene	67	94	34

100	Concentra	tion (ug/Kg)	
Compound	LDW-SS527-010**	LDW-SS603-010	RPD
Anthracene	30	31	3
Di-n-butylphthalate	20	37	60
Fluoranthene	190	230	19
Pyrene	170	170	0
Benzo(a)anthracene	94	90	4
Bis(2-ethylhexyl)phthalate	320	230	33
Chrysene	150	140	7
Benzo(b)fluoranthene	87	94	8
Benzo(k)fluoranthene	87	94	8
Benzo(a)pyrene	86	94	9
Indeno(1,2,3-cd)pyrene	50	45	11
Dibenz(a,h)anthracene	26	22	17
Benzo(g,h,i)perylene	54	46	16
Dimethylphthalate	20U	180	200
Dibenzofuran	20U	11	200
Carbazole	20U	11	200

XVII. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Semivolatiles - Data Qualification Summary - SDG QG62

SDG	Sample	Compound	Flag	A or P	Reason
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	Hexachlorocyclopentadiene 2,4-Dinitrophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	А	Continuing calibration (%D)
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	4-Chloroaniline Aniline	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	Р	Laboratory control samples (%R)(RPD)
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	3,3'-Dichlorobenzidine	J (all detects) UJ (all non-detects)	Р	Laboratory control samples (%R)
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	А	Compound quantitation and CRQLs (peak resolution)

Lower Duwamish Waterway Group Semivolatiles - Laboratory Blank Data Qualification Summary - SDG QG62

No Sample Data Qualified in this SDG

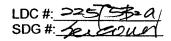
LDC #:_	22575B2a	VALIDATION COMPLETENESS WORKSHEET
SDG #:	QG62	Level ## III/TV
Laborato	ory: <u>Analytical R</u>	esources, Inc.
METHO	D: GC/MS Sem	ivolatiles (EPA SW 846 Method 8270D)



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.	Technical holding times	A	Sampling dates: (//// / 0 , 12/17/09
II.	GC/MS Instrument performance check	A	
III.	Initial calibration	\bigstar	2 50./2
IV.	Continuing calibration/ICV	Km/	12V/CCV = 2570
V.	Blanks	★	
VI.	Surrogate spikes	\Rightarrow	
VII.	Matrix spike/Matrix spike duplicates	2	dient Perfied
VIII.	Laboratory control samples	W	resto, AM
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	
XI.	Target compound identification	*	
XII.	Compound quantitation/CRQLs	W	
XIII.	Tentatively identified compounds (TICs)	N	
XIV.	System performance	\$	
XV.	Overall assessment of data	#	
XVI.	Field duplicates	KIN	D=2+3
XVII.	Field blanks	N	

Note: <u>Valida</u>	A = Acceptable N = Not provided/applicable SW = See worksheet ited Samples:	• √	ND = No compounds dete R = Rinsate FB = Field blank	ected	D = Duplicate TB = Trip blank EB = Equipment blank	
1	LDW-SS502-010-comp Sed	11	MB-012610	21		31
2	LDW-SS527-010 **	12		22		32
3	LDW-SS603-010	13		23		33
4		14		24		34
5		15		25		35
6		16		26		36
7		17		27		37
8		18		28		38
9		19		29		39
10		20		30		40

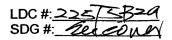


VALIDATION FINDINGS CHECKLIST

Page: /of = Reviewer: _____ 2nd Reviewer: ______

Method: Semivolatiles (EPA SW 846 Method 8270C) *

Validation Area	Yes	No	NA	Findings/Comments
All technical holding times were met.				
Cooler temperature criteria was met.			vienkije:	de de la companya de
			00 S 0 000	
Were the DFTPP performance results reviewed and found to be within the specified criteria?				
Were all samples analyzed within the 12 hour clock criteria?	/			
Did the laboratory perform a 5 point calibration prior to sample analysis?				
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?				
Was a curve fit used for evaluation?	<u></u>		<u> </u>	
Did the initial calibration meet the curve fit acceptance criteria of > 0.990?				
Were all percent relative standard deviations (%RSD) \leq 30% and relative response factors (RRF) \geq 0.05?	/	·		
Constant and a selection of the selectio				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			and the second s
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?				en la regional de la companya de la La companya de la co
Were all percent differences (%D) \leq 25% and relative response factors (RRF) \geq 0.05?				
V Parks			100	
Was a method blank associated with every sample in this SDG?	/			
Was a method blank analyzed for each matrix and concentration?				
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	,			
Minimizer and the second of th				
Were all surrogate %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 %R was less than 10 percent, was a reanalysis performed to confirm %R?				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			•	
Was a MS/MSD analyzed every 20 samples of each matrix?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences				
(RPD) within the QC limits? VIII. Esboratory control samplies: 2				
Was an LCS analyzed for this SDG?				
	نـــــا	·		



VALIDATION FINDINGS CHECKLIST

Page: → of -Reviewer: → 2nd Reviewer: __/_

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?	and the second			
o Castroni Liveri, Alegan, Para Salamatan da Para da Salamatan da Para da Para da Para da Para da Para da Para	Santa Cara			en i Transporte de la Companya de l Companya de la Companya de la Compa
Were performance evaluation (PE) samples performed?		_/		
Were the performance evaluation (PE) samples within the acceptance limits?				and the second s
Concretainance	No. of Control of Control	V. J. (1/2), (1/2)		
Were internal standard area counts within -50% or +100% of the associated calibration standard?				
Were retention times within + 30 seconds from the associated calibration standard?				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?				
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/		<u> </u>	
Were chromatogram peaks verified and accounted for?				
XII Compound summitted to CROLA				
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?	/		e e e e j ê	
MILE a reply average supply composition in the second of t				
Were the major ions (> 10 percent relative intensity) in the reference spectrum evaluated in sample spectrum?				
Were relative intensities of the major ions within ± 20% between the sample and the reference spectra?			/	
Did the raw data indicate that the laboratory performed a library search for all required peaks in the chromatograms (samples and blanks)?		1		
System performance was found to be acceptable.	/			
X/ Next assessment/congress / Section 1.	/			
Overall assessment of data was found to be acceptable.				
XVI Field pupikares (ASA) A Company (ASA)				
Field duplicate pairs were identified in this SDG.				
Target compounds were detected in the field duplicates.		<u></u>		
XVII Tudo banga				
Field blanks were identified in this SDG.		/		
Target compounds were detected in the field blanks.				o

VALIDATION FINDINGS WORKSHEET

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

A. Phenoi**	P. Bis(2-chioroethoxy)methane	EE. 2,6-Dinitrotoluene	TT. Pentachlorophenol**	III. Benzo(a)pyrene**
B. Bis (2-chloroethyl) ether	Q. 2,4-Dichlorophenol**	FF. 3-Nitroaniline	UU. Phenanthrene	JJJ. Indeno(1,2,3-cd)pyrene
C. 2-Chlorophenol	R. 1,2,4-Trichiorobenzene	GG. Acenaphthene**	W. Anthracene	KKK. Dibenz(a,h)anthracene
D. 1,3-Dichlorobenzene	S. Naphthalene	HH. 2,4-Dinitrophenol*	WW. Carbazole	LLL. Benzo(g,h,i)perylene
E. 1,4-Dichlorobenzene**	T. 4-Chloroaniline	II. 4-Nitrophenol*	XX. Di-n-butyiphthalate	MMM. Bis(2-Chlorolsopropyl)ether
F. 1,2-Dichlorobenzene	U. Hexachiorobutadiene**	JJ, Dibenzofuran	YY. Fluoranthene**	NNN. Aniline
G. 2-Methylphenoi	V. 4-Chloro-3-methylphenol**	KK. 2,4-Dinitrotoluene	ZZ. Pyrene	OOO. N-Nitrosodimethylamine
H. 2,2'-Oxybis(1-chloropropane)	W. 2-Methylnaphthalene	LL. Diethylphthalate	AAA. Butylbenzylphthalate	PPP. Benzoic Acid
I. 4-Methylphenol	X. Hexachlorocyclopentadiene*	MM. 4-Chlorophenyl-phenyl ether	BBB. 3,3'-Dichlorobenzidine	QQQ. Benzyl alcohol
J. N-Nitroso-di-n-propylamine*	Y. 2,4,6-Trichlorophenol**	NN. Fluorene	CCC. Benzo(a)anthracene	RRR. Pyridine
K. Hexachioroethane	Z. 2,4,5-Trichlorophenol	OO. 4-Nitroaniline	DDD. Chrysene	SSS. Benzidine
L. Nitrobenzene	AA. 2-Chloronaphthalene	PP. 4,6-Dinitro-2-methylphenol	EEE. Bis(2-ethylhexyl)phthaiate	111
M. Isophorone	BB. 2-Nitroaniline	QQ. N-Nitrosodiphenylamine (1)**	FFF. Di-n-octylphthalate**	ບບບ.
N. 2-Nitrophenoi**	CC. Dimethylphthalate	RR. 4-Bromophenyl-phenylether	GGG. Benzo(b)fluoranthene	ww.
O. 2,4-Dimethylphenol	DD. Acenaphthylene	SS. Hexachlorobenzene	HHH. Benzo(k)fluoranthene	www.

VALIDATION FINDINGS WORKSHEET

Continuing Calibration

Page:_

Reviewer: _ 2nd Reviewer: _

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

LDC # 222/25/20

SDG #: 26

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

Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ? Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?

Were all %D and RRFs within the validation criteria of ≤25 %D and ≥0.05 RRF?

Z

Qualifications	A M	12															
Associated Samples	加十四十四十四十四十四十四十四十四十四十四十四十四十四十四十四十四十四十四十四																
Finding RRF (Limit: >0.05)								,									
Finding %D (Limit: <25.0%)	0.90	3/.									,						
Compound	X	I															
Standard ID	1001070															,	
Date	1/28/1										0						
#										İ		- 1					

SDG #: 281 CONEY

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: ___ 2nd Reviewer: _ Reviewer:

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

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

Was a LCS required?

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

Associated Samples NA + B +				
	긲세			
RPD (Limits) ST.6 () () ()			(
LCSD %R (Limits) () () () () () () () () () (()
LCS %R (Limits) 32.7 (4/38) 32.7 (4/38) (7/3	()	()		(
Compound NININ NININ NININ NININ NININ NININ NININ NININ NINININ NININ N NININ N NININ N NININ N NININ N NININ N NININ NININI NININI NININI NININI				
105/CSD ID				
# Date				

LDC #: 225 SDG #: Zer

Compound Quantitation and Reported CRQLs VALIDATION FINDINGS WORKSHEET

Page:

2nd Reviewer:

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

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? 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) usec (Y N N/A)

Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry worked.

Qualifications	Jake 1A			-						**			
Associated Samples	an	i-max					()						
Finding	AGG BUT HAY WALL	gran ware some	Deak, and usaffed	esulta wice /2	of total conc in	sach and	roak could sex conte						
Sample ID	<u>A1</u>												
Date													
*													

Comments: See sample calculation verification worksheet for recalculations

LDC#:<u>22575B2a</u> SDG#: <u>See Cover</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_ Reviewer:_	1 of 1
2nd Reviewer:	M/

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

YN NA YN NA

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

	Concentrat	ion (ug/Kg)		Qualifications
Compound	2	3	RPD	(Parent Only)
Α	21	20	5	
PPP	48	62	25	
GG	11	11	0	
NN	11	11	0	
UU	67	94	34	
w	30	31	3	
xx	20	37	60	
YY	190	230	19	
zz	170	170	0	
ccc	94	90	4	
EEE	320	230	33	
DDD	150	140	7	
GGG	87	94	8	
ннн	87	94	8	
Ш	86	94	9	
าาา	50	45	11	
ккк	26	22	17	
Ш	54	46	16	
СС	20U	180	200	
IJ	20U	11	200	
ww	20U	11	200	

LDC #: 2555500 SDG #: 566 COUNTY

Initial Calibration Calculation Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Page:_ Reviewer:

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

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

following calculations:

RHF = $(A_u)(C_u)/(A_u)(C_v)$ 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_b = Area of associated internal standard C_b = Concentration of internal standard X = Mean of the RRFs

						AMAGEN WITH	March 19 Comment of the State o		
				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	RRF () ST std)	RRF (25 std)	Average RRF (Initial)	Average RRF (initial)	%RSD	%RSD
-	Lete	0/1/	Phenol (1st internal standard)	1 67486	1.67486	1.55526	1.5532	X SATT	83898
			Naphthalene (2nd internal standard)	1.00450	257001	71526.0	097574	14.9788	14979
			Fluorene (3rd Internal standard)	1.3403	1.3(403	04002-1	1.20070	18.11.576	18:11:58
			Pentachiorophenol-(4th internal standard) UU	50280.1	1.03205	1.04156	1.04156	16.992	12
			Bie(2-othythexyt)phthelate (5th internal standard) $DD\!$	1.10626	1.10626	887b0-1	1.09=88	14.30332	14 303A
			Benzo(a)pyrene (6th internal standard)	709bb.0	40966	0.49476	44476 O. 99476	14.16769	4.1676
2			Phenol (1st Internal standard)	13510 B	0.57667	10395.0	109950	i E	821 b 01
			Naphthalene (2nd internal standard)	-					X
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)	-					
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						
ღ			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)				3,740		
			Bertzo(a)pyrene (6th internal standerd)						

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 # COSTAND SDG #:

Continuing Calibration Results Verification VALIDATION FINDINGS WORKSHEET

Reviewer: 2nd Reviewer: Page:

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

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:

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF RRF = $(A_{\nu})(C_{\nu})/(A_{\nu})(C_{\nu})$

 $A_{\rm k} = {\sf Area}$ of associated internal standard $C_{\rm k} = {\sf Concentration}$ of internal standard $A_x = Area of compound,$ $C_x = Concentration of compound,$

							0.000	
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	0%	0%
-	10018510	01/8=/1	Phenol (1st internal standard)	JE 545.1	145406	1.45406	3	57
		. /	Naphthalene (2nd internal standard)	45260	0.98/56	0.98156	0.1	
			Fluorene (3rd internal standard)	2200=1	02198-1	1.26120	v.	50
			Pentachlorophenel (4th internal standard) \mathcal{U}	951701	1.0034X	1.0034R	3.	14 10
			Bis(2-othylbexyl)phthalate (5th internal standard)	88=601	1.08786	1.08766	4.0	0.0
			Benzo(a)pyrene (6th internal standard)	0.49476	1.01416	1.0416	1.4	7
2			Phonol (Nat Internal standard) ZZZ	0.54601	0.60740	0 4040	レン	1 M
			Naphthalene (2nd internal standard)					
			Fluorene (3rd internal standard)					
			Pentachlorophenol (4th internal standard)					
			Bis(2-ethylhexyl)phthalate (5th internal standard)					
			Benzo(a)pyrene (6th internal standard)					
ဗ			Phenol (1st internal standard)					
			Naphthalene (2nd internal standard)					
			Fluorene (3rd internal standard)					
			Pentachlorophenol (4th internal standard)					
			Bis(2-ethylhexyl)phthalate (5th internal standard)					
			Benzo(a)pyrene (6th internal standard)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results. LDC #: <u>22595B2</u>9 SDG #: <u>See eane</u>

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

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

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	J5.0	15.2379	60.8	60.610	0.3
2-Fluorobiphenyl		18.1424	72.4	72.6	V
Terphenyl-d14	V	19.4222	77.6	77.7	0.
Phenol-d5	37.5	30.2986	80.8	80.8	0
2-Fluorophenol		23.8397	63.5	63.6	0.1
2,4,6-Tribromophenol	1	33.8326	90.1	90.2	0.1
2-Chlorophenol-d4	→	24.8059	66.1	66.	0
1,2-Dichlorobenzene-d4	25.0	15.3466	61.2	61.4	02

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl	raz i William i Lawella	e e exporto de la Herita de la compositione de la composition della and the state of the state of		En 🖘	
Terphenyl-d14			N		
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#301

VALIDATION FINDINGS WORKSHEET

SDG # 100 Control Sample/Laboratory Control Sample Duplicates Results Verification

/ot/		*
Page:	Reviewer:	Reviewer:
	ax.	2nd R

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

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

% Recovery = 100 * (SC/SA

SSC = Spike concentration SA = Spike added Where:

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

LCS/LCSD samples: 405/-01-610

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

7	1									
	S	oike	S	ike	31	CS	USJI	JD.	I CS/I	CS/I CSD
Compound	**	Adold	Concent	infration	Percent Recovery	lecovery	Percent Recovery	(ecovery	RPD	Q,
	1.08	I CSD	SOI	LCSD	Reported	Recalc	Reported	Racalc	Reported	Recalculated
Phenol	205	029	75/c	289	55.0	55.0	8.75	57.8	5.0	5.0
N-Nitroso-di-n-propylamine			278	298	9'55	55.6	59.6	396	6.9	o;o
4-Chloro-3-methylphenol			349	34	8.69	69.8	88.89	68.8	4	4
Acenaphthene			317	332	63.4	634	484	66.4	4.6	4.6
Pentachlorophenol			283	240	9.95	56.6	78.0	48.0	16.4	10 A
Pyrene	>	<u></u>	373	289	74,6	74.6	77.8	77.8	4.	4.7
				,						-
				-						
				-						
		- The state of the								

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 #: 225829 SDG #: 6ex CON O

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:	
Reviewer:	4
2nd reviewer:	N_

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

_		•
ÍΥ	N	N/A
V.	N	N/A

Were all reported results recalculated and verified for all level IV samples?

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

Concentration = $(A_{\bullet})(I_{\bullet})(V_{\bullet})(DF)(2.0)$ $(A_{\bullet})(RRF)(V_{\bullet})(V_{\bullet})(\%S)$

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

A_k = Area of the characteristic ion (EICP) for the specific internal standard

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

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

V, = Volume of extract injected in microliters (ul)

V. = 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:

Conc. = (30343)(20.0)(500)(1)(1)(1)(1)

= 21.0 NS/ES

2.0		ik loi dro clearup		l and the second	
#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification
			\$1.5 2		
					,
	:				
 					
					<u> </u>

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: December 17, 2009 through January 11, 2010

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Semivolatiles

Validation Level: EPA Level III & IV

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): QG62

Sample Identification

LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010 LDW-SS502-010-compMS LDW-SS502-010-compMSD

^{**}Indicates sample underwent EPA Level IV review

Introduction

This data review covers 5 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per a modification of EPA SW 846 Method 8270D using Selected Ion Monitoring (SIM) for Semivolatiles.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008).

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals. All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 30.0% for compounds.

In the case where %RSD was greater than 15.0%, the laboratory used a calibration curve to evaluate the compound. All coefficients of determination (r^2) were greater than or equal to 0.990.

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

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 less than or equal to 25.0% with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
1/29/10	Hexachlorobenzene	36.3	All samples in SDG QG62	J (all detects) UJ (all non-detects)	Α

The percent differences (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

Date	Compound	%D	Associated Samples	Flag	A or P
1/5/10	N-Nitrosodiphenylamine	31.94	All samples in SDG QG62	J (all detects) UJ (all non-detects)	А

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No semivolatile contaminants were found in the method blanks with the following exceptions:

Method Blank ID	Extraction Date	Compound TIC (RT in minutes)	Concentration	Associated Samples
MB-012610	1/26/10	Diethylphthalate	19 ug/Kg	All samples in SDG QG62

Sample concentrations were compared to concentrations detected in the method blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated method blanks.

VI. Surrogate Spikes

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

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	RPD (Limits)	Flag	A or P
LDW-SS502-010-compMS/MSD (LDW-SS502-010-comp)	Hexachlorobenzene	133 (40-130)	131 (40-130)	-	J (all detects)	А

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
LCS-012610	Benzyl alcohol	0 (40-130)	All samples in SDG QG62	J (all detects) UJ (all non-detects)	Р

Although the percent recovery for benzyl alcohol was severely low, using professional judgement, the associated results were qualified as estimated (J/UJ) since the MS/MSD percent recoveries were within the QC limits.

Standard reference material was analyzed at the required frequency.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

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

XI. Target Compound Identifications

All target compound identifications were within validation criteria for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XIII. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not reported by the laboratory.

