DATA VALIDATION REPORT
LDW AOC4 Phase 3
ADDENDUM
DRAFT

Prepared for:

Windward Environmental, LLC
200 West Mercer Street, Suite 401
Seattle, Washington 98119

Anchor QEA, LLC
1201 3rd Ave, Suite 2600
Seattle, Washington 98101

Prepared by:

EcoChem, Inc.
500 Union Street, Suite 1010
Seattle, Washington 98101

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Approved for Release:

Alisa G. Bodkin

Alison Bodkin
Project Manager
EcoChem, Inc.

PROJECT NARRATIVE

Basis for the Data Validation

This report presents the results of Summary (EPA Stage 2B) validation performed on sediment and quality control sample data for the LDW AOC4 Phase 3 project. A complete list of samples is provided in the **Sample Index**.

Samples were analyzed by Analytical Resources LLC (ARL), Tukwila, WA. The analytical methods and EcoChem project chemists are listed below.

ANALYSIS	METHOD	PRIMARY REVIEW	SECONDARY REVIEW
Dioxins and Furans	EPA 1613B	ETC	AGB
PCB Aroclors	EPA 8082A	IWH	AGB
PAH	EPA 8270E	IWH	AGB
Metals	EPA 6020	ETC	CLR
Mercury	EPA 7471B	ETC	CLR
Total Organic Carbon	9060A m	ETC	AGB
Total Solids	ASTM SM2540G-97	ETC	AGB

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-design Investigation* (Windward Environmental, LLC/Anchor QEA, May 19, 2020); *National Functional Guidelines for High Resolution Superfund Methods Data review* (USEPA 2016)*; National Functional Guidelines for Organic Data Review* (USEPA 2017); *National Functional Guidelines for Inorganic Data Review* (USEPA 2017); and *R10 Data Validation and Review Guidelines for Polychlorinated Dibenzo-p-Dioxin and Polychlorinated Dibenzofuran Data (PCDD/PCDF) Using Method 1613B and SW846 Method 8290A* (USEPA May 2014).

EcoChem's goal in assigning data assessment qualifiers is to assist in proper data interpretation. If values are estimated (J or UJ), data may be used for site evaluation and risk assessment purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet the data quality objectives as stated in the documents and methods referenced previously.

Data qualifier definitions, reason codes, and validation criteria are included as Appendix A. A Qualified Data Summary Table is included in Appendix B. Data Validation Worksheets will be kept on file at EcoChem, Inc. A qualified laboratory electronic data deliverable (EDD) is also submitted with this report.

Sample Index
LDW AOC4 Phase 3

SDG	Sample ID	Laboratory ID	Dioxins 1613B	PAH	SVOC (Short List)	PCB	Mercury	Lead	Arsenic	Total Metals	TOC	Total Solids
23B0494	LDW21-IT635A	23B0494-01	✓			✓					✓	✓
23B0494	LDW21-IT635B	23B0494-02	✓			✓					✓	✓
23B0494	LDW21-IT635C	23B0494-03				✓					✓	✓
23B0494	LDW21-IT635D	23B0494-04				✓					✓	✓
23B0494	LDW22-IT789M	23B0494-05							✓		✓	✓
23B0494	LDW22-IT789N	23B0494-06							✓		✓	✓
23C0107	LDW22-SS826	23C0107-01				✓					✓	✓
23C0107	LDW21-IT608C	23C0107-02				✓					✓	✓
23C0107	LDW21-IT608D	23C0107-03				✓					✓	✓
23D0577	LDW22-SC778G	23D0577-01				✓					✓	
23D0577	LDW22-SC777J	23D0577-02				✓					✓	
23D0577	LDW22-SC777K	23D0577-03				✓					✓	
23D0577	LDW22-SC777L	23D0577-04				✓					✓	
23D0577	LDW22-SC777M	23D0577-05				✓					✓	
23D0577	LDW22-SC760I	23D0577-06				✓					✓	
23D0577	LDW21-SC572J	23D0577-07				✓					✓	
23D0577	LDW21-SC572K	23D0577-08				✓					✓	
23D0577	LDW21-SC572L	23D0577-09				✓					✓	
23F0356	LDW20-SC148A	23F0356-01		✓		✓	✓			✓	✓	✓

DATA VALIDATION REPORT
ADDENDUM
LDW AOC4 Phase 3
Dioxin/Furan Compounds by EPA 1613B

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, LLC (ARL), Tukwila, Washington. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
23B0494	2 Sediment	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs reported in the electronic data deliverable (EDD) were verified (100%) by comparing the EDD to the hardcopy laboratory data package. Sample results and laboratory quality control sample results were also verified (10%).

TECHNICAL DATA VALIDATION

The quality control (QC) requirements that were reviewed are listed in the following table.

2	Sample Receipt, Preservation, and Holding Times	2	Laboratory Duplicates
✓	System Performance and Resolution Checks	1	Standard Reference Material
✓	Initial Calibration (ICAL)	1	Field Duplicates
✓	Calibration Verification (CV)	✓	Target Analyte List
1	Laboratory Blanks	✓	Reporting Limits
1	Field Blanks	2	Compound Identification
✓	Labeled Compound Recovery	✓	Compound Quantitation
2	Ongoing Precision and Recovery (OPR)	2	Reported Results
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)		

✓Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
1 Quality control results are discussed below, but no data were qualified.
2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received the sample coolers within the advisory temperature range.