XIV. System Performance

The system performance was acceptable for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XV. Overall Assessment

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

Samples LDW-SS527-010** and LDW-SS603-010 were identified as field duplicates. No semivolatiles were detected in any of the samples with the following exceptions:

	Concentra	ation (ug/Kg)	
Compound	LDW-SS527-010**	LDW-SS603-010	RPD
Butylbenzyiphthalate	22	22	0

Lower Duwamish Waterway Group Semivolatiles - Data Qualification Summary - SDG QG62

SDG	Sample	Compound	Flag	A or P	Reason
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	Hexachlorobenzene	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	N-Nitrosodiphenylamine	J (all detects) UJ (all non-detects)	А	Continuing calibration (ICV %D)
QG62	LDW-SS502-010-comp	Hexachlorobenzene	J (all detects)	А	Matrix spike/Matrix spike duplicates (%R)
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010	Benzyl alcohol	J (all detects) UJ (all non-detects)	Р	Laboratory control samples (%R)

Lower Duwamish Waterway Group Semivolatiles - Laboratory Blank Data Qualification Summary - SDG QG62

No Sample Data Qualified in this SDG

VALIDATION COMPLETENESS WORKSHEET CLDC #: 22575B2b SDG #: QG62

Level TV

Reviewer: 2nd Reviewer:

Laboratory: Analytical Resources, Inc.

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

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

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 1=/17/09 - 1/11/10
11.	GC/MS Instrument performance check	7	
III.	Initial calibration	\forall	PSD. Y 2
IV.	Continuing calibration/ICV	W	PSD. Y = 101/001 < 7570
V.	Blanks	W	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	W	
VIII.	Laboratory control samples	W	Les Sty
IX.	Regional Quality Assurance and Quality Control	N,	
X.	Internal standards	1	
XI.	Target compound identification	A	
XII.	Compound quantitation/CRQLs	A	
XIII.	Tentatively identified compounds (TICs)	N	
XIV.	System performance	4	
XV.	Overall assessment of data		
XVI.	Field duplicates	M	カーンナラ
XVII.	Field blanks	N	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

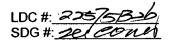
FB = Field blank

D = Duplicate

TB = Trip blank
EB = Equipment blank

Validated Samples: 14 Lund IV

M.	seds				 	
1	LDW-SS502-010-comp	11	MB-012610	21	31	
2	LDW-SS527-010 **	12		22	32	·
3	LDW-SS603-010	13		23	33	
4	LDW-SS502-010-compMS	14		24	34	
5	LDW-SS502-010-compMSD	15		25	 35	
6		16		26	 36	
7		17		27	37	
8		18		28	 38	
9		19	.,	29	39	
10		20		30	40	

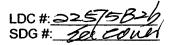


VALIDATION FINDINGS CHECKLIST

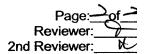
Page: __of__ Reviewer: _____ 2nd Reviewer: _______

Method: Semivolatiles (EPA SW 846 Method 8270C) "

Method: Semivolatiles (EPA SW 846 Method 8270C)				
Validation Area	Yes	No	NA	Findings/Comments
Michiel Charles				
All technical holding times were met.	/			
Cooler temperature criteria was met.		t said		en prima grande de marie de la companio de la companio de la companio de la companio de la companio de la comp
	. A 10			
Were the DFTPP performance results reviewed and found to be within the specified criteria?			3.1-6	
Were all samples analyzed within the 12 hour clock criteria?	/			
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?				· ·
Was a curve fit used for evaluation?				
Did the initial calibration meet the curve fit acceptance criteria of > 0.990?	/			
Were all percent relative standard deviations (%RSD) ≤ 30% and relative response factors (RRF) ≥ 0.05?				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			and the second s
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?		-		n i i i i i i i i i i i i i i i i i i i
Were all percent differences (%D) ≤ 25% and relative response factors (RRF) ≥ 0.05?		/		
V. Banki.				
Was a method blank associated with every sample in this SDG?				
Was a method blank analyzed for each matrix and concentration?	/			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.				
Were all surrogate %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 %R was less than 10 percent, was a reanalysis performed to confirm %R?			/	
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/	-		
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
VAIL Estoratory common samples (2004)	,			
Was an LCS analyzed for this SDG?	V_{\perp}	<u> </u>		



VALIDATION FINDINGS CHECKLIST



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?				
Were performance evaluation (PE) samples performed?				
Were the performance evaluation (PE) samples within the acceptance limits?			/	
Were internal standard area counts within -50% or +100% of the associated calibration standard?				
Were retention times within \pm 30 seconds from the associated calibration standard?				
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?		220.00	an management	
XIII seingetreinunmatka (ege s.)				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?		<u></u>		
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/	inger in	· v	and the second s
Were the major ions (> 10 percent relative intensity) in the reference spectrum evaluated in sample spectrum?				
Were relative intensities of the major ions within \pm 20% between the sample and the reference spectra?			/	
Did the raw data indicate that the laboratory performed a library search for all required peaks in the chromatograms (samples and blanks)?				
System performance was found to be acceptable.	/	**************************************		
Overall assessment of data was found to be acceptable.				
		-		
Field duplicate pairs were identified in this SDG.				
Target compounds were detected in the field duplicates.				
XXII Fine Units				
Field blanks were identified in this SDG.				
Target compounds were detected in the field blanks.				

VALIDATION FINDINGS WORKSHEET

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

			with the second the second of	
A. Phenol**	P, Bis(2-chloroethoxy)methane	EE. 2,6-Dinitrotoluene	TT. Pentachlorophenoi**	III. Benzo(a)pyrene**
B. Bis (2-chloroethyl) ether	Q. 2,4-Dichlorophenol**	FF, 3-Nitroaniline	UU. Phenanthrene	JJJ. Indeno(1,2,3-cd)pyrene
C. 2-Chlorophenol	R. 1,2,4-Trichlorobenzene	GG, Acenaphthene**	W. Anthracene	KKK. Dibenz(a,h)anthracene
D. 1,3-Dichlorobenzene	S. Naphthalene	HH. 2,4-Dinitrophenol*	WW. Carbazole	LLL. Benzo(g,h,l)perylene
E. 1,4-Dichlorobenzene**	T. 4-Chloroaniline	II. 4-Nitrophenol*	XX. Di-n-butyiphthalate	MMM. Bis(2-Chlorolsopropyl)ether
F. 1,2-Dichlorobenzene	U. Hexachiorobutadiene**	JJ. Dibenzofuran	VY. Fluoranthene**	NNN. Aniline
G. 2-Methylphenol	V. 4-Chloro-3-methylphenol**	KK. 2,4-Dinitrotoluene	ZZ. Pyrene	OOO. N-Nitrosodimethylamine
H. 2,2'-Oxybis(1-chloropropane)	W. 2-Methylnaphthalene	LL. Diethylphthalate	AAA. Butylbenzylphthalate	PPP. Benzoic Acid
i. 4-Methylphenol	X. Hexachlorocyclopentadiene*	MM. 4-Chlorophenyl-phenyl ether	BBB. 3,3'-Dichlorobenzidine	QQQ, Benzyl alcohol
J. N-Nitroso-di-n-propylamine*	Y. 2,4,6-Trichlorophenol**	NN. Fluorene	CCC. Benzo(a)anthracene	RRR. Pyridine
K. Hexachloroethane	Z. 2,4,5-Trichlorophenol	OO. 4-Nitroaniline	DDD. Chrysene	SSS. Benzidine
L. Nitrobenzene	AA. 2-Chloronaphthalene	PP. 4,6-Dinitro-2-methylphenol	EEE. Bis(2-ethylhexyl)phthalate	
M. Isophorone	BB. 2-Nitroaniline	QQ. N-Nitrosodiphenylamine (1)**	FFF. Di-n-octylphthalate**	non.
N. 2-Nitrophenol**	CC. Dimethylphthalate	RR. 4-Bromophenyl-phenylether	GGG. Benzo(b)fluoranthene	wv.
O. 2,4-Dimethylphenol	DD. Acenaphthylene	SS. Hexachlorobenzene	HHH. Benzo(k)fluoranthene	WWW

VALIDATION FINDINGS WORKSHEET

Page:

2nd Reviewer: Reviewer:

Continuing Calibration

LDC #: 225 SDG #:

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

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

| N | N/A | Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?
| N | N/A | Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?

Were all %D and RRFs within the validation criteria of ≤25 %D and ≥0.05 RRF?

Qualifications	女ノスシブ				<i></i>													
Associated Samples	W+BX			M+NA														
Finding RRF (Eimit: >0.05)																		
Finding %D (Limit: <25.0%)	31.94		N	26.7												ŕ		
Compound	88		,	8														
Standard ID	700/05/		0000	GC 0														
# Date	1/5/10		1/2/2	01/10										0				
	Щ		 Ц,		<u> </u>	<u></u>	 <u> </u>]	1		l	1	

LDC #. 225/5/26 SDG #: 1/2/ COVER

VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Reviewer. Page:

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

Was a method blank analyzed for each matrix?

XN NA

Was a method blank analyzed for each concentration preparation level?

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

Was the blank contaminated? If yes, please see gualification below. 0/ 4/0 Blank analysis date: 1/29 Blank extraction date:

Conc. units:

Sample Identification Associated Samples: 013210 Blank ID Compound

Blank analysis date: Blank extraction date: Conc. units:

Associated Samples:

Sample Identification Blank ID Compound

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

LDC #: 223 EPD SDG #: 224 COULT

Matrix Spike/Matrix Spike Duplicates VALIDATION FINDINGS WORKSHEET

Page:_ 2nd Reviewer: Reviewer:

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

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

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

N N/A

Was a MS/MSD analyzed every 20 samples of each matrix? Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

4#								
	Date	MS/MSD ID	Compound	MS %R (⊔mits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		2/4	35	133 40-130	13/40-130)	()		125/A-
				()	()	()		
				()	()	()		
				()	(·)	()		
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•				()	()	()		
				()	()	()		
		-		()	<u> </u>	(

		QC Limits	RPD	QC Limits	RPD			QC Limits	RPD	QC Limits	RPD
	Compound	(Soil)	(Soil)	(Water)	(Water)		Compound	(Soil)	(Soll)	(Water)	(Water)
ď	Phenol	26-90%	< 35%	12-110%	< 42%	GG.	Acenaphthene	31-137%	≥ 19%	46-118%	≤ 31%
ci	C. 2-Chlorophenol	25-102%	≥ 50%	27-123%	%0 <i>≯</i> ⋝	11.	4-Nitrophenol	11-114%	≥ 50%	10-80%	× 20%
ш	1,4-Dichlorobenzene	28-104%	< 27%	36-97%	%8Z >	KK.	2,4-Dinitrotoluene	28-89%	< 47%	24-96%	≥ 38%
٦	N-Nitroso-di-n-propylamine	41-126%	≥ 38%	41-116%	%8€ ⋝	Ë	Pentachiorophenol	17-109%	≥ 47%	9-103%	≥ 50%
œ	1,2,4-Trichlorobenzene	38-107%	≥ 23%	39-98%	≥ 28%	22.	Pyrene	35-142%	~36% ≥	26-127%	< 31%
>	4-Chloro-3-methylphenol	26-103%	≥ 33%	23-97%	< 42%						

LDC #: 225/5/8-10 SDG #: 5/20 KC

VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

2nd Reviewer: Reviewer: Page: _

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

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

Was a LCS required?

Y(N) N/A

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

i I	1/M1/P #	/ / /			THS ASD W										The state of the s										
Associated Samples	W + 184	,			* Lucto																			-	
RPD (Limits)	()	()			()	()	()	()		()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()
LCSD %R (Limits)	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	
LCS %R (Limits)	0 40-130		()		()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()		()	()	()	()
Compound	A A A																								
CS/LCSD ID	405-01-501																								
# Date	 																								

SDG #: See cover

Field Duplicates

Reviewer:	7
2nd reviewer:	\sim

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

ΙΥ	N	N/A
Y	N	N/A

Were field duplicate pairs identified in this SDG?

	Concentration	(MGG1	
Compound	j_	3	RPD
LA	22	22	0
7.77			
·			
	Concentration	()	
Compound			RPD
	W		
	Concentration		
Compound	Concentration	()	RPD
Compound	Concentration	()	RPD
Compound	Concentration	()	RPD
Compound	Concentration	()	RPD
Compound	Concentration		RPD
	Concentration		RPD

SDG #: Les apres LDC #: 4-24-500

Initial Calibration Calculation Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Reviewer:__ Page:

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

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

A_k = Area of associated internal standard C_k = Concentration of internal standard X = Mean of the RRFs A_x = Area of compound, C_x = Concentration of compound, S = Standard deviation of the RRFs,

				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	RRF () S etd)	RRF (2, Setd)	Average RRF Average RRF (initial)	Average RRF (initial)	%RSD	%RSD
_	194	1/4/10	Phenol (1st internal standard)	1.39959	1.39959	1410141	1.41012	255928	25598
			Napbibalone (2nd internal standard)	56020	200750	0.282/2	0.28=120.28=12		
			Hoorene (3rd internal standard)	715021	1.5031	1.50245	300	- 5030 3.004	30005
			Pentachlorophenol (4th internal standard) \leq	18204	D. 18204		8-18973 0.18973	14	17151047150
			Bie(2-eithylhexyl)phthalate (5th internal standard)				0.78522	١٧	45054
			Benzo(a)pyrene (6th internal standard)	1					
~			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)				- 44		
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						
က			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						

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

SDG #: 200 COUNTY

Continuing Calibration Results Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Page: Reviewer:

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

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 = $(A_{\nu}(C_{\nu})/(A_{\nu})(C_{\nu})$

eve. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

 A_x = Area of compound, C_x = Concentration of compound,

 $A_{\rm B} = {\sf Area}$ of associated internal standard $C_{\rm B} = {\sf Concentration}$ of internal standard

								,
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	0%	0%
-	80000	01/691	Deposo (1st internal standard)	1.41012	1.32392	1.32392	1.9	6.
		/ /	Nephthalene (2nd Internal standard)	2/282.0	1825.0	0.32291	4si	40
			Fluorene (3rd internal standard) / /	1.50245	E7527.1	(.75373	16.7	16.7
			Pentachlorophenol (4th internal standard) 🧲 🧲	0.18973	0.25930	0.25930	36.5	36.7
			Bis(2-othythexyd)phthelete (5th internal standard)	C-2870	094423	0.8423	18	20.7
			Benzo(a)pyrene (6th Internal standard)					
2			Phenol (1st internal standard)					
			Naphthalene (2nd internal standard)					-
			Fluorene (3rd internal standard)					
			Pentachlorophenol (4th Internal standard)					
			Bis(2-ethylhexyl)phthalate (5th Internal standard)					
			Benzo(a)pyrene (6th internal standard)					
ဗ			Phenol (1st internal standard)				At a constant of the constant	
			Naphthalene (2nd internal standard)					
			Fluorene (3rd internal standard)					
			Pentachlorophenol (4th internal standard)			27		
			Bis(2-ethylhexyl)phthalate (5th internal standard)					
			Benzo(a)pyrene (6th internal standard)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results. LDC #: 205/5820 SDG #: 200 COWN

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page:_	
Reviewer:_	'A
2nd reviewer:	\mathcal{N}

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found

SS = Surrogate Spiked

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	250	1.46654	58.0	58.7	0.1
2-Fluorobiphenyl		1.86182	74.4	74.5	
Terphenyl-d14		1.82824	73.3	73.1	
Phenol-d5	3.75	2.18075	58./	58.2	
2-Fluorophenol		1.81533	48.5	18.4	
2,4,6-Tribromophenol	,	300306	80.0	80.1	V
2-Chlorophenoi-d4		1.95118	52.0	52.0	0
1,2-Dichlorobenzene-d4	2.50	1.47885	59.2	59.2	V

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5				er er er er er	
2-Fluorobiphenyl	e, for the earlier ex	Harris Daniel	. we make the second		. n=j: . ⁴
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					

SDG#: 120/ COND LDC #:225/5/84

Matrix Spike/Matrix Spike Duplicates Results Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: ____ Reviewer:___ Page:

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

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

MSDC = Matrix spike duplicate concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

MS/MSD samples: ____

Compound	0							CONTRACTOR OF THE PROPERTY OF THE PARTY OF T	The state of the s		
	ממ	Ke .	Sample	Spiked Sample		Matrix Spike	Spike	Matrix Spike Duplicate	- Duplicate	MS/MSD	SD.
	Add Add Add Add Add Add Add Add Add Add	ŽŽ	Concentration	Concentration	ation	Percent Recovery	ecovery	Percent Recovery	ecovery	RPD	
	SM	USD		SM	MSD	Renorted	Recalc	Renorted	Recalc	Reported	Recalculated
Phenol					v						
so-di-n-propylamine	<u>v</u>	52	A) Z	シニ	52	76.2	-76.2	7.57	7.57	0.0	0.0
<u> </u>					-				**************************************		
Acensohthene											
lone	0	40	AZ	W. W.	12	1.88 1.88.1		86.2	86.2	\	pi.
Pyrene											

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 #: 225/28 Page SDG # 2015 CONN

VALIDATION FINDINGS WORKSHEET

<u>Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification</u>

2nd Reviewer: ______ Page: Reviewer:

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

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

SSC = Spike concentration SA = Spike added Where:

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

LCS/LCSD samples: CCS/LCSD samples: CCS/LC

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

	S	Spike	S	ike	31	CS		J. C. C.	103/	CS/I CSD
Compound	A)	X X X X X X X X X X	Concentration	A CO	Percent Recovery	Recovery	Percent	Percent Recovery	R	RPD
e de la companya del companya de la companya de la companya del companya de la companya del companya de la companya de la companya de la companya de la companya del companya de la companya dela companya de la companya de la companya dela companya de la companya dela companya de la companya dela c	1.08	I CSD	SOI	I CSD	Reported	Recalc.	Renorted	Racalc	Reported	Recalculated
Phenol										
N-Nitroso-di-n-propylamine	126	¥2	10	ν¥	744	74.4				
4-Chloro-3-methylphenol										
Acenaphthene										
Pentachlorophenol	156	*2	201	RA	769	69 2	\			
Pyrene										
			÷							

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 #: 225/5B-b SDG #5el Conel

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:	/ of
Reviewer:_	9
2nd reviewer:	N

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

R	N	N/A
7	N	N/A N/A

%S

2.0

only.

Were all reported results recalculated and verified for all level IV samples?

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

Concentration = (A_)(I,)(V)(DF)(2.0)
(A_k)(RRF)(V_0)(V)(%S)

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

A_k = 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_t = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

Factor of 2 to account for GPC cleanup

Percent solids, applicable to soil and solid matrices

Example:	
Sample I.D.	<u> </u>
Conc. = 12950	21 0.0 11 1000 11 / 11 21 0.7870) 1 11/6.2 11)
= 22.	8 mg/

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration	Qualification
ļ					•
	:		 		
	<u> </u>				
-					
				<u> </u>	

Lower Duwamish Waterway Group Data Validation Reports LDC #22575

Polynuclear Aromatic Hydrocarbons



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwmaish Waterway Group

Collection Date: December 15, 2009 through January 12, 2010

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: EPA Level III & IV

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): QG62

Sample Identification

LDW-SS503-043-comp

LDW-SS503-043-compDL

LDW-SS508-010**

LDW-SS509-010**

LDW-SS509-010DL**

LDW-SS523-010**

LDW-SS525-010

LDW-SS526-010

LDW-SS526-010DL

LDW-SS529-041-comp

LDW-SS529-041-compDL

LDW-SS530-010

LDW-SS530-010DL

LDW-SS531-010-comp

LDW-SS533-043-comp

LDW-SS544-010-comp

LDW-SS547-010

LDW-SS601-010

LDW-SS601-010MS

LDW-SS601-010MSD

^{**}Indicates sample underwent EPA Level IV review

Introduction

This data review covers 20 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per a modification of EPA SW 846 Method 8270D using Selected Ion Monitoring (SIM) for Polynuclear Aromatic Hydrocarbons.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008).

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. The cooler temperature for samples LDW-SS525-010, LDW-SS526-010 and LDW-SS526-010DL was reported at 10.6°C upon receipt by the laboratory. Using professional judgment, associated results were not qualified as estimated since polynuclear aromatic hydrocarbons are not expected to degrade significantly during transport.

All other cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals. All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 30.0% for all compounds.

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

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 less than or equal to 25.0%.

The percent differences (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polynuclear aromatic hydrocarbon contaminants were found in the method blanks.

VI. Surrogate Spikes

Surrogates were added to all samples and blanks as required by the method. Surrogate recoveries (%R) were not within QC limits for LDW-SS529-041-compDL and LDW-SS530-010DL. Since the samples were diluted out, no data were qualified.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	RPD (Limits)	Flag	A or P
LDW-SS601-010MS/MSD (LDW-SS601-010)	Fluoranthene	154 (40-130)	-	-	J (all detects)	А

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Standard reference material was analyzed at the required frequency.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

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

XI. Target Compound Identifications

All target compound identifications were within validation criteria for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
LDW-SS503-043-comp	Fluoranthene Pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	NA NA	-
LDW-SS509-010**	Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	NA	-
LDW-SS526-010	Fluoranthene Pyrene Chrysene	Sample result exceeded calibration range.	Reported result should be within calibration range.	NA	-
LDW-SS529-041-comp	Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	Sample result exceeded calibration range.	Reported result should be within calibration range.	NA	-
LDW-SS530-010	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	Sample result exceeded calibration range.	Reported result should be within calibration range.	NA	-

N/A = Not applicable

For the results above flagged "Not applicable", the affected compound results in the associated samples were deemed unusable and did not warrant qualification of the data.

Sample	Compound	Finding	Flag	A or P
LDW-SS503-043-comp LDW-SS508-010** LDW-SS509-010** LDW-SS509-010DL** LDW-SS523-010** LDW-SS525-010 LDW-SS526-010 LDW-SS526-010 LDW-SS529-041-comp LDW-SS529-041-comp LDW-SS530-010 LDW-SS530-010DL LDW-SS530-010DL LDW-SS531-010-comp LDW-SS534-010-comp LDW-SS534-010-comp LDW-SS534-010-comp	Benzo(b)fluoranthene Benzo(k)fluoranthene	Due to lack of resolution between these compounds in the samples, the laboratory performed the quantitation using the total peak area and reported the average concentration for both compounds.	J (all detects) J (all detects)	Α

The actual values of these compounds may be lower or higher than the values reported by the laboratory.

Raw data were not evaluated for the samples reviewed by Level III criteria.

XIII. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not reported by the laboratory.

XIV. System Performance

The system performance was acceptable for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XV. Overall Assessment

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
LDW-SS503-043-comp	Fluoranthene Pyrene	R R	А
LDW-SS503-043-compDL	All TCL compounds except Fluoranthene Pyrene	R	А

Sample	Compound	Flag	A or P
LDW-SS509-010**	Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	R R R R R R R R R	А
LDW-SS509-010DL**	Ali TCL compounds except Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	R	А
LDW-SS526-010	Fluoranthene Pyrene Chrysene	R R R	А
LDW-SS526-010DL	All TCL compounds except Fluoranthene Pyrene Chrysene	R	Α
LDW-SS529-041-comp	Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene		A
LDW-SS529-041-compDL	All TCL compounds except Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R	А

Sample	Compound	Flag	A or P
LDW-SS530-010	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R R R R R R R R R R R R R R R R R R R	A
LDW-SS530-010DL	All TCL compounds except Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R	Α

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

Samples LDW-SS523-010** and LDW-SS601-010 were identified as field duplicates. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

	Concentration (ug/Kg)		
Compound	LDW-SS523-010** LDW-SS601-010		RPD
Naphthalene	5.7	4.8U	200
Acenaphthylene	9.5	10	5
Acenaphthene	4.8	6.3	27
Fluorene	6.2	6.3	2
Phenanthrene	42	81	63

	Concentra				
Compound	LDW-SS523-010**	LDW-SS601-010	RPD		
Anthracene	22	32	37		
Fluoranthene	150	230	42		
Pyrene	90	150	50		
Benzo(a)anthracene	65	94	36		
Chrysene	150	180	18		
Benzo(b)fluoranthene	85	110	26		
Benzo(k)fluoranthene	85	110	26		
Benzo(a)pyrene	72	110	42		
Indeno(1,2,3-cd)pyrene	49	68	32		
Dibenz(a,h)anthracene	17	26	42		
Benzo(g,h,i)perylene	66	81	20		

XVII. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG QG62

	T ****			i	
SDG	Sample	Compound	Flag	A or P	Reason
QG62	LDW-SS601-010	Fluoranthene	J (all detects)	А	Matrix spike/Matrix spike duplicates (%R)
QG62	LDW-SS503-043-comp LDW-SS508-010** LDW-SS509-010** LDW-SS509-010DL** LDW-SS523-010** LDW-SS526-010 LDW-SS526-010 LDW-SS526-01DL LDW-SS529-041-comp LDW-SS529-041-comp LDW-SS530-010 LDW-SS530-010 LDW-SS530-010 LDW-SS530-010 LDW-SS530-010 LDW-SS530-010 LDW-SS530-010 LDW-SS531-010-comp LDW-SS531-010-comp LDW-SS547-010 LDW-SS547-010 LDW-SS601-010	Benzo(b)fluoranthene Benzo(k)fluoranthene	J (all detects) J (all detects)	A	Compound quantitation and CRQLs (peak resolution)
QG62	LDW-SS503-043-comp	Fluoranthene Pyrene	R R	А	Overall assessment of data
QG62	LDW-SS503-043-compDL	All TCL compounds except Fluoranthene Pyrene	R	А	Overall assessment of data
QG62	LDW-SS509-010**	Phenanthrene R Fluoranthene R Pyrene R Benzo(a)anthracene R Chrysene R Benzo(b)fluoranthene R Benzo(k)fluoranthene R Benzo(a)pyrene R		А	Overall assessment of data
QG62	LDW-SS509-010DL**	All TCL compounds except Phenanthrene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	R	А	Overall assessment of data
QG62	LDW-SS526-010	Fluoranthene Pyrene Chrysene	R R R	А	Overall assessment of data
QG62	LDW-\$\$526-010DL	All TCL compounds except Fluoranthene Pyrene Chrysene	R	А	Overall assessment of data

			-		
SDG	Sample	Compound	Flag	A or P	Reason
QG62	LDW-SS529-041-comp	Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R R R R R R R R R R R R R R R R R R R	А	Overall assessment of data
QG62	LDW-SS529-041-compDL	All TCL compounds except Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R	А	Overall assessment of data
QG62	LDW-SS530-010	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R R R R R R R R R R R R R R R R R R R	A	Overall assessment of data
QG62	LDW-SS530-010DL	All TCL compounds except Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	R	A	Overall assessment of data

Lower Duwamish Waterway Group Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG QG62

No Sample Data Qualified in this SDG

CLDC #: 22575B2c

VALIDATION COMPLETENESS WORKSHEET

Level X II/IV

Page:<u>//</u>d Reviewer:_*_*

Reviewer: 2nd Reviewer: 1

SDG #: QG62
Laboratory: Analytical Resources, Inc.

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

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

	Validation Area		Comments
1.	Technical holding times	W	Sampling dates: 13/15/09 - 1/12/10
<u> </u>	GC/MS Instrument performance check	A	
181.	Initial calibration	A	
IV.	Continuing calibration/ICV	4)	1cv/ccv = 1570
V.	Blanks	\triangle	/
VI.	Surrogate spikes	W	
VII.	Matrix spike/Matrix spike duplicates	W	
VIII.	Laboratory control samples	ADATA.	LCS. SRM
IX.	Regional Quality Assurance and Quality Control	N	· · · · · · · · · · · · · · · · · · ·
X.	Internal standards	A	
XI.	Target compound identification	A	
XII.	Compound quantitation/CRQLs	W	
XIII.	Tentatively identified compounds (TICs)	N	
XIV.	System performance	A	
XV.	Overall assessment of data	M	
XVI.	Field duplicates	W	D=6+18
XVII.	Field blanks	N	

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate

FB = Field blank

D = Duplicate

TB = Trip blank EB = Equipment blank

Validated Samples: * Well IV

M	sed >						
1 /	LDW-SS503-043-comp	11	LDW-SS529-041-compDL	21	MB-012610	31	
2	LDW-SS503-043-compDL	12 <	LDW-SS530-010	22		32	
3	LDW-SS50%-010 **	13 /	LDW-SS530-010DL	23		33	
4	LDW-SS509-010	14 /	LDW-SS531-010-comp	24		34	
5 /	₩¥ LDW-SS509-010DL	15 /	043 LDW-SS533-0 19 -comp	25		35	
6 /	LDW-SS523-010	16 /	LDW-SS544-010-comp	26		36	
7	LDW-SS525-010 ,	17 ,	LDW-SS547-010	27		37	
8 /	(LDW-SS526-010	18 /	LDW-SS601-010 -010-	28		38	
9 /	LDW-SS526-010DL	19	LDW-SS601-010 -010 MS	29		39	
10 /	LDW-SS529-041-comp	20	LDW-SS601-010- 010 MSD	30		40	

LDC #: 2257582C SDG #: 3de COUL

VALIDATION FINDINGS CHECKLIST

Method: Semivolatiles (EPA SW 846 Method 8270C) *

Validation Area	Yes	No	NA	Findings/Comments
i sen rationomice.				
All technical holding times were met.				
Cooler temperature criteria was met.	e glera		2.50	
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			ing the section of the contraction
Were all samples analyzed within the 12 hour clock criteria?				
	1	22./23		
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?		-		
Was a curve fit used for evaluation?	<u> </u>			
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			Ĺ	
Were all percent relative standard deviations (%RSD) \leq 30% and relative response factors (RRF) \geq 0.05?				
Machining employees a superior and the second of the second				A SAME OF THE SAME
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?				
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?				
Were all percent differences (%D) \leq 25% and relative response factors (RRF) \geq 0.05?				
V Diantiti. 1 (1965) (2) 1 (2006) (1966) (2006) (2006)				
Was a method blank associated with every sample in this SDG?	1/		<u> </u>	
Was a method blank analyzed for each matrix and concentration?	<u> </u>			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		/	agenta and the same	
Were all surrogate %R within QC limits?	ļ	/	ļ	
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?		<u></u>		
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.				
Was a MS/MSD analyzed every 20 samples of each matrix?		ļ		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				
Ville Laboratory control Lamples Was an LCS analyzed for this SDG?				

VALIDATION FINDINGS WORKSHEET

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

				Section of the sectio
A. Phenol**	P. Bis(2-chloroethoxy)methane	EE. 2,6-Dinitrotoluene	TT. Pentachlorophenol**	III. Benzo(a)pyrene**
B. Bis (2-chloroethyl) ether	Q. 2,4-Dichlorophenol**	FF. 3-Nitroaniline	UU. Phenanthrene	JJJ, Indeno(1,2,3-cd)pyrene
C, 2-Chlorophenol	R. 1,2,4-Trichlorobenzene	GG. Acenaphthene**	VV. Anthracene	KKK, Dibenz(a,h)anthracene
D. 1,3-Dichlorobenzene	S, Naphthalene	HH. 2,4-Dinitrophenol*	WW. Carbazole	LLL Benzo(g,h,l)perylene
E. 1,4-Dichlorobenzene**	T. 4-Chloroaniline	II. 4-Nîtrophenol*	XX. Di-n-butyiphthalate	MMM. Bis(2-Chloroisopropyl)ether
F. 1,2-Dichlorobenzene	U. Hexachlorobutadiene**	JJ. Dibenzofuran	YY. Fluoranthene**	NNN Aniine
G. 2-Methylphenol	V. 4-Chloro-3-methylphenol**	KK. 2,4-Dinitrotoluene	ZZ. Pyrene	OOO. N-Nitrosodimethylamine
H. 2,2'-Oxybis(1-chloropropane)	W. 2-Methylnaphthalene	LL. Diethylphthalate	AAA. Butylbenzylphthalate	PPP, Benzoic Acid
I. 4-Methylphenol	X. Hexachlorocyclopentadiene*	MM. 4-Chlorophenyl-phenyl ether	BBB. 3,3'-Dichlorobenzidine	QQQ. Benzyl alcohol
J. N-Nitroso-di-n-propylamine*	Y. 2,4,6-Trichlorophenol**	NN. Fluorene	CCC. Benzo(a)anthracene	RRR. Pyridine
K. Hexachloroethane	Z. 2,4,5-Trichlorophenol	00. 4-Nitroaniline	DDD. Chrysene	SSS. Benzidine
L. Nitrobenzene	AA. 2-Chioronaphthalene	PP. 4,6-Dinitro-2-methylphenol	EEE. Bis (2-ethylhexyl) phthalate	III. 1-Noth I washalfone
M. Isophorone	BB. 2-Nitroaniline	QQ. N-Nitrosodiphenylamine (1)**	FFF. Di-n-octylphthalate**	UUU.
N. 2-Nitrophenol**	CC. Dimethylphthalate	RR. 4-Bramophenyl-phenylether	GGG. Benzo(b)fluoranthene	, ww
O. 2,4-Dimethylphenol	DD. Acenaphthylene	SS. Hexachlorobenzene	HHH. Benzo(k)fluoranthene	WWW.
			The Spile of the second of the	



VALIDATION FINDINGS CHECKLIST

Page: Of Control Page:

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?				
Were performance evaluation (PE) samples performed?				
Were the performance evaluation (PE) samples within the acceptance limits?			/	
		To the second		Bendrade (Bendrade)
Were internal standard area counts within -50% or +100% of the associated calibration standard?	/	/		
Were retention times within ± 30 seconds from the associated calibration standard?		77 (15) 17		
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?		ĺ		
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	7			
Were chromatogram peaks verified and accounted for?		F		
XII (Canytaurd) plein fleib ACR (La 1915) (Canytaurd) (Canytaurd)				
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?				
MILE Company Code Control Code (18)				Andrews of the second of the s
Were the major ions (> 10 percent relative intensity) in the reference spectrum evaluated in sample spectrum?				
Were relative intensities of the major ions within \pm 20% between the sample and the reference spectra?			/	
Did the raw data indicate that the laboratory performed a library search for all required peaks in the chromatograms (samples and blanks)?				
				enti alla karata
System performance was found to be acceptable.				
Overall assessment of data was found to be acceptable.				
Watchers (7	Apple of the second
Field duplicate pairs were identified in this SDG.				
Target compounds were detected in the field duplicates.	/			
Field blanks were identified in this SDG.		/		
Target compounds were detected in the field blanks.			/	

LDC #: 225/5B2c SDG #: 6ex COUL

VALIDATION FINDINGS WORKSHEET Technical Holding Times

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

All circled dates have exceeded the technical holding times.

YNNA Were all cooler temperatures within validation criteria?	
METHOD : GC/MS BNA (EPA SW 846 Method 8270)	=

METHOD : GC/	MS BNA (EPA S	W 846 Method	1 8270)				
Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total #	Qualifier
7-9		Temp	Q 10.6				Text
		1					
-							
	·						
							<u> </u>
-							

ECHNICAL HOLDING TIME CRITERIA

later: Extracted within 7 days, analyzed within 40 days.

oil: Extracted within 14 days, analyzed within 40 days.

VALIDATION FINDINGS WORKSHEET

Surrogate Recovery

2nd Reviewer: Reviewer: Page:

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

SDG #: 2ed COND

W/N/N M/M/A

If 2 or more base neutral or acid surrogates were 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? Were percent recoveries (%R) for surrogates within QC limits?

	ii .					, -	 				-		<u></u>	 -										•
Qualifications	NOGAR	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	•																					QC Limits (Water) 21-100 10-123 33-110*
(s)	((~ /	(((((((((((((((((()	OC Limits (Soil) 25-121 19-122 20-130*
%R (Limits)	(DO () /) /)))))))))))))))))))	S5 (2FP) = 2-Fluorophenol S6 (TBP) = 2,4,6-Tribromophenol S7 (2CP) = 2-Chlorophenol-d4 S8 (DCB) = 1,2-Dichlorobenzene-d4
Surrogate	114		1																					
OI 0	(x25)		(xes																					QC Limits (Water) 35-114 43-116 33-141 10-94
Sample ID	S) El		5																					* QC limits are advisory QC Limits (Soil) S1 (NBZ) = Nitrobenzene-d5 23-120 S2 (FBP) = 2-Fluorobiphenyl 30-115 S3 (TPH) = Terphenyl-d14 18-137 S4 (PHL) = Phenol-d5 24-113
Date												0												nits are advisory) = Nitrobenzens) = 2-Fluorobiph) = Terphenyl-d1) = Phenol-d5
*					<u></u>																			* OC lir S1 (NBZ S2 (FBP) S3 (TPH) S4 (PHL)

1DC #: 2255522 SDG #: 261 COULD

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates

Page: Reviewer:_ 2nd Reviewer:_

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

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

| N/A | N/A | Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this

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

Was a MS/MSD analyzed every 20 samples of each matrix? Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits? Y(N) N/A

						П											Ī
Qualifications	1 Jacks/ A																
Associated Samples	8																
RPD (Umits)	()	()	(()	()	()	()	(^ _	^)	()	()	()	()	()	
MSD %R (Limits)	()	()	()	()	()	()	()		()	()	^	()	()	()	()		
MS %R (Limits)	(St. 40-13)	()	(()	()	()	()		(()	(()	()	()	()	()	
Compound														·			
OI OSW/SW	19/20	/,															
Date															3		
*																	L

	Compound	QC Limits (Soil)	RPD (Soil)	QC Limits (Water)	RPD (Water)		Compound	QC Limits (Soil)	RPD (Soil)	QC Limits (Water)	RPD (Water)
٠	Phenol	26-90%	< 35%	12-110%	≥ 42%	GG.	Acenaphthene	31-137%	≥ 19%	46-118%	< 31%
ن	2-Chlorophenol	25-102%	≥ 50%	27-123%	< 40%	=	4-Nitrophenol	11-114%	≥ 50%	10-80%	<u>< 50%</u>
ші	1,4-Dichlorobenzene	28-104%	≥ 27%	36-97%	≥ 28%	춪	2,4-Dinitratoluene	28-89%	< 47%	24-96%	< 38%
خ	N-Nitroso-di-n-propylamine	41-126%	≥ 38%	41-116%	≥ 38%	Ë	Pentachlorophenol	17-109%	< 47%	9-103%	≥ 50%
αċ	1,2,4-Trichlorobenzene	38-107%	≥ 23%	39-98%	≥ 28%	.72	Pyrene	35-142%	%9€ ⋝	26-127%	≤ 31%
>	4-Chloro-3-methylphenol	26-103%	≥ 33%	23-97%	≥ 42%						

SDG #: 200 000 LDC #: 225/3B2

Compound Quantitation and Reported CRQLs VALIDATION FINDINGS WORKSHEET

Page: 2nd Reviewer: Reviewer:

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

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

|V | N/A | N/A | Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV were

Comments: See sample calculation verification worksheet for recalculations

LDC #: 22 4 352 SDG #: 526

Compound Quantitation and Reported CRQLs VALIDATION FINDINGS WORKSHEET

Page: Reviewer:

2nd Reviewer:

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

/N N/A

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

Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation? Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Qualifications	Joets/1									1.			
Associated Samples	81-8:1					Ü	(pap						
Finding	444 and HHH WAR	grav Usice some	Deak Owe	isoabal usulto	لہ	total	ctoak could sepan						
Sample ID	1=18 1.3-18												
Date													
#													

Comments: See sample calculation verification worksheet for recalculations

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page:

2nd Reviewer: Reviewer:

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

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

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

Was the overall quality and usability of the data acceptable? KN N/A

*	Date	Sample ID	Finding	Associated Samples	Qualifications
		-	74,22		4/4
		7	\$1 except XX,22	7	
		7	WM. XX. 22. Coc.	4	
			DOD. 444. HHH. 1111		
		\$	All excet abone	5	
			(sp(#4)		
		×	W. 22. GOD	8	
		0	All except about #81	b	
Comments:	ents:				

DG #: 225(5B2

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

Page: کورکد Viewer:

Reviewer:

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

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

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

YN N/A Was the overall quality and usability of the data acceptable?

Qualifications	B/8								^	-		
Associated Samples	10	-			[2				4			
Finding	WW. VV. XX. 22. CCC 520	三	177	All except above	S.W. TTT. 44. NN. UU	VV. XX. 22, ccc. DDD	444.HHH.III.NJ	44.44C	All excent above #12			,
Sample ID	<i>a)</i>			11	<u> </u>		Y		<u>U</u>			
Date												
#												

Comments:

LDC#:<u>22575B2c</u> SDG#: <u>See Cover</u>

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: of Reviewer: 2nd Reviewer:

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

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

	Concentrat	ion (ug/Kg)		Qualifications
Compound	6	18	RPD	(Parent Only)
s	5.7	4.8U	200	
DD	9.5	10	5	
GG	4.8	6.3	27	
NN	6.2	6.3	2	
UU	42	81	63	
vv	22	32	37	
YY	150	230	42	
ZZ	90	150	50	
ccc	65	94	36	
DDD	150	180	18	
GGG	85	110	26	
KKK HHH	85	110	26	
111	72	110	42	
JJJ	49	68	32	
ккк	17	26	42	
LLL	66	81	20	

LDC #: 22958C

Initial Calibration Calculation Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Page:_ Reviewer:__

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

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 = $(A_u)(C_u)/(A_u)(C_u)$ 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_a = Area of associated internal standard C_a = Concentration of internal standard X = Mean of the RRFs

						The state of the s			
				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	RRF (2.5 etd)	RRF (> Setd)	Average RRF (initial)	Average RRF (Intial)	%RSD	%RSD
-	17	0/-/-	Phenol (1st internal standard)						
		18/2/2	Naphthalene (2nd internal standard)	1.034	1.034	E\$0.1	1.053	1.00	13.7
	?	`	Fluorene (3rd internal standard)	1.267	181	252	05c.	Wid	W.0
			Pentachicrophenol (4th internal standard) ${\cal U}{\cal U}$	611.1	611.1	1.132	(.(32	3.5	w N
			Bis(2-ethythesyl)phthalate (5th internal standard) DDD	1.135	1.135	1.116	1	/' E	N)
			Benzo(a)pyrene (6th internal standard)	1.050	1.150	1.046	1.046	5.0	5.0
2			Phenol (1st Internal standard)						
			Naphthalene (2nd internal standard)	1					
			Fluorene (3rd internal standard)						
			Pentachiorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)	÷		lor.			
ო			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)				S. T. Ja		
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th Internal standard)						

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

LDC #: 22575 B2

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

Page: Of Reviewer: Cand Reviewer:

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

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 = $(A_{\nu})(C_{\nu})/(A_{\nu})(C_{\nu})$

Where: ave. RRF = initial calibration average RRF RRF = continuing calibration RRF

 $A_x = Area of compound,$ $C_x = Concentration of compound,$

A_k = Area of associated internal standard C_k = Concentration of internal standard

				-				,	
					Reported	Recalculated	Reported	Recalculated	
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (Initial)	RRF (CC)	RRF (CC)	۵%	Q%	
	S=1000	1/85/1	Phenol (1st internal standard)	1.05					
		/ /	Naphthalene (2nd internal standard)	1.053	1.09574	1.056Z	40	4.0	-
			Fluorene (3rd internal standard)	1.250	1.30266	1.3026	Z V	NA	_
	,		Pentachierophanol (4th Internal standard) μU	1.132	1-11-104	1.11 704	W	ر' ا	_
			Bis(2 ethylhexyl)phthalate-(5th internal standard)	6	1.41W	- 4-2	グイ	7	_
			Benzo(a)pyrene (6th internal standard)	1.046	1.04626	1.04031	0.0	6.0	_
~	COPAL	1/62/1	Phenol (1st internal standard)						_
		/ /	Naphthalene (2nd internal standard)	1.053	1.06168	89190.	0.8	Į.	
			Fluorene (3rd internal standard)	1.250	0/1921	011/2	0.0	000	
			Pentachiorophenol (4th internal standard) \mathcal{M}	1.132	1.13307	1.13%	8.0	N.O	
			Bis(2-ethylhexyl)phthalate (5th internal stafidard)	. [6	1.10653	E 5901.1	6.0	000	
	-		Benzo(a)pyrene (6th internal standard)	1.046	6 1520.	1.02219	7.7	0.0	
က			Phenol (1st internal standard)	, ir					
			Naphthalene (2nd internal standard)	-					
			Fluorene (3rd Internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)			- 1984 -			
			Benzo(a)pyrene (6th internal standard)						

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10,0% of the recalculated results.

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

	Page:	/of/
	Reviewer:_	9
2nd	reviewer:_	1./

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

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

% Recovery: SF/SS * 100

Where: SF = Surrogate Found SS = Surrogate Spiked

Sample ID:___

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-gl5 / 10 - W	30	196459	65.3	65.5	0.
2-Fluorobiphenyl did [Baltoning and the commence of the property of the confidence of	2.59885	86.7	86.6	0.
Terphenyl-d14					
Phenol-d5	anta di Salah Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Baran Ba		The factor of an engineering the factor of t		
2-Fluorophenol					
2,4,6-tribromophenol					
2-Chlorophenol-d4					
1, 2-Dichlorobenz éne-d4			·		

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl		i je voj opi k e com mij	era eran eran eran garan eran gera (d. 1901). Ger		
Terphenyl-d14	en de la companya de la companya de la companya de la companya de la companya de la companya de la companya de			: :	
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					
Terphenyi-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC # 225 SDG#7

Matrix Spike/Matrix Spike Duplicates Results Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer:__ Page: Reviewer:

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

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

MSDC = Matrix spike duplicate concentration

RPD = 1 MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration

MS/MSD samples: __

	\				-						
	3	ike	Sample		ample	Matrix Spike	nike	Matrix Spike Duplicate	Duplicate	MS/MSD	J.
Compound	S. S. S. S. S. S. S. S. S. S. S. S. S. S	Addid Addid	Concentration (Concentration)	Concentration	Pation	Percent Recovery	ecovery	Percent Recovery	ecovery	RPD	
	MS	MSD		MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Creato											
edimelyanda-d-ib-aoritik-N											
4-Chloro-3-methylohenol											
Acenaphthene	4	147	6.3	751	(S)	83.8 83.8		84.8	848	3.	- M
Pentachlorophenol											
Pyrene	4 4	#	25)	275	252	88.8	88.8	694	894	\/\@	100
										/	
					a						
									20 20 20 20 20 20 20 20 20 20 20 20 20 2		

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.

SDG # JECTONON

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification VALIDATION FINDINGS WORKSHEET

/ot/	4	
age:	eviewer:	Reviewer:
ı	Revi	Revi
		g

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

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

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration SA = Spike added

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

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

LCS/LCSD samples: 405-0 1-6 (0

Compound Applied Congentation Percent Recovery Percent Recovery Reported Reported Phenol I.GS <		Sp	ike	S	ey!	31	SO	USD I		SD 1	I CS/I CSD
1CS 1CSD 1CSD Benorted Bacalo Benorted Be	Compound	3		Conce	atration -0)	Percent F	Recovery	Percent Rec	overy	12	Odi
152 NA 103 W 581 68.7 68.7 18.7 18.7 18.7 18.7) I CS	I CSD	1.08	I CSD	Reported	Recalc		Racalc	Reported	Recalculated
1.82 AN 811 AN 821 1.83 WA 78.7	Phenol				-						
158 NA 103 NA 58.7 153 NA 118 NA T8.7	N-Nitroso-di-n-propylamine							and the second			
158 NA 103 NA 68.1 153 NA 118 NA T8.7	4-Chloro-3-methylphenol										
153 NY 118 WY 78.7	Acenaphthene	251	*Z	103	¥	1.89	1×9				
187 W 78.7	Pentachiorophenol										
	Pyrene	15 J	ΝĂ	811	Ž	1,87	78.T				
						r					

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 #: 25 53 C SDG #: 20 0000

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:	
Reviewer:	9-
2nd reviewer:	DI.

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

	_	0
14	Ŋ	N/A
Y	N	N/A

Were all reported results recalculated and verified for all level IV samples?

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

\cup			
Cond	centratio	on = $\frac{(A_{*})(I_{*})(V_{*})(DF)(2.0)}{(A_{*})(RRF)(V_{*})(V_{*})(%S)}$	Example:
A _x	=	Area of the characteristic ion (EICP) for the compound to be measured	Sample I.D:
A _k	=	Area of the characteristic ion (EICP) for the specific internal standard	- 19
1.	- -	Amount of internal standard added in nanograms (ng)	Conc. = $(5/34/1)(2.3)(500)(1)(1)$
V.	=	Volume or weight of sample extract in milliliters (ml) or grams (g).	
V,		Volume of extract injected in microliters (ul)	= 91.63 19
V,	=	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 accou	int for GPC cleanup					·
#	Sample ID	Compound		Reported Concentration	•	Calculated Concentration ()	Qualification
							·
		Market Market Market Market Market Market Market Market Market Market Market Market Market Market Market Market					
	- I dive						
-							
			·		0		
			:				

Lower Duwamish Waterway Group Data Validation Reports LDC #22575

Polychlorinated Biphenyls



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: December 15, 2009 through January 12, 2010

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Polychlorinated Biphenyls

Validation Level: EPA Level III & IV

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): QG62

Sample Identification

LDW-SS502-010-comp

LDW-SS527-010**

LDW-SS603-010

LDW-SS503-043-comp

LDW-SS508-010**

LDW-SS509-010**

LDW-SS523-010

LDW-SS525-010

LDW-SS526-010

LDW-SS529-041-comp

LDW-SS530-010

LDW-SS531-010-comp

LDW-SS533-043-comp

LDW-SS544-010-comp

LDW-SS547-010

LDW-SS523-010MS

LDW-SS523-010MSD

LDW-SS525-010MS

LDW-SS525-010MSD

^{**}Indicates sample underwent EPA Level IV review.

Introduction

This data review covers 19 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8082 for Polychlorinated Biphenyls.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008).

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

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. The cooler temperature for samples LDW-SS525-010 and LDW-SS526-010 was reported at 10.6°C upon receipt by the laboratory. Using professional judgment, associated results were not qualified as estimated since polychlorinated biphenyls are not expected to degrade significantly during transport.

All other cooler temperatures met validation criteria.

II. GC/ECD Instrument Performance Check

Instrument performance was acceptable unless noted otherwise under initial calibration and continuing calibration sections.

III. Initial Calibration

Initial calibration of multicomponent compounds was performed for the primary (quantitation) column as required by the method.

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

Retention times (RT) of all compounds in the calibration standards were within QC limits for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples on which a Level III review was performed.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) of calibration factors in continuing standard mixtures were within the 20.0% QC limits.

The percent difference (%D) of the second source calibration standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Affected Compound	Flag	A or P
1/15/10	0114B044	ZB35	Aroclor-1268	21.2	LDW-SS527-010** LDW-SS603-010 LDW-SS503-043-comp LDW-SS508-010** LDW-SS525-010 LDW-SS531-010-comp LDW-SS544-010-comp LDW-SS544-010-comp LDW-SS525-010MS LDW-SS525-010MSD MB-0126102	Aroclor-1268	J (all detects) UJ (all non-detects)	Α
1/27/10	0127A021	ZB35	Aroclor-1268	24.0	LDW-SS502-010-comp LDW-SS509-010** LDW-SS523-010 LDW-SS526-010 LDW-SS529-041-comp LDW-SS530-010 LDW-SS533-043-comp LDW-SS533-043-comp LDW-SS523-010MS LDW-SS523-010MS MB-012610	Aroclor-1268	J (all detects) UJ (all non-detects)	А

Retention times (RT) of all compounds in the calibration standards were within QC limits for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples on which a Level III review was performed.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated biphenyl contaminants were found in the method blanks.

VI. Surrogate Spikes and Internal Standards

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

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

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Pesticide Cleanup Checks

a. Florisil Cartridge Check

Florisil cleanup was not required and therefore not performed in this SDG.

b. GPC Calibration

GPC cleanup was not required and therefore not performed.

XI. Target Compound Identification

All target compound identifications were within validation criteria for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria for samples on which an EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

Samples LDW-SS527-010** and LDW-SS603-010 were identified as field duplicates. No polychlorinated biphenyls were detected in any of the samples with the following exceptions:

	Concentra	ation (ug/Kg)	
Compound	LDW-SS527-010**	LDW-SS603-010	RPD
Aroclor-1248	23	23	0
Aroclor-1254	37	35	6
Aroclor-1260	31	20	43

XV. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Polychlorinated Biphenyls - Data Qualification Summary - SDG QG62

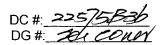
SDG	Sample	Compound	Flag	AorP	Reason
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010 LDW-SS503-043-comp LDW-SS508-010** LDW-SS509-010** LDW-SS523-010 LDW-SS525-010 LDW-SS526-010 LDW-SS530-010 LDW-SS531-010-comp LDW-SS531-010-comp LDW-SS533-043-comp LDW-SS544-010-comp	Aroclor-1268	J (all detects) UJ (all non-detects)	A	Continuing calibration (ICV %D)

Lower Duwamish Waterway Group Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG QG62

No Sample Data Qualified in this SDG

DG#	22575B3b VALIDATIO QG62 tory: Analytical Resources, Inc.		LETE _evel		,	SHEET		Date: 2/26/17 Page:
	OD: GC Polychlorinated Biphenyls (EPA mples listed below were reviewed for ea					Validation	findi	ngs are noted in attached
	on findings worksheets.	1	i -	9 14		· validation		
	Validation Area					Commer	nts	
I.	Technical holding times	w	Sampli	ng dat	es: 12/13	=109-	را .	12/10
II.	GC/ECD Instrument Performance Check	A				·		
III.	Initial calibration	1						
IV.	Continuing calibration/ICV	W	10	V /c	2c/ =	20/0		
V.	Blanks	A						
VI.	Surrogate spikes	A						
VII.	Matrix spike/Matrix spike duplicates	$\downarrow A$						
VIII.	Laboratory control samples	A	20	25				
IX.	Regional quality assurance and quality control	N						
Xa.	Florisil cartridge check	N						
Xb.	GPC Calibration	N					.	
XI.	Target compound identification	<u> </u>						
XII.	Compound quantitation and reported CRQLs	A	ļ					
XIII.	Overall assessment of data	⋪,	<u> </u>					
XIV.	Field duplicates	In	≯	= =	+3.			
XV.	Field blanks	N						
lote:	N = Not provided/applicableR = RinSW = See worksheetFB = F	lo compound sate ield blank	s detect	ed	D = Dupl TB = Trip EB = Equ			
	d Samples: ** level (V Seds						- :=:	 1
1 1 1	_DW-SS502-010-comp)-010		21	MB-01	2610	31	
フィ	_DW-SS527-010 ** 12 7 LDW-SS531	-010-comp		22	11/2 -01	-/1/2	22	1

\mathcal{M}	seds						
1	LDW-SS502-010-comp	111 l	LDW-SS530-010	21	MB-012610	31	
2	LDW-SS527-010 **	127	LDW-SS531-010-comp	22	MB-0126102	32	
37	LDW-SS603-010	13	LDW-SS533-019-comp	23		33	
47	LDW-SS503-043-comp	14 7	LDW-SS544-010-comp	24		34	
5 V	LDW-SS 30/8-010 **	15 7	LDW-SS547-010	25		35	
6	LDW-SS509-010 ***	16	LDW-SS523-010MS	26		36	
7 /	LDW-SS523-010	17	LDW-SS523-010MSD	27		37	
82	LDW-SS525-010	18 7	LDW-SS525-010MS	28		38	
9	LDW-SS526-010	19 Y	LDW-SS525-010MSD	29		39	
10	LDW-SS529-041-comp	20		30		40	



VALIDATION FINDINGS CHECKLIST

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

Method: /	GC	HPLC
1110011001		

Wethod: / GC HPLC Validation Area	Yes	No	NA	Findings/Comments
In:Technical holding:times	100	Į.		
All technical holding times were met.				
Cooler temperature criteria was met.				
II. 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?				
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?				
Were the RT windows properly established?				
IV:Continuing calibration				
Was a continuing calibration analyzed daily?				
Were all percent differences (%D) ≤ 1 5%.0 or percent recoveries 85-115%?				
Were all the retention times within the acceptance windows?				
V. Blanks				
Was a method blank associated with every sample in this SDG?				
Was a method blank analyzed for each matrix and concentration?				
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.				
VI. Surrogate spikes		Ya.		
Were all surrogate %R within the QC limits?				
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?		ac acc 1 I was as c		
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.				
Was a MS/MSD analyzed every 20 samples of each matrix?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		-		
VIII. Laboratory control samples			άħ.	
Was an LCS analyzed for this SDG?				
Was an LCS analyzed per extraction batch?				
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				
IX. Regional Quality Assurance and Quality Control	430.		1	
Were performance evaluation (PE) samples performed?				
Were the performance evaluation (PE) samples within the acceptance limits?				



VALIDATION FINDINGS CHECKLIST

Page: __of __ Reviewer: ____ 2nd Reviewer: ____

Validation Area	Yes	No	NA	Findings/Comments
X. Target compound identification				
Were the retention times of reported detects within the RT windows?		Consumeration of	2.86000P-12	
XI. Compound quantitation/CRQLs			10 5 -	
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XII. System performance				
System performance was found to be acceptable.				
XIII. Overall assessment of data 1	, il			
Overall assessment of data was found to be acceptable.				
XIV.Field duplicates				
Field duplicate pairs were identified in this SDG.				
Target compounds were detected in the field duplicates.				
XV:Field blanks			d Ser	
Field blanks were identified in this SDG.			<u></u>	
Target compounds were detected in the field blanks.			/	

VALIDATION FINDINGS WORKSHEET

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

A. alpha-BHC	I. Dieldrin	Q. Endrin ketone	Y. Aroclor-1242	GG.
B. beta-BHC	J. 4,4'-DDE	R. Endrin aldehyde	Z. Aroclor-1248	HH.
C. delta-BHC	K. Endrin	S. alpha-Chlordane	AA. Aroclor-1254	H.
D. gamma-BHC	L. Endosulfan II	T. gamma-Chlordane	BB. Aroclor-1260	JJ.
E. Heptachior	M. 4,4'-DDD	U. Toxaphene	CC. DB 608	KK.
F. Aldrin	N. Endosulfan sulfate	V. Aroclor-1016	DD. DB 1701	П.
G. Heptachlor epoxide	0.4,4'-DDT	W. Aroclor-1221	EE. 4 YOC 01-1268	MM.
H. Endosulfan I	P. Methoxychlor	X. Aroclor-1232	F.	NN.

Notes:

LDC#:225[3]

VALIDATION FINDINGS WORKSHEET **Technical Holding Times**

Page:__ Reviewer: 2nd Reviewer:

> Were all cooler temperatures within validation criteria? All circled dates have exceeded the technical holding times.

	Qualifier	Tex +									
	Total # of Days										
	Analysis date										
METHOD: / GC HPLC	Extraction date										
	Sampling Date	00									
	Preserved	11 \									
	Matrix	The T									
METHOD	Sample ID	6-8									

TECHNICAL HOLDING TIME CRITERIA

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

Both within 14 days of sample collection. Both within 14 days of sample collection. Water preserved:

Soils:

EXTRACTABLES:
Water:
Soil:

Extracted within 7 days, analyzed within 40 days.

Extracted within 14 days, analyzed within 40 days.

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VALIDATION FINDINGS WORKSHEET Continuing Calibration

Page:	Reviewer:	2nd Reviewer:

METHOD: __ GC __ HPLC (EPA_

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

Did the continuing calibration standards meet the %D / RPD validation criteria of <15.0%?

NA NIA

Were the refention times for all calibrated compounds within their respective acceptance windows? Level IV Only

	Qualifications	7/12/4					1/W/B	/ /												
	Associated Samples	2-5, 8, 12	14-15.18-19	MB-0136102			11-6-7-9-1	13.16-17	NB-012610											
Westermortes for all calibrated compounds within their respective acceptance windows Westermortes for all calibrated compounds within their respective acceptance windows	RT (Limits)	()	((((William Course design internal	()		A CONTRACTOR OF THE PROPERTY O			()	(((()	((
%D/RPD	(Limit < 15.0)			A DESCRIPTION OF THE PROPERTY			a control of the cont		manada para da manada	A CONTRACTOR CONTRACTO										
ated compound	Compound	25		COCK, Cock and Cock of Administration and Administration (Act of Adm			ZZ Z					APPLE, A SET THE THE THE THE THE THE THE THE THE T								
	Column / Detector	2835		A CALL CO. CA CATOMETER THE SECOND SE			2832			Control of the Contro										
	Standard ID	014B94		ansatema (garanta tara da da caranta taranta taranta taranta taranta taranta taranta taranta taranta taranta t			FOF15 0 127 AD 31	((< / >	e o versión de la company designado de la company de la co	Appropriate the second of the	TOTAL TOTAL CONTRACTOR	nome highway a cyntha e e santa da can tan tan tan tan tan tan tan tan tan t								
- 1/A - 1	# Date	1		And the second of the second s			1/24/10			Commission and the state of the		The second secon								

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VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	_/of_	
Reviewer:	4-	
2nd reviewer:	bÌ	\mathcal{T}

METHOD:GC HPLC (EPA)		•
Were field duplicate pairs ic Were target compounds de	dentified in this SDG? tected in the field duplicate [pairs?	
		n Mis	
Comment	Concentratio		nno.
Compound			RPD
Z	37	23	
AA PD	3/	35	<u> </u>
BB	3/	20	4.5
	Concentratio	n ()	
Compound			RPD
, , , , , , , , , , , , , , , , , , , ,			
	Concentratio	n ()	
Compound			RPD
	Concentratio	n()	
Compound			RPD
			·
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A CONTRACTOR OF THE CONTRACTOR			1-17-1-1

SDG #: Les GOUN LDC #: 225 EB3

Initial Calibration Calculation Verification VALIDATION FINDINGS WORKSHEET

/ of /	d	1
Page:_	Reviewer:_	2nd Reviewer:

HPLC METHOD: GC The calibration Factor (CF), average CF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

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

A = Area of compound, C = Concentration of compound, S = Standard deviation of the CF X = Mean of the CFs

				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
₩ **	Standard ID	Calibration Date	Compound	GF (Ø. (std)	CF CF (0 std)	Average CF (initial)	Average CF (initial)	%RSD	%RSD
-	1	1/4/10	BR-1 (2BS)	19110	1167	DE11.0 SE11.0 72110 T2110	0.1136	8.11	11:3
<u>.</u> [1		#B-1 (2835)	0,1188	0.1188	0,1188 0,1188 0,147	0.1147	10.6	10-6
Τ									
			BR-1 (2BS)	0.12387	1387	7-5-3 801-10 8012108 T85-10 T85-10	801010	1-5.3-1	5.326
1/2	tr.	01/2=/1		0.08378	0.08378	12580.012580.0837	0.0825	18452	8452 18451
I									
er.									
<u> </u>									
<u> </u>									
ν									
-									

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#: SSCTS B3b

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

Reviewer: Co-

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 CF = A/C

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

				Reported	Recalculated	Reported	Recalculated
	Calibration Date	Compound	Average CF(Ical)/ CCV Conc.	CF/Conc. CCV	CF/Conc. CCV	%D	%D
	012813064 1621.	BB-1 (285)	250.0	9682	9.682	4.2	1 /
	01/62/	BB-1 (2B3S)	<i>></i>	0'242	242.0	3,2	W V
	1 / 1	BB-1 (2805)	0.05E	788.4	5 995	6.6	65
	01/1/	BB-1 (2835)	7	254.4	254.4	R · 1	
	3 0129400G1759/2	(285) HE	0.025	259.5	259.5	XX	Øj M
	1/10	BB- (2B3S)	250.0	1.0tc	340.	J.0	4.0
1							
•							

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 #: 225/5839 SDG #: 28/2010

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

2nd reviewer:_

METHOD: _GC _ HPLC

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

Sample ID:

SF = Surrogate Found SS = Surrogate Spiked

% Recovery: SF/SS * 100

Where:

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
	5 42	0.8	9.T	/ح/	/ح/	10
TENX	2B35	8.0	6.0	74.6	52	40
Sample ID:						
Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

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=	1	١
횰	I	١
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		Surrogate	Surrogate	Percent	Percent	Percent
Surrogate	Column/Detector	Spiked	Found	Recovery	Recovery	Difference
				Reported	Recalculated	

LDC#: 255 SEP SDG#: 26 DUN

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification VALIDATION FINDINGS WORKSHEET

/ot/	4	<i>\</i>
Page:	Reviewer:	2nd Reviewer:

METHOD: GC HPLC

The percent recoveries (%R) and Relative Percent difference (RPD) of the 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 SSCLCS - SSCLCSD I * 2/(SSCLCS + SSCLCSD)

LCS/LCSD samples: 125-18610

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

Spiked Sample LCS LCSD LCSD LCS/LCSD	Concentration Percent Recovery Recovery RPD	TCS TCSD Reb											143 NA PIS PIS
rcs	Percent Re	ported											15.
													F
Sample	intration	CSD					-						XX
Spiked	Conce	SOT											4 W
pikę	Agold (Agos)	CSD											\$
S		SOT											200
	Compound		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)	袋

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.

SDG #Jack COUN LDC #= 225 B3

Matrix Spike/Matrix Spike Duplicates Results Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: 12 Reviewer:_ Page:

> HPLC ၁၅ METHOD:

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

using the following calculation: %Recovery = 100 * (SSC - SC)/SA

Where

SC = Sample concentration

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

SSC = Spiked sample concentration SA = Spike added MS = Matrix spike

MSD = Matrix spike duplicate

MS/MSD samples:

	Spike		Sample	Spike S	ample	Matrix spike	spike	Matrix Spike Duplicate	3 Duplicate	MS/MSD	SD
Compound	Adage		Sono	Concentration	Mation (Percent Recovery	ecovery	Percent Recovery	ecovery	RPD	G
	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)											
H	1.1	98.	325	106	1.10	7.S.T	72.7	10.	4	0	M

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 #. 225 1283 SDG #: 20

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:

2nd Reviewer: __ Reviewer:

N/A	N/A
Z	χV
	نـــــــــــــــــــــــــــــــــــــ

Were all recalculated results for detected target compounds agree within 10% of the reported results? Were all reported results recalculated and verified for all level IV samples?

(RF)(Vs or Ws)(%S/100) (A)(Fv)(Df) Concentration=

Area or height of the compound to be measured

A= Area or height of the cor Fv= Final Volume of extract

RF= Average response factor of the compound Dilution Factor 造

Vs= Initial volume of the sample Ws= Initial weight of the sample %S= Percent Solid In the initial calibration

Example:

かり Compound Name __ d Sample ID.

h

(32424581[33) (0:09245) Concentration = (606468)(80=173.49

= 30.T Mg-S	Qualifications				
	Recalculated Results Concentrations (
paB 1260 = (173.494141.2+149.37(5)(1)	Reported Concentrations				
PCB 1260	Compound				
	Sample ID				
	#				

Comments: _

Lower Duwamish Waterway Group Data Validation Reports LDC #22575

Metals



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Lower Duwamish Waterway Group

Collection Date:

December 15, 2009 through January 12, 2010

LDC Report Date:

April 29, 2010

Matrix:

Sediment

Parameters:

Metals

Validation Level:

EPA Level III & IV

Laboratory:

Analytical Resources, Inc.

Sample Delivery Group (SDG): QG62

Sample Identification

LDW-SS502-010-comp

LDW-SS527-010**

LDW-SS603-010

LDW-SS503-043-comp

LDW-SS508-010**

LDW-SS509-010**

LDW-SS523-010

LDW-SS525-010

LDW-SS526-010

LDW-SS529-041-comp

LDW-SS530-010

LDW-SS531-010-comp

LDW-SS533-043-comp

LDW-SS544-010-comp

LDW-SS547-010

LDW-SS502-010-compMS

LDW-SS502-010-compDUP

^{**}Indicates sample underwent EPA Level IV review

Introduction

This data review covers 17 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 200.8 and EPA SW 846 Method 7000 for Metals. The metals analyzed were Antimony, Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Molybdenum, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

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

Blanks are summarized in Section IV.

Field duplicates are summarized in Section XIV.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is based on QC data.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. ICPMS Tune

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

III. Calibration

An initial calibration was performed.

The frequency and analysis criteria of the initial calibration verification (ICV) and continuing calibration verification (CCV) were met.

CRDL standards for ICP and AA were analyzed and reported as required.

IV. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks with the following exceptions:

Method Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Copper Zinc	0.3 mg/Kg 1 mg/Kg	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010 LDW-SS502-010-compDUP

Data qualification by the initial, continuing and preparation blanks (ICB/CCB/PBs) was based on the maximum contaminant concentration in the ICB/CCB/PBs in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated method blanks.

V. ICP Interference Check Sample (ICS) Analysis

The frequency of analysis was met.

The criteria for analysis were met.

VI. Matrix Spike Analysis

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	%R (Limits)	Flag	A or P
LDW-SS502-010-compMS (LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010 LDW-SS502-010-compDUP)	Antimony	12.8 (70-130)	J (all detects) UJ (all non-detects)	А

Although the percent recovery for antimony was severely low, using professional judgement, the associated results were qualified as estimated (J/UJ) since the post spike percent recovery was within the QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW-SS502-010-compDUP (LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010)	Nickel	30.8 (≤30)	-	J (all detects) UJ (all non-detects)	А

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

IX. Internal Standards

All internal standard percent recoveries (%R) were within QC limits.

X. Furnace Atomic Absorption QC

Graphite furnace atomic absorption was not utilized in this SDG.

XI. ICP Serial Dilution

ICP serial dilution was not performed for this SDG.

XII. Sample Result Verification

All sample result verifications were acceptable for samples on which an EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

XIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

Samples LDW-SS527-010** and LDW-SS603-010 were identified as field duplicates. No metals were detected in any of the samples with the following exceptions:

	Concentra		
Analyte	LDW-SS527-010**	LDW-SS603-010	RPD (Limits)
Arsenic	18.5	16.7	10 (≤50)
Chromium	20	25.8	25 (≤50)
Cobalt	6.7	8.6	25 (≤50)
Copper	31.4	39.7	23 (≤50)
Lead	10	15	40 (≤50)
Mercury	0.09	0.10	11 (≤50)
Nickel	16	21	27 (≤50)
Vanadium	46.9	60.7	26 (≤50)
Zinc	62	80	25 (≤50)

XV. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Metals - Data Qualification Summary - SDG QG62

SDG	Sample	Analyte	Flag	A or P	Reason
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010 LDW-SS502-010-compDUP	Antimony	J (all detects) UJ (all non-detects)	А	Matrix spike analysis (%R)
QG62	LDW-SS502-010-comp LDW-SS527-010** LDW-SS603-010 LDW-SS502-010-compDUP	Nickel	J (all detects) UJ (all non-detects)	А	Duplicate analysis (RPD)

Lower Duwamish Waterway Group Metals - Laboratory Blank Data Qualification Summary - SDG QG62

No Sample Data Qualified in this SDG

LDC #:	22575B4	VALIDATION COMPLETENESS WORKSHEET	Date: 2-16-10
SDG #:	QG62	Level IX II/II	Page: <u> of </u>
Laborato	ry: Analytical Resour	ces, Inc.	Reviewer: MG
METHO	ר. Metals (EPA Meth	nd 200.8 FPA SW 846 Method 7000)	2nd Reviewer:

METHOD: Metals (EPA Method 200.8, EPA SVV 846 Method 7000)

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

	Validation Area		Comments
I.	Technical holding times	Asw	Sampling dates: 12-15-09 through 1-12-10
11.	ICP/MS Tune	Α	Ü
III.	Calibration	Α	CRDL Std (70-130%)
IV.	Blanks	SW	
V.	ICP Interference Check Sample (ICS) Analysis	A	
VI.	Matrix Spike Analysis	5W	MS
VII.	Duplicate Sample Analysis	SW	DUP
VIII.	Laboratory Control Samples (LCS)	Α	LCS
IX.	Internal Standard (ICP-MS)	A	
X.	Furnace Atomic Absorption QC	N	not utilized
XI.	ICP Serial Dilution	7	not utilized not performed
XII.	Sample Result Verification	Α	
XIII.	Overall Assessment of Data	Α	
XIV.	Field Duplicates	SW	D = 2+3
χV	Field Blanks	7	

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

Validated Samples: 14 level IV

1

1	LDW-SS502-010-comp	11	LDW-SS530-010	21		31	
2	LDW-SS527-010 **	12	LDW-SS531-010-comp	22		32	
₃ 1	LDW-SS603-010	13 1	- 043 - LDW-SS533-0 10 -comp	23	9m H	33	
4	LDW-SS503-043-comp	14	LDW-SS544-010-comp	24		34	
5 5	-5\$508~ LDW-SS50 \ 8-010	15)	LDW-SS547-010	25		35	
6 I	LDW-SS509-010	16	LDW-SS502-010-compMS	26		36	
7	LDW-SS523-010	17	D り LDW-SS502-010-comp MSD	27	:	37	
8	LDW-SS525-010	18	PBS	28		38	
9 1	LDW-SS526-010	19		29		39	
10 1	LDW-SS529-041-comp	20		30		40	

Notes:	 	 	

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Method: Metals (EPA SW 846 Method 6010/7000/6020)				
Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times: 1999 1999 1999 1999 1999 1999 1999 19	137	(Less)		建型199 4年第二次中央支持指数
All technical holding times were met.	✓	JK		
Cooler temperature criteria was met.	<u> </u>			
II. Calibration 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
Were all instruments calibrated daily, each set-up time?	1			
Were the proper number of standards used?	/			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury and 65-115% for cyanide) QC limits?	/			
Were all initial calibration correlation coefficients > 0.995? (Level IV only)	$oxed{oldsymbol{arphi}}$			
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.	/			
McCP interference Check Sample 1 - 1941 2011				
Were ICP interference check samples performed daily?	4	 	L	
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	<u> </u>			
IV. Matrocspike/Matrix spike duplicates 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2				
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 +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.		/		
V. Laboratory control samples		(i)		数
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% QC limits for water samples and laboratory established QC limits for soils?	<u> </u>			
If MSA was performed, was the correlation coefficients > 0.995?			4	
Do all applicable analysies have duplicate injections? (Level IV only)			V	
For sample concentrations > RL, are applicable duplicate injection RSD values < 20%? (Level IV only)			4	
Were analytical spike recoveries within the 85-115% QC limits?			V	

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer:

	T		1	<u> </u>
Validation Area	Yes	No	NA	Findings/Comments
VII, ICP Señal Diudon				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the IDL?		1		
Were all percent differences (%Ds) < 10%?			/	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			1	
VIII. Internal Standards (EPA SW 046 Method 6020)			20 (2) 20 (2)	
Were all the percent recoveries (%R) within the 30-120% of the intensity of the internal standard in the associated initial calibration?	/			
If the %Rs were outside the criteria, was a reanalysis performed?			/	
IX: Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?				-
Were the performance evaluation (PE) samples within the acceptance limits?				
Xi Sample Result Vertication				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI (Vetallassesarientofdera (1995)				
Overall assessment of data was found to be acceptable.	/			
XII Field gubicates (1981) 1981 1981 1981 1981 1981 1981 1981				
Field duplicate pairs were identified in this SDG.				·
Target analytes were detected in the field duplicates.				
XIII. Field plants (See 1997) 11 20 11 11 11 11 11 11 11 11 11 11 11 11 11				
Field blanks were identified in this SDG.		/		
Target analytes were detected in the field blanks.				

LDC #: 22575 B4 SDG #: QG62

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page:_	1_of_1_
Reviewer:	MG
2nd reviewer:	12

All circled elements are applicable to each sample.

		Table 1 to (TAI)
Sample ID	Matrix	Target Analyte List (TAL)
1->3	sed	Al, (Sb, As) Ba, Be, Cd) Ca, Cr, Co, Cu) Fe, Pb, Mg, Mn, Hg, Ni) K, (Se, Ag) Na, (Ti, V, Zn, Mo) B, Si, CN,
4->15		Al, Sb, As Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
QC 16,17		Al, Sb, As) Ba, Be, Cd) Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag) Na, (II, V, Zn, Mo) B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN',
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN',
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN',
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN',
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al. Sb. As, Ba, Be, Cd. Ca, Cr. Co. Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Π, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN ⁻ ,
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Si, CN ⁻ ,
		Analysis Method
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN,
ICP Trace	sed	Al, Sb, As, Ba, Be, Cd) Ca, Cr, Co, Cu) Fe, Pb) Mg, Mn, Hg, Ni, K, Se, Ag) Na, Tl, V, Zn, Mo B, Si, CN,
ICP-MS	1	Al Sb, As Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se Ag, Na Ti V, Zn, Mo, B, Si, CN,
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN',

Comments: Mercury by CVAA if performed

PB/ICB/CCB QUALIFIED SAMPLES

Page: 1 of 1

Reviewer: MG 2nd Reviewer: L

(×01 <)

173

Soil preparation factor applied: 50 × Associated Samples: 200 Sample Concentration units, unless otherwise noted:

gulalifiel Sample Identification e Se O 3 les 3 Sa 2 Blank Action 3.00 10,00 Maximum ICB/CCB^a (11011) Maximum 17011 PB Maximum (mg/Kg) PB3 3 o. Analyte ₽ Σ Š S As Ba BB 8 පි ပိ ਨ æ Я 뫈 Ag g Se S ර ₹ Ž

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".

Note: a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

73575B4 **9862** LDC #:

VALIDATION FINDINGS WORKSHEET Matrix Spike Analysis

Page: 1 Reviewer:___ 2nd Reviewer:__

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

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

Was a matrix spike analyzed for each matrix in this SDG?

Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor

of 4 or more, no action was taken. Was a post digestion spike analyzed for ICP elements that did not meet the required criteria for matrix spike recovery? YNNA

LEYEL IV ONLY:

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

)								Ī
*	Matrix Spike ID	OI e	Matrix	Analyte	% R	Associated Samples		
<u> </u>	91		sed	9S	13.8 (70-130)	1-3, 17	* Je/UJ/A	7
<u> </u>								7
<u> </u>								Ŧ
								_
								-
L								
								7
								-
								-
								-
ဝ	Comments: P	b +sed	digostion Spike	Spike in	limit for Sb			
			0					

23575 BY 2990

VALIDATION FINDINGS WORKSHEET **Duplicate Analysis**

Page: 1 of Reviewer:__ 2nd Reviewer:

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

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?

Were all duplicate sample relative percent differences (RPD) < 20% for water samples and < 35% for soil samples? If no, see qualifications below. A control limit of ±R.L. (±2X R.L. for soil) was used for sample values that were <5X the R.L., including the case when only one of the duplicate sample values was <5X R.L.. If field blanks were used for laboratory duplicates, note in the Overall Assessment.

LEVEL IV ONLY:

Were recalculated results acceptable? See Leval IV Recalculation Worksheet for recalculations

الا	THE IST	מוכחומובת ופי	Were recaiculated results acceptable:		See Level IV necalculation Worksheet 101 recalculations.	1018.		
	# Duplicate ID	Matrix	Analyte	RPD (Limits)	Difference (Limits)	Associated Samples	Qualifications	
1	21	sed	N.	30.8 (430)		1+3, 17	5/05/A	
								T
								T
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DUP.4S2

LDC#: <u>22575</u>B4 SDG#: <u>QG62</u>

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Page:_	1_of_1_
Reviewer:	MG
2nd Reviewer:	5

METHOD: Metals (EPA Method 6010B/7000)

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

	Concentrat	ion (mg/Kg)	(< 50)
Compound	2	3	RPD
Arsenic	18.5	16.7	10
Chromium	20	25.8	25
Cobalt	6.7	8.6	25
Copper	31.4	39.7	23
Lead	10	15	40
Mercury	0.09	0.10	11
Nickel	16	21	27
Vanadium	46.9	60.7	26
Zinc	62	80	25

V:\FIELD DUPLICATES\FD_inorganic\22575B4.WPD

LDC#: 32575 B4 SDG#: 0G62

Initial and Continuing Calibration Calculation Verification VALIDATION FINDINGS WORKSHEET

Reviewer: Page:

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

An initial and 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 (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution True = concentration (in ug/L) of each analyte in the ICV or CCV source

					Recalculated	Reported	
Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	%R	%R	Acceptable (Y/N)
1102 Icv	ICP (Initial calibration)	cd	1015.	0.0001	101.5	5.101	\ \
	GFAA (Initial calibration)						
1905 ICV	CVAA (Initial calibration)	Нд	7.66	æ Ö	95.8	95.8	
1906 CCVB	ICP (Continuing calibration)	Cu	1044.	0.0001	h'hol	104.4	
	GFAA (Continuing calibration)						
1354 CCV7	CVAA (Continuing calibration)	Hq	3.92	4.0	98.0	0.86	
HOII LCV	ICP/MS (initial calibration)	, 85	49.743	50.0	99.5	2.66	
7671 CCV7	ICP/MS (Continuing calibation)	1-1	49.338	50.0	7.86	98.7	>

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# 23575 B4 990

VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

Reviewer: 16 2nd Reviewer: Page: ☐

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

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

%R = Found x 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.

RPD = <u>|S-D|</u> x 100 (S+D)/2

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

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

%D = 1-SDR x 100

Where, I = Initial Sample Result (mg/L) SDR = Serial Ditution Result (mg/L) (Instrument Reading x 5)

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

Concentration =

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	<u>l</u> of \
Reviewer:	MG
2nd reviewer:	~

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

	Please see	qualifications	below for	r all questions	answered "N"	'. Not applicabl	e questions ar	e identified	as "N/A".
-	# \	•							

Have results been reported and calculated correctly? (Y)N N/A

Are results within the calibrated range of the instruments and within the linear range of the ICP? YN N/A

 \bigcirc N N/A Are all detection limits below the CRDL?

(RD)(FV)(Dil)

Detected analyte results for _ were recalculated and verified using the following equation:

Recalculation:

 $\frac{(9.795 \text{ Mg/L})(0.050 \text{ L})(20)}{(1.051 \text{ q})(0.505)} = 18.455 \frac{\text{Mg}}{\text{g}} \text{ or } \frac{\text{Mg}}{\text{kg}}$ (in. Vol.)(%S) Raw data concentration RD Final volume (ml) F۷ initial volume (ml) or weight (G) in. Vol. Dilution factor Dil %S Decimal percent solids

Sample ID	Analyte	Reported Concentration (Mg / Kg)	Calculated Concentration (Mg / Kg)	Acceptable (Y/N)
2	As	18.5	18.5	Y
	Cr	20.	₽0.0	
	Со	6.7	6.7	
	Cu	31.4	31.4	
	Pb	10.	10.4	
	Hq	0.09	0.094	
	Hg Ni	16.	16.3	
	V	46.9 62.	46.9	
	Zn	62.	62.1	J
·				
	•			
	,			
·	·			

Lower Duwamish Waterway Group Data Validation Reports LDC #22575

Wet Chemistry



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

Lower Duwamish Waterway Group

Collection Date:

January 11 through January 12, 2010

LDC Report Date:

April 29, 2010

Matrix:

Sediment

Parameters:

Wet Chemistry

Validation Level:

EPA Level IV

Laboratory:

Analytical Resources, Inc.

Sample Delivery Groups (SDG):

QF92

Sample Identification

LDW-SS502-010-comp

LDW-SS503-043-comp

LDW-SS529-041-comp

LDW-SS531-010-comp

LDW-SS533-043-comp

LDW-SS544-010-comp

LDW-SS547-010

LDW-SS520-010

LDW-SS502-010-compMS

LDW-SS502-010-compDUP

LDW-SS502-010-compTRP

LDW-SS544-010-compDUP

LDW-SS544-010-compTRP

Introduction

This data review covers 13 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per the Plumb Method for Total Organic Carbon, PSEP Method for Particle Size, and EPA Method 160.3 for Percent Solids.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004).

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

Blank results are summarized in Section III.

Field duplicates are summarized in Section IX.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

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

b. Calibration Verification

Calibration verification frequency and analysis criteria were met for each method when applicable.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No contaminant concentrations were found in the initial, continuing and preparation blanks.

IV. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) analyses were not required by the method.

V. Duplicates/Triplicates

Duplicate (DUP) and triplicate (TRP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VI. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

VII. Sample Result Verification

All sample result verifications were acceptable.

VIII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Wet Chemistry - Data Qualification Summary - SDG QF92

No Sample Data Qualified in this SDG

Lower Duwamish Waterway Group Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG QF92

No Sample Data Qualified in this SDG

)G#	:22575A6 #:QF92 atory:_Analytical Resourc			N COMPI L	LETE evel l'		WORKS	HEET		Date: <u></u> <u></u> <u></u> - 16- Page: <u>1</u> of <u>1</u> Reviewer: <u>MG</u> 2nd Reviewer: <u></u>
ne sa	OD: TOC (Plumb Metho amples listed below were tion findings worksheets.	e revi								s are noted in attached
	Validation							Comm		
l.	Technical holding times	ALEA	9n H	SWA	Samplin	n dates:	1-11			h 1-12-10
IIa.	Initial calibration			A		<u>, catoo, </u>				
IIb.	Calibration verification			A	***					
111.	Blanks			A				187		
IV	Matrix Spike/Matrix Spike Do	uplicat	es	A	MS			1		
V	Duplicates	·		A	DU	P/T	RP			
VI.	Laboratory control samples			A	LC			·		
VII.	Sample result verification			A						
/III.	Overall assessment of data			Α						
IX.	Field duplicates			N						
x_	Field blanks			7						
te:	A = Acceptable N = Not provided/applicable SW = See worksheet	1	R = Rir	lo compounds nsate ield blank	detecte	1	D = Duplica TB = Trip bl EB = Equip	lank	nk	
idate	ed Samples: all Sedimen	+								
	LDW-SS502-010-comp	11	LDW-SS502	<u> </u>	P 21				31	
	LDW-SS503-043-comp	12		-010-compDU				*	32	***************************************
	LDW-SS529-041-comp	13		-010-compTRI					33	
	LDW-SS531-010-comp	14	PBS		24				34	
	LDW-SS533-043-comp	15			25				35	
Т	LDW-SS544-010-comp	16			26				36	
	LDW-SS547-010	17			27				37	
	LDW-SS520-010	18			28				38	
	LDW-SS502-010-compMS	19			29				39	
	DUP LDW-SS502-010-comp MSD	20			30				40	

Notes:_

Method: Inorganics (EPA Method See over)

Metrod.morganics (EPA Metrod				
Validation Area	Yes	No	NA	Findings/Comments
Effectived holding times:	. 3			
All technical holding times were met.		/		
Coolor temperature criteria was met.	/			
II. Calibration				
Were all instruments calibrated daily, each set-up time?				
Were the proper number of standards used?	1			- 1
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 (84)				
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 (2012)				
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.	1			
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.				
was used for samples that were < 5X the CRDL, including when only one of the				
was used for samples that were < 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL.				
was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL. X Laboratory course samples 2:				
was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL. ✓ Eaboratory course samples Was an LCS analytized for this SDG?	\ \ \ \ \			
was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL.				
was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL. ** Eaborators Courses amples : **Was an LCS analyzed 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?**				

LDC #: 32575A6 SDG #: QF92

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer:

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.			/	
χ. Field blanks				
Field blanks were identified in this SDG.				
Target analytes were detected in the field blanks.			/	

SDG #: QF92

VALIDATION FINDINGS WORKSHEET Sample Specific Analysis Reference

Page: __of__!

Reviewer: __MG

2nd reviewer: __

All circled methods are applicable to each sample.

Sample ID	Matrix	Po-po-pot-po-
1-18	sed	pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ (TOC)CN NH ₃ TKN CEC S Cr ⁶⁺
QC 9→11	1	
		PH Br Cl F NO, NO, SO, O-PO, ClO, TOC)CN NH, TKN CEC S Cr6+
		pH Br Cl F NO, NO, SO, O-PO, ClO, TOC CN NH, TKN CEC S Cr6+
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ ClO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		PH Br CI F NO ₃ NO ₂ SO ₄ O-PO ₄ CIO ₃ TOC CN NH ₃ TKN CEC S Cr ⁶⁺
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr5+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr8+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr8+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr8+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		ph Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br CI F NO3 NO2 SO4 O-PO4 CIO3 TOC CN NH3 TKN CEC S Cr6+
		pH Br Cl F NO3 NO2 SO4 O-PO4 ClO3 TOC CN NH3 TKN CEC S Cr6+
		3 020 0 0
1-78		Moisture Density Porosity Organic Solids Gravity Particle size
10,11		Moisture Density Porosity Organic Solids Gravity Particle size (5-11-4)
12,13		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size
		Moisture Density Porosity Organic Solids Gravity Particle size

Comments:	
Name of the last o	

LDC #: <u>2257</u>546 SDG #: <u>QF92</u>

VALIDATION FINDINGS WORKSHEET Technical Holding Times

Page: lof l Reviewer: MG 2nd reviewer: V

All circled dates have exceeded the technical holding time.

Y N N/A Were all samples preserved as applicable to each method?

Were all cooler temperatures within validation criteria? YN N/A Method: 160.3 Parameters: Total Solids Technical holding time: 7 day Sampling Analysis **Analysis Analysis Analysis Analysis** Sample ID date date date date date date Qualifier (8 day 1-19-10 1-11-10 2 3 7 8 10 11 were COM

22575AG OF92 SDG #: LDC #:

Initial and Continuing Calibration Calculation Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Page: Reviewer:

> cover see METHOD: Inorganics, Method _

0-7was recalculated. Calibration date: 70C The correlation coefficient (f) for the calibration of __

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

%R = Found x 100

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

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

					Hecalculated	Reported	
Type of Analysis	Analyte		Mag C (units)	Area (unite)	r or %R	ror %R	Acceptable (Y/N)
Initial calibration		Blenk	0.0 (49)	28147			
Calibration verification		Standard 1	(') 0.8	1770583			
		Standard 2	0.00	. 686119H			
	70C	Standard 3	40.0 ()	9454085			>
		Standard 4	100.0 (1)	36887546	-0.14/65	V = 0. 99965	-
		Standard 5		,			
		Standard 6	•	ı			
		Standard 7		,			
Calibration verification	(-		(/ out)				
	201	LCV	798. (We	498. ("They 1000. ("1/44)	99.8	. 08.80	
Calibration verification	, ()-	1/33	(/9m) 0001	() om)			
-	301	^	1000. COK	1000. (8/4) 1000. (8/4) 103. B	103.8	00.00	⋗
Calibration verification)	.]	P				
				•			

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#: 23575A6 OF92 SDG #:

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

2nd Reviewer: Reviewer:

> 5.00 S METHOD: Inorganics, Method

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

%R = Found x 100 Where, True

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). concentration of each analyte in the source.

True =

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

RPD = $\frac{1.5 \cdot D_1}{(S+D)/2}$ x 100 Where, $\frac{(S+D)}{2}$

Original sample concentration

| | | | 0

Duplicate sample concentration

					Recalculated	Reported	
Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	%R / RPD	%R / RPD	Acceptable (Y/N)
	Laboratory control sample				ī		
165		Toc	0.0998 (%) 0.100 (%)	0.100 (%)	8.66	0.001	>
6	Matrix spike sample	700	(5SR-5R) 2.13 (%) 1.86 (%) 114.5	1.86 (%)	114.5	1.9.1	
11/01/1	Duplicate sample	Total Solids	39mp 73.8 (%)	70.8 (%) 74.0 (%) 73.5 (%)	72.5 (%)	RSD recalc. refart	-

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results. LDC #: 22575A6 SDG #: 0F92

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page:	of
Reviewer:	MG
2nd reviewer:	10

METHOD: Inorganics,	Method	s <i>e</i> e	COV	er

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

WN N/A Have results been reported and calculated correctly?

V 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 #1, Toc reported with a positive detect were recalculated and verified using the following equation:

Concentration =

Recalculation:

for Mg C:

Y = Mx + b

12064713 = 2.464 e +05(x) -186465

where m = 2.464 e +05

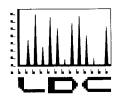
49.72 Mg C = X

b = -186465. burn ut = 2.8 mg or 0.0078q

then $\frac{49.72 \, \mu g}{0.0038 \, g} = 17757 \, \frac{\mu g}{g} \, or \, \frac{mg}{\kappa_g} \, or \, 1.776 \, \%$

	T T		7 0		
#	Sample ID	Analyte	Reported Concentration	Calculated Concentration (%70)	Acceptable (Y/N)
	1	Total Solids	72.80	72.77	Y
		TOC	1.82	1.78	
	· · · · · · · · · · · · · · · · · · ·	% Finer Than			
		4750. (um)	96.2	96.2	
		2000. ()	92-1	92.1	
		1000. ()	87.0	87.0	
		500. ()	68.6	68.6	
		250. ()	29.0	<i>3</i> 9.0	
		125. ()	9.7	9.6	
		63. ()	6.0	6.0	
		31.0 ()	4-8	4.9	
		15.6 ()	4.0	4.2	
		7.8 ()	3.5	3.6	
		3.9 ()	2.8	2.9	
		2.0 ()	1.9	3.0	
	·	1.0 (1)	1.1	1.3	

Note:	·		



LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119 ATTN: Ms. Marina Mitchell

April 30, 2010

SUBJECT: Lower Duwamish Waterway Group, Data Validation

Dear Ms. Mitchell,

Enclosed is the revised validation report for the fraction listed below. This SDG was received on February 19, 2010. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 22612:

SDG#

Fraction

DPWG31853/WG31628 Dioxins/Dibenzofurans

The data validation was performed under EPA Level IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005
- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005, Dioxin/Furan Addendum, December 2009
- EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin(PCDD) and Polychlorinated Dibenzofuran(PCDF) Data, Revision 2.0, January 1996
- USEPA, Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Diobenzofurans Data Review, September 2005

Please feel free to contact us if you have any questions.

Rei Feng In

Sincerely,

Stella S. Cuenco

Data Validation Operations Manager/Senior Chemist

	1 WEEK TAT														men																		and the second	Valence School of	
	EDD	LDC#	‡ 22612	? (W	/ind	wa	rd E	Env	iro	nme	enta	al, I	_LC	: - S	Seat	ttle	WA	\	.ow	⁄er l	Duv	wan	nisł	า W	ate	rwa	ay (∋ro	up)			PO#	Axys	07-04	•
_DC	SDG#	DATE REC'D	(3) DATE DUE		xins !90)																														
	: Water/Sediment			w		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 D	PWG31853/WG31628	3 02/19/10	02/26/10	0	12																														
Total	T/SC			0	12	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	12

Lower Duwamish Waterway Group Data Validation Reports LDC #22612

Dioxins/Dibenzofurans



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: December 15 through December 16, 2009

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Dioxins/Dibenzofurans

Validation Level: EPA Level IV

Laboratory: AXYS Analytical Services Ltd.

Sample Delivery Group (SDG): DPWG31853/WG31628

Sample Identification

LDW-SS523-010

LDW-SS530-010

LDW-SS509-010

LDW-SS501-010

LDW-SS505-010

LDW-SS507-010

LDW-SS510-010

LDW-SS514-010

LDW-SS515-010

LDW-SS516-010

LDW-SS517-010

LDW-SS525-010

LDW-SS505-010DUP

Introduction

This data review covers 13 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 1613 for Polychlorinated Dioxins/Dibenzofurans.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data (Revision 2.0, January 31, 1996) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Dibenzofurans Data Review (September 2005) as there are no current guidelines for the method stated above.

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XIV.

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
 - J1 Blank Contamination: Indicates possible high bias and/or false positives.
 - J2 Calibration Range exceeded: Indicates possible low bias.
 - J3 Holding times not met: Indicates low bias for most analytes.
 - J4 Other QC parameters outside control limits: bias not readily determined.
 - J5 Other QC parameters outside control limits. The reported results appear to be biased high. The actual value of target compound in the sample may be lower than the value reported by the laboratory.
 - J6 Other QC parameters outside control limits. The reported results appear to be biased low. The actual value of target compound in the sample may be higher than the value reported by the laboratory.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required daily frequency.

Retention time windows were established for all homologues. The chromatographic resolution between ¹³C-2,3,7,8-TCDD and ¹³C-1,2,3,4-TCDD was less than or equal to 25%.

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

III. Initial Calibration

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

Percent relative standard deviations (%RSD) were less than or equal to 20.0% for all native compounds and less than or equal to 35.0% for all labeled compounds.

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

The minimum S/N ratio was technically acceptable.

IV. Routine Calibration (Continuing)

Routine calibration was performed at the required frequencies.

All of the routine calibration concentrations were within the QC limits.

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated dioxin/dibenzofuran contaminants were found in the method blanks.

Method blank results flagged "K" by the laboratory as estimated maximum possible concentration (EMPC) were considered not detected.

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.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

VII. Ongoing Precision & Recovery (OPR) and Standard Reference Material (SRM) Samples

Percent recoveries (%R) of the ongoing precision and recovery samples were within QC limits.

Standard reference material samples were analyzed at the required frequency.

VIII. Regional Quality Assurance and Quality Control

Not applicable.

IX. Internal Standards

All internal standard recoveries were within QC limits.

X. Target Compound Identifications

All target compound identifications were within validation criteria.

XI. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31853/WG31628	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	А

XII. System Performance

The system performance was acceptable.

XIII. Overall Assessment of Data

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31853/WG31628	2,3,7,8-TCDF (from DB-5)	R	А

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Data Qualification Summary - SDG DPWG31853/WG31628

SDG	Sample	Compound	Flag	A or P	Reason
DPWG31853/ WG31628	LDW-SS523-010 LDW-SS530-010 LDW-SS509-010 LDW-SS501-010 LDW-SS505-010 LDW-SS507-010 LDW-SS510-010 LDW-SS514-010 LDW-SS515-010 LDW-SS516-010 LDW-SS517-010 LDW-SS5515-010 LDW-SS525-010 LDW-SS505-010DUP	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	A	Compound quantitation and CRQLs (EMPC)
DPWG31853/ WG31628	LDW-SS523-010 LDW-SS530-010 LDW-SS509-010 LDW-SS501-010 LDW-SS505-010 LDW-SS507-010 LDW-SS510-010 LDW-SS514-010 LDW-SS515-010 LDW-SS516-010 LDW-SS517-010 LDW-SS517-010 LDW-SS505-010DUP	2,3,7,8-TCDF (from DB-5)	R	A	Overall assessment of data

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG DPWG31853/WG31628

No Sample Data Qualified in this SDG

SDG#	: 22612A21 : DPWG31853/WG3 atory: AXYS Analytical S	1628			LETENE .evel IV	ESS WO	RKSHEET		Date: <u>→</u> Page:(Reviewer: 2nd Reviewer:	(of 1
ИЕТН	OD: HRGC/HRMS Dio	xins/Di	benzofuran	s (EPA Me	ethod 161	3)			Zna Neviewer	
	amples listed below wer ion findings worksheets		ewed for ea	ch of the fo	ollowing va	alidation a	reas. Validatio	n findi	ings are noted in atta	ached
	Validatio	n Area					Comm	ents		
l.	Technical holding times			4	Sampling d	ates:	15-16/	89		
. 11.	HRGC/HRMS Instrument	oerforma	nce check	A			····			
III.	Initial calibration			A	20/25				· · · · · · · · · · · · · · · · · · ·	
IV.	Routine calibration			A	ac h	miti_				
V.	Blanks			W						
VI.	Matrix spike/Matrix spike d	luplicate	s/OUP	N/A				*		
VII.	Laboratory control sample	s		\rightarrow	OPR.	CRY				
VIII.	Regional quality assurance	e and qu	ality control	N						
IX.	Internal standards			 4						
Χ.	Target compound identific	ations		♦						
XI.	Compound quantitation an	d CRQL	s	* W					*-	
XII.	System performance			70						
XIII.	Overall assessment of dat	а		W						
XIV.	Field duplicates			N						
XV.	Field blanks			N						
lote: ′alidate	A = Acceptable N = Not provided/applicab SW = See worksheet ad Samples:	ile	R = Rin	lo compounds sate eld blank	s detected	TB :	Duplicate = Trip blank = Equipment blan	k		
٦T	LDW-SS523-010	112	LDW-SS517	-010	21 /	W43	628-101	31		
-2	LDW-SS530-010	127			22	7-		32		
2	LDW-SS509-010	735	LDW-SS505		23			33		
42/1	LDW-SS501-010	14			24			34		
5 % 1	LDW-SS505-010	15			25			35		
6/7/1	LDW-SS507-010	16			26			36		
₇ ႗႗ႃႝ լ	LDW-SS510-010	17			27			37		
2	LDW-SS514-010	18			28			38		
~	LDW-SS515-010	19			29			39		
10	LDW-SS516-010	20			30			40		

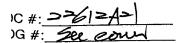
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VALIDATION FINDINGS CHECKLIST

Page:_	_(of >
Reviewer:	4
2nd Reviewer:_	_1/

Method: Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

All technical holding times were met. Cooler temperature criteria was met. I. GCMS instruitive performance choise. Was PFK exact mass 380,976 wellted? Were the reference in time windows established for all homologues? Was the chromatographic resolution between 2,37,8-TCDD and peaks representing any other unlabelled TCDD isomes < 25%? Was the chromatographic resolution between 2,37,8-TCDD and peaks representing any other unlabelled TCDD isomes < 25%? Was the instruction adequately check with FFK? Was the mass resolution adequately check with FFK? Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PcDF verified? II. Initial calibration performed at 5 concentration levels? Was the initial calibration performed at 5 concentration levels? Was the initial calibration standard deviations (KRSD) < 20% for unlabelled attandards and < 35% for labeled standards? Was the signal to noise ratio for each target compound ≥ 25 and for each recovery and internal standard ≥ 10? IV. Certifician standards meet the lon Abundance Ratio criteria? Was the signal to noise ratio for each target compound ≥ 25 and for each recovery and internal standard ≥ 10? IV. Certifician standards and the beginning and end of each 12 hour period? Was a routine calibration performed at the beginning and end of each 12 hour period? IV. Books Was a method blank associated with every sample in this SDG? Was a method blank associated with every sample in this SDG? Was a method blank performed for each matrix and concentration? Was the each performed for each matrix and concentration? Was the each contemination in the method blanks? If yes, please see the Blanks variedation completeness workshow? Was the contemination in the method blanks? If yes, please see the Blanks variedation completeness workshow? Was the contemination in the method blanks? If yes, please see the Blanks variedation completeness workshow? III. Laborstony Sofia of this SDG?	Validation Area	Yes	No	NA	Findings/Comments
Cooler temperature criteria was met. III. GC/MS Instrument performance shock Was PFK exact mass 380.9760 verified? Were the retension time windows established for all homologues? Was the chromatographic resolution between 2.3,7.8-TCDD and peaks representing any other unlabeled TCD0 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 12,8.9-TCDD and 1,3.4.6.8-PECDF verified? III. Internal celibration; Was the initial calibration performed at 5 concentration levele? Was the initial calibration performed at 5 concentration levele? Was the initial calibration performed at 5 concentration levele? Was the signal to noise ratio for each target compound ≥ 2.5 and for each recovery and internal standard 2 10? V-Constituting celibration Was a routine celibration performed at the beginning and end of each 12 hour period? Was a routine celibration standards meet the lon Abundance Ratio criteria? Was a routine celibration standards meet the lon Abundance Ratio criteria? V-Constituting celibration Was a routine celibration standards meet the lon Abundance Ratio criteria? V-Barks Was a method blank associated with every sample in this SDG? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration? Was a method blank performed for each matrix and concentration?	l Technical holding times				
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period? We're all percent differences (%D) ≥ 20% for unlabeled standards and ≥ 86% for labeled standards? Did all routine 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 concentration? Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet? V. Metrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits?	IV. Continuing calibration				
Did all routine 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 concentration? Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet? VI. Matrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits?	period?				
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 completeness worksheet? W. Matrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	Were all percent differences (%D) ≤ 20% for unlabeled standards and ≤ 30% for labeled standards?				
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 completeness worksheet? W. Matrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits?	Did all routine calibration standards meet the Ion Abundance Ratio criteria?				
Was a method blank performed for each matrix and concentration? Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet? VI. Matrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	V. Blanks	· · · · ·			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet? W. Matrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	Was a method blank associated with every sample in this SDG?				
Walidation completeness worksheet? W. Matrix spike/Matrix spike duplicates 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. Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	Was a method blank performed for each matrix and concentration?				
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. Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet?				
Matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water. Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits? All: Leboratory control samples	A. Matrix spike/Matrix spike duplicates				
Were the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits? Al. Leboratory control samples	natrix in this SDG? It no, indicate which matrix does not have an associated				BUP
	Nere the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits?		/	7	
Nas an LCS analyzed for this SDG?	Al. Laboratory control samples				
	Vas an LCS analyzed for this SDG?	7			



VALIDATION FINDINGS CHECKLIST

Page: of 3
Reviewer: 9
2nd Reviewer: 1

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?				
VIII. Regional Quality Assurance and Quality Control			<u> - </u>	
Were performance evaluation (PE) samples performed?			L	
Were the performance evaluation (PE) samples within the acceptance limits?				
IX. Internal standards				
Were internal standard recoveries within the 40-135% criteria?				
Was the minimum S/N ratio of all internal standard peaks \geq 10?				
X. 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 and labeled standard \geq 2.5?				
Does the maximum intensity of each specified characteristic ion coincide within \pm 2 seconds (includes labeled standards)?				
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?				
Was an acceptable lock mass recorded and monitored?				
XI. Compound quantitation/CRQLs				
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, System performance				
System performance was found to be acceptable.				
XIII. Overall assessment of data			ı	
Overall assessment of data was found to be acceptable.				
XIV. Field duplicates			I	l
Field duplicate pairs were identified in this SDG.	į	/		

DG #: 22612/2

VALIDATION FINDINGS CHECKLIST

Page: 3 of 3 Reviewer: 2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
Target compounds were detected in the field duplicates.				
XV. Field blanks				
Field blanks were identified in this SDG.		7		
Target compounds were detected in the field blanks.				

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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. ocop	L. 1,2,3,6,7,8-HxCDF	a. 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	1, 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:

SDG #: Les com LDC #: 22/2/

VALIDATION FINDINGS WORKSHEET

2nd Reviewer:_ Reviewer:_

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 8290)

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

Were all samples associated with a method blank?	Was a method blank analyzed for each matrix?	Was the blank contaminated? If yes, please see qualific
 ≺ N N/A	Y N N/A	YN N/A

Was a method blank analyzed for each matrix? Was the blank contaminated? If yes, please see qualification below.

	Associated Samples:
e:	Ass
Blank analysis date:	
Blank extraction date:	Conc. units:
Blank extr	Conc

Sample Identification	 - and U			
Blank ID	L			
Compound	ALZIPO VEIN			

	Associated Samples:
Blank analysis date:	Asso
Slank extraction date:	conc. units:

Compound	Blank ID	Sample Identification	
			,

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

LDC #: 35/13/42 | SDG #: 26.6 GOULD!

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: fof f Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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? Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

L					
*	Date	Sample ID	Finding	Associated Samples	Qualifications
		W	1	an	7
	-				
	0				
			#100 m		

Comments: See sample calculation verification worksheet for recalculations

VALIDATION FINDINGS WORKSMEET Overall Assessment of Data

Page: Reviewer: 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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

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

Y N N/A

Was the overall quality and usability of the data acceptable?

Reviewer: 2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 829のアノメノヨノ

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 = $(A_s)(C_s)/(A_s)(C_s)$ 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,

 $A_{\rm k}$ = Area of associated internal standard $C_{\rm k}$ = Concentration of internal standard X = Mean of the RRFs

				Reported	Recalculated	Reported	Recalculated	Reported	Recelousted
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Average RRF (Initial)	RRF A & std)	RRF / A Wstd)	%BSD	%BSD
Ŀ	19/2	2./8/.	2,3,7,8-TCDF (10-2,3,7,8-TCDF)	\$8.0	0.83	0.83	NX O	2.19	J 30
		60/1/1/	2,3,7,8-TCDD (1ºC-2,3,7,8-TCDD)	0.87	180	0 84	AX O	4.30	V
			1,2,3,8,7,8-HxCDD ("C-1,2,3,8,7,8-HxCDD)	0.79	0.79	0.78	0.78	1.5.1	1.45
		-	1,2,3,4,6,7,8-HpCDD (16C-1,2,4,6,7,8,-HpCDD)	1.07	1.07	1.13	1.13	3.27	352
			OCDF ("C-OCDD)	0.78	0.78	0.75	0.75	8.61	200
~	lete	12/3/69	12/23/04 23.7.8-TCDF ("C-2.3.7.8-TCDF)	0.92	0.92	0.91	100	1 is a	4 08
		///	2,3,7,8-TCDD (1°C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (10-1,2,4,8,7,8,-HpCDD)						
			OCDF (4c-OCDD)						
6			2,3,7,8-TCDF (40-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (1°C-1,2,4,6,7,8,-HpCDD)						
	٠		OCDF ("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.

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET



METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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:

 $A_{\rm k}={\rm Area}$ of associated internal standard $C_{\rm k}={\rm Concentration}$ of internal standard $A_x = Area of compound,$ $C_x = Concentration of compound,$

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where: % Difference = 100 * (ave. RRF - RRF)/ave. RRF RRF = (A,)(C,)/(A,)(C,)

L								
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	0%	3
-	DXONOS		2,3,7,8-TCDF (*C-2,3,7,8-TCDF)	0.83	9.01	106		
	5-6	21/2/2	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	0.87	2 01	100		
		_	1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	0.79	53,0	530		
		4	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	45.9	46		
			OCDF (*c-OCDD)	0.98	211	1.6		
2	TROBO3	2/3/10	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.92	æ :	90		
\Box	43.0	10/	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (1°C-1,2,3,6,7,8-HxCDD)					
		<u></u>	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (1°C-OCDD)					
၈	DXON-015	1	2,3,7,8-TCDF (1°C-2,3,7,8-TCDF)	6.83	10.5	901		
	2=17	0)/8/	2,3,7,8-TCDD (1°C-2,3,7,8-TCDD)	D.ST	10.1	0.01		
		1	1,2,3,6,7,8-HxCDD (°C-1,2,3,6,7,8-HxCDD)	0.79	53.8	5533		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	70.1	45.4	456		
			OCDF (*C-OCDD)	0.7 B	7-	5)		
						,11,		

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.

* SDG #:

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET

Page: 2nd Reviewer: Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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 = $(A_{\mu})(C_{\mu})/(A_{\mu})(C_{\mu})$

ave. RRF = initial calibration average RRF RRF = continuing calibration RRF Where:

 $A_{\rm k} = {\sf Area}$ of associated internal standard $C_{\rm k} = {\sf Concentration}$ of internal standard A_x = Area of compound, C_x = Concentration of compound,

L								
					Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	۳۵	278
	DEOR OSS	, ,	2,3,7,8-TCDF (*C-2,3,7,8-TCDF)	0.02	1.11	X .		9
	γ., γ	7410	2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)		\ \ \ \ \			
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)					
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (*c-OCDD)					
C(I	DVON-DIS	12/11	2,3,7,8-TCDF (¹³ C-2,3,7,8-TCDF)	0.83	2.0	501		
	15:28	4	2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	787	10 4	40		
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	010	53.9	238		
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	46.7	N.X.		
			OCDF (*3c-OCDD)	0.78	707	0		
က			2,3,7,8-TCDF (13C-2,3,7,8-TCDF)					
			2,3,7,8-TCDD (1°C-2,3,7,8-TCDD)					
			1,2,3,6,7,8-HxCDD (°C-1,2,3,6,7,8-HxCDD)					
\prod		1	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
			OCDF (*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#: 226/24-)
SDG #224 COUNTY

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample Results Verification

METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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

% Recovery = 100 * SSC/SA Where: \$

Where: SSC = Spiked sample concentration SA = Spike added

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

LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS ID: W4316-10-2

	os.	ike	Spiked S	ample	SOI	8	I CSD	D	I CS/I CSD	csp
Compound	Added (N.S. N.V.	and a	Concentration (US/ILL)	ration	Percent Recovery	ecovery	Percent Recovery	есочегу	RPD	Q
A CONTRACTOR OF THE PARTY OF TH	831	1 CSD	SOI	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
2,3,7,8-TCDD	0.01	N.A.	896	NA	8.96					
QC	o'es		8.00		97.7	ar.T				
	5/5		51.3		90.8	90.8				
L	08		43.9		87.9	87. 8				
	104	>	4	/	108	108				
	٠					-				

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.

Analyte	HPCDF HPCDF HPCDF HPCDD HPCDD HPCDD (S) HPCDD (S) PFK	ocdf ocdd ocdd ocdd (s) ocdd (s) DCGPE PFK	
Elemental Composition	C ₁₂ H ³ C ₁₃ 7C1O C ₁₂ H ³ C ₁₃ 7C1 ₂ O 19C ₁₂ H ³ C ₁₃ 7C1 ₂ O 19C ₁₂ H ³ C ₁₃ 7C1O C ₁₂ H ³ C ₁₃ 7C1O C ₁₂ H ³ C ₁₃ 7C1O ₂ 13C ₁₂ H ³ C ₁₃ 7C1 ₂ O ₂ 13C ₁₂ H ³ C ₁₃ 7C1 ₂ O ₂ C ₁₂ H ³ C ₁₃ 7C1 ₂ O ₂ C ₁₂ H ³ C ₁₃ 7C1 ₂ O ₂ C ₁₂ H ³ C ₁₃ 7C1 ₂ O ₂	C, 20CJ, 37ClO C, 20CJ, 37ClO C, 20CJ, 37ClO ₂ C, 20CJ, 37ClO ₂ C, 20CJ, 37ClO ₂ 13C, 20CJ, 37ClO ₂ C, 20CJ, 37Cl ₂ O C, 20CJ, 37Cl ₂ O C, 20CJ, 37Cl ₂ O C, 10CJ, 37Cl ₂ O	
lon ID	M + 4 M + 4 M + 2 M + 4 M + 4 M + 4 LOCK	M M M H + 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
Accurate Mass ^(a)	407.7818 409.7788 417.8250 419.8220 423.7767 425.7737 435.8169 437.8140 479.7165 [430.9728]	441.7428 443.7399 457.7377 459.7348 469.7780 471.7750 513.6775	
Descriptor	4	ro	·
Analyte	TCDF TCDF (8) TCDF (8) TCDD TCDD TCDD (8) TCDD (8) HXCDPE	Pecde Pecde Pecde (s) Pecde Pecde Pecde Pecde (s) Pecde (s) Pecde (s) Pecde (s)	HXCDF HXCDF (S) HXCDF (S) HXCDD HXCDD HXCDD (S) HXCDD (S) OCDPE PFK
Elemental Composition	C ₁₂ H, 201,0 C ₁₂ H, 201,0 C ₁₂ H, 201,0 G ₁₂ H, 201,0 C ₁₂ H, 201,0 C ₁₂ H, 201,0 G ₁₂ H, 201,0 G ₁₂ H, 201,0 C ₁₂ H, 201,0 C ₁₂ H, 201,0 C ₁₂ H, 201,0 C ₁₂ H, 201,0	C ₁₂ H ₃ &C ₁₄ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO 19C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO ₂ C ₁₂ H ₃ &Cl ₃ 7°ClO ₂ 19C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO C ₁₂ H ₃ &Cl ₃ 7°ClO	C ₁₂ H ₂ *C ₁₃ *C ₁₀ C ₁₂ H ₂ *C ₁₃ *C ₁₀ 1°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 1°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 0°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 1°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 1°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 1°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 0°C ₁₂ H ₂ *C ₁₃ *C ₁₀ 0°C ₁₃ H ₂ *C ₁₃ *C ₁₀ 0°C ₁₄ H ₂ *C ₁₃ *C ₁₀
O) uol	C C C C C C C C C C C C C C C C C C C	M+2 M+4 M+2 M+2 M+4 M+4 COCK	M M H + 2 2 2 4 4 4 2 2 4 4 4 4 4 4 4 4 4 4 4
Accurate mass ^(a)	303.9016 305.8987 315.9419 317.9389 319.8965 321.8936 331.9368 333.9338 375.8364 [354.9792]	339.8597 341.8567 351.9000 353.8970 355.8546 357.8516 367.8949 369.8919 409.7974 [354.9792]	373.8208 375.8178 383.8639 385.8610 389.8156 391.8127 401.8559 445.7555 [430.9728]
Descriptor	-	0	ო

(a) The following nuclidic masses were used:

	ਲ	6	
.007825	12.000000	3.003355	18.9984
I	C = 12	0=13	Ħ
-1-	J	ဦ	11.

O = 15.994915 $^{36}Cl = 34.968853$ $^{37}Cl = 36.965903$

S = internal/recovery standard

LDC #: 251-A2| SDG #: Zer CONEN

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page:	of
Reviewer:_	2
2nd reviewer:_	11/

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

\bigcirc	N	N/A
Y)	N	N/A

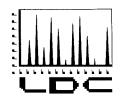
Were all reported results recalculated and verified for all level IV samples?

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

Concen	tration	$= \frac{(A_{\bullet})(I_{\bullet})(DF)}{(A_{\bullet})(RRF)(V_{\circ})(\%S)}$
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
l _s	=	Amount of internal standard added in nanograms (ng)
V.	=	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:
Conc. = (8,705) (2000) () 4.77es) (1.07) (10.6) ()
= 313.1 n=/+3

			Reported Concentration	Calculated Concentration	
#	Sample ID	Compound	(-)	()	Qualification
			-		
					



LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Windward Environmental, LLC 200 West Mercer Street, Suite 401 Seattle, WA 98119 ATTN: Ms. Marina Mitchell April 30, 2010

SUBJECT: Lower Duwamish Waterway Group, Data Validation

Dear Ms. Mitchell,

Enclosed is the revised validation report for the fraction listed below. This SDG was received on March 3, 2010. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 22683:

SDG#

Fraction

DPWG31962/WG31619 D

Dioxins/Dibenzofurans

The data validation was performed under EPA Level IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005
- Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan, January 2005, Dioxin/Furan Addendum, December 2009
- EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin(PCDD) and Polychlorinated Dibenzofuran(PCDF) Data, Revision 2.0, January 1996
- USEPA, Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Diobenzofurans Data Review, September 2005

Please feel free to contact us if you have any questions.

Per Forg (In

Sincerely,

Stella S. Cuenco

Data Validation Operations Manager/Senior Chemist

1 WEEK TAT Attachment 1

TALE .	EDD	I DC 1	#22683	R (NA	line	lw/2	rd I	= _{nv}	iro	nm	enf	al l		· _ C			W	Δ / I	ΩW	/er	Din	var	nisl	1 W	late	rw:	av (Gro	un)				10391818589	07-04
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Lower Duwamish Waterway Group Data Validation Reports LDC #22683

Dioxins/Dibenzofurans



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Lower Duwamish Waterway Group

Collection Date: January 11 through January 12, 2010

LDC Report Date: April 29, 2010

Matrix: Sediment

Parameters: Dioxins/Dibenzofurans

Validation Level: EPA Level IV

Laboratory: AXYS Analytical Services Ltd.

Sample Delivery Group (SDG): DPWG31962/WG31619

Sample Identification

LDW-SS502-010-COMP

LDW-SS503-043-COMP

LDW-SS529-041-COMP

LDW-SS531-010-COMP

LDW-SS533-043-COMP

LDW-SS544-010-COMP

LDW-SS547-010

LDW-SS520-010

LDW-SS520-010DUP

Introduction

This data review covers 9 sediment samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 1613 for Polychlorinated Dioxins/Dibenzofurans.

This review follows the Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway Quality Assurance Project Plan (QAPP) (January 14, 2005), Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the Lower Duwamish Waterway QAPP, Dioxin/Furan Addendum (December 15, 2009), EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data (Revision 2.0, January 31, 1996) and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Polychlorinated Dioxins/Dibenzofurans Data Review (September 2005) as there are no current guidelines for the method stated above.

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

Blank results are summarized in Section V.

Field duplicates are summarized in Section XIV.

The following are definitions of the data qualifiers:

The following are definitions of the data qualifiers:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
 - J1 Blank Contamination: Indicates possible high bias and/or false positives.
 - J2 Calibration Range exceeded: Indicates possible low bias.
 - J3 Holding times not met: Indicates low bias for most analytes.
 - J4 Other QC parameters outside control limits: bias not readily determined.
 - J5 Other QC parameters outside control limits. The reported results appear to be biased high. The actual value of target compound in the sample may be lower than the value reported by the laboratory.
 - Other QC parameters outside control limits. The reported results appear to be biased low. The actual value of target compound in the sample may be higher than the value reported by the laboratory.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required daily frequency.

Retention time windows were established for all homologues. The chromatographic resolution between ¹³C-2,3,7,8-TCDD and ¹³C-1,2,3,4-TCDD was less than or equal to 25%.

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

III. Initial Calibration

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

Percent relative standard deviations (%RSD) were less than or equal to 20.0% for all native compounds and less than or equal to 35.0% for all labeled compounds.

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

The minimum S/N ratio was technically acceptable.

IV. Routine Calibration (Continuing)

Routine calibration was performed at the required frequencies.

All of the routine calibration concentrations were within the QC limits.

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

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polychlorinated dioxin/dibenzofuran contaminants were found in the method blanks with the following exceptions:

Method Blank ID	Extraction Date	Compound	Concentration	Associated Samples
WG31619-101	1/25/10	OCDD	0.123 pg/g	All samples in SDG DPWG31962/WG31619

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

Method blank results flagged "K" by the laboratory as estimated maximum possible concentration (EMPC) were considered not detected.

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.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Compound	RPD (Limits)	Difference (Limits)	Flag	A or P
LDW-SS520-010DUP (LDW-SS520-010 LDW-SS520-010DUP)	2,3,4,6,7,8-HxCDF	62.7 (≤50)	-	J (all detects)	A

VII. Ongoing Precision & Recovery (OPR) and Standard Reference Material (SRM) Samples

Percent recoveries (%R) of the ongoing precision and recovery samples were within QC limits.

Standard reference material samples were analyzed at the required frequency.

VIII. Regional Quality Assurance and Quality Control

Not applicable.

IX. Internal Standards

All internal standard recoveries were within QC limits.

X. Target Compound Identifications

All target compound identifications were within validation criteria.

XI. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31962/WG31619	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	U	А

XII. System Performance

The system performance was acceptable.

XIII. Overall Assessment of Data

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
All samples in SDG DPWG31962/WG31619	2,3,7,8-TCDF (from DB-5)	R	А

Data flags are summarized at the end of this report if data has been qualified.

XIV. Field Duplicates

No field duplicates were identified in this SDG.

XV. Field Blanks

No field blanks were identified in this SDG.

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Data Qualification Summary - SDG DPWG31962/WG31619

SDG	Sample	Compound	Flag	A or P	Reason	
DPWG31962/ WG31619	LDW-SS520-010 LDW-SS520-010DUP	2,3,4,6,7,8-HxCDF	J (all detects)	А	Duplicate sample analysis (RPD)	
DPWG31962/ WG31619	LDW-SS502-010-COMP LDW-SS503-043-COMP LDW-SS529-041-COMP LDW-SS531-010-COMP LDW-SS531-010-COMP LDW-SS544-010-COMP LDW-SS547-010 LDW-SS520-010 LDW-SS520-010DUP	All TCL compounds flagged "K" by the laboratory as estimated maximum possible concentration.	А	Compound quantitation and CRQLs (EMPC)		
DPWG31962/ WG31619	LDW-SS502-010-COMP LDW-SS503-043-COMP LDW-SS529-041-COMP LDW-SS531-010-COMP LDW-SS531-010-COMP LDW-SS544-010-COMP LDW-SS547-010 LDW-SS520-010 LDW-SS520-010	2,3,7,8-TCDF (from DB-5)	R	A	Overall assessment of data	

Lower Duwamish Waterway Group Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG DPWG31962/WG31619

No Sample Data Qualified in this SDG

	#: <u> DPWG31962/WG3</u> atory: <u> AXYS Analytical S</u>		 td	l	_evel IV			Page:_/of// Reviewer:
	•						2	nd Reviewer:
METH	IOD: HRGC/HRMS Diox	kins/D	ibenzofurar	ns (EPA M	ethod 1613)			
	amples listed below were		ewed for ea	ch of the fo	ollowing valida	ition areas. Valida	tion findings	are noted in attached
valida	tion findings worksheets	i.						
	Validation	Area				Com	ments	
1.	Technical holding times			A	Sampling dates:	,	110	
11.	HRGC/HRMS Instrument p	erforma	ance check	1		, , , , , , , , , , , , , , , , , , , 		
III.	Initial calibration			A				
IV.	Routine calibration			A				
V.	Blanks			W				
VI.	Matrix spike/Matrix spike du	uplicate	s But	W				
VII.	Laboratory control samples		/ (\triangle	OFR.C	e M		
VIII.	Regional quality assurance	and qu	uality control	N				
IX.	Internal standards			4				
Χ.	Target compound identifica	tions		A				
XI.	Compound quantitation and	CRQ	_S	NW		 		
XII.	System performance			A				
XIII.	Overall assessment of data	ì		M				
XIV.	Field duplicates			N				
XV.	Field blanks							
Note:	A = Acceptable N = Not provided/applicabl SW = See worksheet	e	R = Rir	lo compound nsate ield blank	s detected	D = Duplicate TB = Trip blank EB = Equipment bl	ank	
Validat ////	ed Samples: Sed S							
1	LDW-SS502-010-COMP	11	W431	619-10	21		31	
2	LDW-SS503-043-COMP	12			22		32	
3	LDW-SS529-041-COMP	13			23		33	· · · · · · · · · · · · · · · · · · ·
4	LDW-SS531-010-COMP	14			24		34	
5	LDW-SS533-043-COMP	15			25		35	
6	LDW-SS544-010-COMP	16			26		36	
7	LDW-SS547-010	17			27		37	
8	LDW-SS520-010	18			28		38	
9	LDW-SS520-010DUP	19			29		39	
10		20		 	30		40	
Notes	:				***************************************	. <u> </u>		_

LDC #: 22683A21 VALIDATION COMPLETENESS WORKSHEET

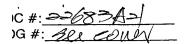
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VALIDATION FINDINGS CHECKLIST

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

Method: Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

				
Validation Area	Yes	No	N/	Findings/Comments
I. Technical holding times				
All technical holding times were met.		1_		
Cooler temperature criteria was met.				
II. GC/MS Instrument performance check				
Was PFK exact mass 380.9760 verified?				
Were the retention time windows established for all homologues?				
Was the chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomers \leq 25% ?				
Is the static resolving power at least 10,000 (10% valley definition)?				
Was the mass resolution adequately check with PFK?				
Was the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF verified?	/		Π	
III, Initial calibration			•	
Was the initial calibration performed at 5 concentration levels?				
Were all percent relative standard deviations (%RSD) \leq 20% for unlabeled standards and \leq 56% for labeled standards?				
Did all calibration standards meet the Ion Abundance Ratio criteria?				
Was the signal to noise ratio for each target compound \geq 2.5 and for each recovery and internal standard \geq 10?				
IV. Continuing calibration				
Was a routine calibration performed at the beginning and end of each 12 hour period?			***********	
Were all percent differences (%D) ≤ 20% for unlabeled standards and ≤ 30% for labeled standards?		-		
Did all routine calibration standards meet the Ion Abundance Ratio criteria?	7			
V. Blanks				
Was a method blank associated with every sample in this SDG?	M			
Was a method blank performed for each matrix and concentration?				
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet?				
/i. Matrix spike/Matrix spike duplicates			1	
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each natrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.				DuP
Vere the MS/MSD percent recoveries (%R) and the relative percent differences RPD) within the QC limits?				
II. Laboratory control samples		1		
Vas an LCS analyzed for this SDG?	71	T	T	



VALIDATION FINDINGS CHECKLIST

Page: of 3
Reviewer: 2nd Reviewer:

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?				
VIII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			-	
Were the performance evaluation (PE) samples within the acceptance limits?				
IX. Internal standards				
Were internal standard recoveries within the 40-135% criteria?				
Was the minimum S/N ratio of all internal standard peaks \geq 10?				
X 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 and labeled standard \geq 2.5?		-		
Does the maximum intensity of each specified characteristic ion coincide within \pm 2 seconds (includes labeled standards)?	/			
For PCDF identification, was any signal (S/N \geq 2.5, at \pm seconds RT) detected in the corresponding PCDPE channel?			/	
Was an acceptable lock mass recorded and monitored?				
XI. Compound quantitation/CRQLs				
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?				
XIL System performance				
System performance was found to be acceptable.				
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.				
XIV. Field duplicates				
Field duplicate pairs were identified in this SDG.		1		

IC #: 2583A=

VALIDATION FINDINGS CHECKLIST

Page: Sof S Reviewer: 9 2nd Reviewer: A

Validation Area	Yes	No	NA	Findings/Comments
Target compounds were detected in the field duplicates.				
XV. Field blanks				
Field blanks were identified in this SDG.				
Target compounds were detected in the field blanks.			\overline{Z}	

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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. ocbb	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	1. 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 #: 23683/1-SDG #: 201 COM

VALIDATION FINDINGS WORKSHEET Blanks

Page: Reviewer:_ 2nd Reviewer:_

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 8290)

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

Were all samples associated with a method blank? Was a method blank analyzed for each matrix?

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

Associated Samples: Blank extraction date: 1/2/10 Blank analysis date: Z Conc. units: ns/FS ON N/A

Sample Identification 0.123 01-619. THE Blank ID gua Compound 4

sis date:	Associated Samples:	ucijenski elemes
Blank analysis date:		:
Blank extraction date:	Conc. units:	

Compound	Blank ID	Sample Identification

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

hammed attent

SDG #: 2000 LDC #:2-202-475

Matrix Spike/Matrix Spike Duplicates VALIDATION FINDINGS WORKSHEET

ō 2nd Reviewer:_ Page: Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A". Y (M/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 ε associated MS/MSD. Soil / Water.

Y (M) N/A

Was a MS/MSD analyzed every 20 samples of each matrix? Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

Qualifications	4/4/1	7000																						
Associated Samples	×	+																						
RPD (Limits)	157152 1			((()	()	()	()	()	()	()	()	()	()	(()	()	()		()	()	(
MSD %R (Limits)		, , , , , , , , , , , , , , , , , , , ,	,		2 the of 1	() /	()	()	(()	()	()	()	()		(;)	()	()	()	()	()	()	
MS %R (Limits)	(,		ialt spe	(/	()	()	(()	()	()	()	()	()	()	()	()	()	()	()	()	()	
Compound	K				10	,																	·	
DI DSW/SW	8			\	NOWS/NSD																			
Date																								
*		<u></u>																						

LDC #: 226834

VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: Of Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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? Compound quantitation and CRQLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

Qualifications	\mathcal{Z}								
Associated Samples	M	\ \							
Finding	ZNDC USULAS								
Sample ID]/\$>								
Date									
*									

Comments: See sample calculation verification worksheet for recalculations

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

SDG #: Ser Cond

Page: _____of__/ Reviewer: ______ 2nd Reviewer: ______

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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

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

X N N/A W

<u>I/A</u> Was the overall quality and usability of the data acceptable?

Qualifications	\$ / A								
ā	Υ								
Associated Samples	M	,							
Finding	4 on DB-5								
Sample ID	- - - - - - - - - - - -								
Date									
*									

Comments:



VALIDATION FINDINGS WORKSHEET Initial Calibration Calculation Verification

Page: /of / Reviewer: Q______ 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 = $(A_x)(C_n)/(A_n)(C_x)$ average RRF = sum of the RRFs/number of standards %RSD = 100 * (S/X)

 $A_k = Area\ of\ compound, \qquad A_s = Area\ of\ associated\ internal\ standard$ $C_k = Concentration\ of\ compound, \qquad C_k = Concentration\ of\ internal\ standard$ $S = Standard\ deviation\ of\ the\ RRFs, \qquad X = Mean\ of\ the\ RRFs$

				Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
*	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Average RRF (initial)	RRF (<>> >td)	RRF (<>>>td)	%RSD	%RSD
1	19AL	60/6/11	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.83	6.83	0.83	0.83	2.19	15.5
				780	T8.0	0.84	0.84	4.39	4.26
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	079	67.0	0.78	0.78	(5.1	1.45
			1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	T0.1	1.07	1.13	61.1	2.5	3.52
			OCDF (13C-OCDD)	0.78	0.78	0.75	0.75	8.6	20.0
2	1CAL	12/23/69	12/23/69 2,3,7,8-TCDF (°C-2,3,7,8-TCDF)	0.92	0.92	0.91	0.91	469	4.56
			2,3,7,8-TCDD (°C-2,3,7,8-TCDD)					,	
			1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)						
			1,2,3,4,6,7,8-HpCDD (¹³ C-1,2,4,6,7,8,-HpCDD)						
			OCDF (13C-OCDD)						
3			2,3,7,8-TCDF (13C-2,3,7,8-TCDF)						
			2,3,7,8-TCDD (13C-2,3,7,8-TCDD)						
			1,2,3,6,7,8-HxCDD (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)						
			ОСDF (3-0СDD)						

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.

COM OLO IONIMINALIMACIAMENTALIMATICALIMATE ACTIVITÀ

Routine Calibration Results Verification VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Page: Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

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 = (A₂)(C_a)/(A_a)(C_a)

ave. RRF = initial calibration average RRF Where:

RRF = continuing calibration RRF

 $A_{\rm k}$ = Area of associated internal standard $C_{\rm k}$ = Concentration of internal standard $A_x = Area of compound,$ $C_x = Concentration of compound,$

Standard ID Date Compound (Reference Interna CALIBRATION CAMPOINT CALIBRATION CAMPOUND INTERNATION CANDOUND Average RRF (initial)	RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D	
--	-----------------------	-------------	-----------------------	----------------	-----------------

# Standard ID Date Compound (Reference Internal Standard) Average RRF RRF RRF RRF	<u> </u>					Reported	Recalculated	Reported	Recalculated
DXBM.019	*		Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	RRF (CC)	RRF (CC)	% D	0%
S = 2			6776	2,3,7,8-TCDF (*C-2,3,7,8-TCDF)	0.83	10.4	4.0-		
1,2,3,6,7,84xCDD (**C-1,2,3,6,7,84xCDD)	\perp	-	11/10	2,3,7,8-TCDD (¹³ C-2,3,7,8-TCDD)	0.87	10.7	(0.3		
1,23,4,6,7,8,HpCDD (°C-1,2,4,6,7,8,HpCDD) 0 \(\triangle \)				1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	6.79	53.12	530		
DEOBLO34				1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	45.9	420		
DB0B_034 2,3,7,8-TCDF (³C-2,3,7,8-TCDF) 0.92 1.2.9				OCDF (*c-OCDD)	820	W	W		
\$\int 2.3.7.8-TCDD (\frac{1}{2}C-2.3.7,8-TCDD)\$ 1,2.3,6.7.8-HxCDD (\frac{1}{2}C-1,2.4,6.7,8,HxCDD)\$ \$\int 2.3,6.7.8-HxCDD (\frac{1}{2}C-1,2.4,6.7,8,HyCDD)\$ \$\int 2.3,7.8-TCDF (\frac{1}{2}C-3.7,8-TCDF)\$ \$\int 2.3,7.8-TCDF (\frac{1}{2}C-2.3,7,8-TCDF)\$ \$\int 2.3,7.8-TCDD (\frac{1}{2}C-3.7,8-TCDD)\$ \$\int 2.3,7.8-TCDD (\frac{1}{2}C-3.7,8-TCDD)\$ \$\int 2.3,6.7,8-HxCDD (\frac{1}{2}C-1,2.3,6.7,8-HxCDD)\$ \$\int 2.3,6.7,8-HxCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD)\$ \$\int 2.3,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD)\$ \$\int 2.2,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD)\$ \$\int 2.2,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD)\$ \$\int 2.2,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD (\frac{1}{2}C-1,2.4,6.7,8-HyCDD (\fra	7		7/1	2,3,7,8-TCDF (13C-2,3,7,8-TCDF)	0.92	13.9	0.81		
1,2,3,6,7,8+kcDD (*3-1,2,3,6,7,8+kcDD)		5=2	1/1/	2,3,7,8-TCDD (³ C-2,3,7,8-TCDD)					
1,2,3,4,6,7,8,HpCDD (°C-1,2,4,6,7,8,HpCDD)				1,2,3,6,7,8-HxCDD (1°C-1,2,3,6,7,8-HxCDD)					
DVDM_OI 4 2,3,7,8-TCDF (**0-2,3,7,8-TCDF) 0.85 (0.7) 10. S= = 2,3,7,8-TCDP (**0-2,3,7,8-TCDP) 0.87 (0.7) (0.7) 1,2,3,6,7,8-HxCDD (**0-1,2,3,6,7,8-HxCDD) 0.79 5=.2 5=.2 1,2,3,4,6,7,8-HpCDD (**0-1,2,4,6,7,8,-HpCDD) 1.07 45.5 45 0CDF (**0-0CDD) 0.78 (1.5 11.2				1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)					
DVOM_OIM 2.3,7,8-TCDF (*°C-2,3,7,8-TCDF) 0.85 (0.7 10. S=1= 2,3,7,8-TCDD (*°C-2,3,7,8-TCDD) 0.87 (0.8 10. 1,2,3,6,7,8-HxCDD (*°C-1,2,3,6,7,8-HxCDD) 0.74 5=. 5=. 1,2,3,4,6,7,8-HyCDD (*°C-1,2,4,6,7,8,HyCDD) 1.07 45.5- 45. 0CDF (*°C-0CDD) 0.78 1.5 1.5				OCDF (13C-OCDD)					
2,3,7,8-TCDD ("0-2,3,7,8-TCDD)	ဗ			2.3,7,8-TCDF (*C-2,3,7,8-TCDF)	0.83	(0.7	9.01		
(*C-1,2,3,6,7,8-HxCDD) 0 74 52.2 52.2 D (*C-1,2,4,6,7,8,-HpCDD) 1.07 45.5 45.		5= 2		2,3,7,8-TCDD (13C-2,3,7,8-TCDD)	0.8T	(0.8	10.7		
D (*C-1,24,6,7,8,-HpCDD)				1,2,3,6,7,8-HxCDD (13C-1,2,3,6,7,8-HxCDD)	079	んりん			
87.0			<u>-</u>	1,2,3,4,6,7,8-HpCDD (13C-1,2,4,6,7,8,-HpCDD)	1.07	45.5	404		
				ocpf (*c-ocpb)	o.⊤8	(15	12		

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

SDG #: Sel COMO -17 E-1702 H-1717

Laboratory Control Sample Results Verification VALIDATION FINDINGS WORNSHEET



METHOD: GC/MS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy 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

LCS = Laboraotry control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

WES1619-102 LCS ID:

RPD = ILCS - LCSD | * 2/(LCS + LCSD)

8	ķ	Spiked S	amole	<u> </u>	CS	I CSD	, D	1/SD 1	CS/I CSD
AAK (AAK)	Added ()	Concentration (N. 30.1)	tration	Percent Recovery	Recovery	Percent Recovery	ecovery	RPD	D,
1.08	LCSD	SUI	1 CSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
0.01	7	9:01	7	901	901				
52		5.7		1.66	0.60				
26.5		4		957	15.Z				
025		464			856				
7	\	23		611	X				
			in-						
-					-		-		

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.

			· · · · · · · · · · · · · · · · · · ·
Analyte	HPCDF HPCDF HPCDF HPCDD HPCDD HPCDD (S) HPCDD (S) NCDPE PFK	000 P 000 P 000 0 000 (S) 000 (S) D00 PE PFK	
Elemental Composition	C ₁₂ H ² C ₁₃ ,7ClO C ₁₂ H ² C ₁₃ ,7ClO 10 _{C2} H ² C ₁₃ ,7Cl ₂ O 10 _{C2} H ² C ₁₃ ,7ClO ₂ C ₁₂ H ² C ₁₃ ,7ClO ₂ C ₁₂ H ² C ₁₃ ,7Cl ₂ O ₂ 13C ₁₂ H ² C ₁₃ ,7Cl ₂ O ₂ C ₁₂ H ² C ₁₃ ,7Cl ₂ O ₂ C ₁₂ H ² C ₁₃ ,7Cl ₂ O ₂ C ₁₂ H ² C ₁₃ ,7Cl ₂ O ₂	C1.20CJ,37ClO C1.20CJ,37ClO C1.20CJ,37ClO ₂ C1.20CJ,37ClO ₂ 13C,20CJ,37ClO ₂ 13C,20CJ,37ClO ₂ 13C,20CJ,37ClO ₂ C1.20CJ,37ClO ₂ C1.20CJ,37ClO ₂ C1.20CJ,37ClO ₂	
Ol nol	M+2 M+2 M+2 M+2 M+4 M+4	M+2 M+4 M+4 M+4 M+4 LOCK	
Accurate Mass ^(a)	407.7818 409.7788 417.8250 419.8220 425.7767 425.7737 435.8169 437.8140 479.7165 [430.9728]	441.7428 443.7399 457.7377 459.7348 469.7780 513.6775 [422.9278]	
Descriptor	4	ശ	
Analyte	TCDF TCDF (S) TCDF (S) TCDD TCDD TCDD (S) TCDD (S) HXCDPE	Pecdf Pecdf Pecdf (s) Pecdd Pecdd Pecdd (s) Pecdd (s) Pecdd (s) Pecdd (s)	HXCDF HXCDF (S) HXCDF (S) HXCDD HXCDD HXCDD (S) HXCDD (S) HXCDD (S) PFK
Elemental Composition	C ₁₂ H ₂ ²⁰ Cl ₁ O C ₁₂ H ₂ ²⁰ Cl ₁ O 13C ₁₂ H ₂ ²⁰ Cl ₂ O 13C ₁₂ H ₂ ²⁰ Cl ₃ O C ₁₂ H ₂ ²⁰ Cl ₃ O C ₁₂ H ₂ ²⁰ Cl ₃ O 13C ₁₂ H ₂ ²⁰ Cl ₃ O C ₁₂ H ₂ ²⁰ Cl ₃ OCl ₂ O C ₁₂ H ₂ ²⁰ Cl ₃ OCl ₂ O C ₁₂ H ₂ ²⁰ Cl ₃ OCl ₂ O C ₁₂ H ₂ ²⁰ Cl ₃ OCl ₂ O	C,2H,36Cl,37ClO C,2H,34Cl,37Cl,O 19C,2H,34Cl,37Cl,O 19C,2H,34Cl,37Cl,O C,2H,34Cl,37Cl,O 19C,2H,34Cl,37Cl,O 19C,2H,34Cl,37Cl,O C,2H,34Cl,37Cl,O C,2H,34Cl,37Cl,O C,2H,34Cl,37ClO	C,2H,34C 37C O C,2H,34C 37C O 10C,2H,34C 37C O 11C,2H,34C 37C O C,2H,34C 37C O ₂ C,2H,34C 37C O ₂ 11C,2H,34C 37C O ₂ 0 ₂ C,2H,34C 37C O ₂ 0 ₂ C,2H,34C 37C O ₂ 0 ₂ C,2H,34C 37C O ₂
Ol nol	M W W W W W W W W W W W W W W W W W W W	M M M M M M M M M M M M M M M M M M M	M M M M M M H H H H H H H H H H H H H H
Accurate mass ^(a)	303,9016 305,8987 315,9419 317,9389 319,8965 321,8936 331,9368 333,9338 375,8364 [354,9792]	339,8597 341,8567 351,9000 353,8970 355,8546 357,8516 367,8949 369,8919 409,7974	373.8208 375.8178 383.8639 385.8610 389.8156 391.8127 401.8559 403.8529 445.7555
Descriptor	-	2	en .

The following nuclidic masses were used: ₫

O = 15.994915 $^{36}Cl = 34.968853$ $^{37}Cl = 36.965903$

S = internal/recovery standard

LDC #: 2-68-A/ SDG #: Sec Cover

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

Page:_	
Reviewer:	9
2nd reviewer:	

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA SW 846 Method 8290)

LX	N	N/A
A	N	N/A

Were all reported results recalculated and verified for all level IV samples?

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

C	Concent	ration	$= \frac{(A_o)(I_o)(DF)}{(A_{io})(RRF)(V_o)(\%S)}$
A	ι,	=	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
1,	:	=	Amount of internal standard added in nanograms (ng)
١	,	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
F	RRF	==	Relative Response Factor (average) from the initial calibration
0	Of	=	Dilution Factor.
9	%S	=	Percent solids, applicable to soil and solid matrices only.

Example.		
Sample I.D.	:	
Conc. = (1.10e5)(2000 11 07 11 10.2 11)

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification
			:	* ****	-
<i>'</i>					