SDG 23B0494: The samples were pulled from frozen archive (original SDG 21G0244). The samples were extracted past the 365-day holding time at 592 days; all sample results were estimated (J/UJ-1).

Laboratory Blanks

Method blanks were analyzed at the appropriate frequency. To assess the impact of any blank contaminant on the reported sample results, an action level is established at five times (5x) the concentration reported in the blank. If a contaminant is reported in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). No action is taken if the sample result is greater than the action level, or for non-detected results.

The laboratory assigned EMPC-flags to values when a peak was detected but did not meet ion abundance identification criteria. These values are "estimated maximum possible concentrations". When these occurred in the method blank and were less than the reporting limit (RL), the results were considered as false positives, and no action levels were established for these analytes. EMPC values greater than the RL in the method blank were considered positive results, and action levels were established.

SDG 23B0494: There was a positive result for 1,2,3,4,6,7,8-HpCDD in the method blank. All associated sample results were greater than the 5x action level; no data were qualified.

Field Blanks

No field blanks were submitted.

Ongoing Precision and Recovery

Ongoing precision and recovery (OPR) standards were analyzed at the proper frequency. With the following exceptions, all recovery values were within the control limits.

SDG 23B0494: For OPR Sample BLB0709-BS1, the recovery values for 1,2,3,6,7,8-HxCDF and 1,2,3,4,6,7,8-HpCDF were less than the lower control limits; results in the associated samples were estimated (J-10L).

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses are not required for this method. Accuracy was assessed using labeled compound recoveries and laboratory control samples. Precision was evaluated using the laboratory duplicate analyses.

Laboratory Duplicates

One sample from each laboratory batch was extracted and analyzed in duplicate. The relative percent difference (RPD) control limit is 25% for results greater than five times the RL. For results less than 5x the RL, the control limit for the difference between the sample and duplicate is 2x the RL. With the exceptions noted below, RPD and difference values were within the acceptance criteria.

SDG 23B0494: Sample LDW21-IT635A was analyzed as the laboratory duplicate sample. The RPD values for 1,2,3,4,7,8,9-HpCDF, 1,2,3,7,8,9-HxCDD, Total PeCDF, and Total TCDF were greater than the control limit; the associated parent and laboratory duplicate results were estimated (J-9). The difference value for Total TCDD was greater than the control limit; the associated parent and laboratory duplicate results were estimated (J-9).

Standard Reference Material

The Puget Sound Reference Material was analyzed with each batch. All recoveries were within the advisory limits of 50% – 150%.

Field Duplicates

Field duplicates were not submitted.

Compound Identification

The method requires the confirmation of 2,3,7,8-TCDF detects using an alternate GC column. The DB5 column that is typically used cannot fully separate 2,3,7,8-TCDF from closely eluting non-target TCDF isomers. The laboratory uses an RTX-Dioxin2 column which adequately separates 2,3,7,8-TCDF from TCDF isomers.

The laboratory reported EMPC, or "estimated maximum possible concentrations", when a peak was detected but did not meet the ion abundance identification criteria as required by the method. Native EMPC values less than the RL were qualified as not detected (U-25) as per project guidelines. Native EMPC values greater than the RL and homolog group EMPC values were estimated (J-25).

The laboratory assigned "X" flags to several of the reported results to indicate that diphenyl ether interference was present, which may result in a high bias to the reported result. All results that were X- flagged by the laboratory were estimated (J-23H).

Reported Results

SDG 23B0494: For Sample LDW21-IT635B, the laboratory E-flagged the OCDD result to indicate that the analyte response exceeded the calibration range of the instrument; the associated result was estimated (J-20).

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory performed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the labeled compound

and OPR recoveries and precision was acceptable as indicated by the laboratory duplicate RPD values.

EMPC values that were less than the RL were flagged as not detected at an elevated reporting limit. EMPC values greater than the reporting limit were estimated. Data were also estimated due to exceeded holding times, OPR recovery outliers, laboratory duplicate precision outliers, and matrix interferences.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
ADDENDUM
LDW AOC4 Phase 3
Polycyclic Aromatic Hydrocarbons (PAH)
by EPA SW8270E

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, LLC (ARL), Tukwila, Washington. Refer to the Sample Index for a complete list of samples.

SDG	ANALYTES	NUMBER OF SAMPLES	VALIDATION LEVEL
23F0536	PAH	1 Sediment	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs reported in the electronic data deliverable (EDD) were verified (100%) by comparing the EDD to the hardcopy laboratory data package. Sample results and laboratory quality control sample results were also verified (10%).

TECHNICAL DATA VALIDATION

The quality control (QC) requirements that were reviewed are listed in the following table:

2	Sample Receipt, Preservation, and Holding Times	2	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
✓	GC/MS Instrument Performance	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
2	Continuing Calibration (CCAL)	✓	Internal Standards
✓	Laboratory Blanks	1	Certified Reference Material
1	Field Blanks	✓	Reporting Limits
✓	Surrogate Compounds	2	Reported Results
✓	Laboratory Control Samples (LCS/LCSD)		

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, Holding Times

SDG 23F0536: Sample LDW20-SC148A was extracted past the one-year holding time for frozen samples at 1,115 days. There were positive results for all target analytes. All results were estimated (J-1). The sample was originally from SDG 20F0160 and was stored in frozen archive prior to extraction.

Continuing Calibration

SDG 23F0536: A continuing calibration verification (CCAL) standard was analyzed at the required frequency. Relative response factors (RRF) were acceptable. With the noted exceptions, the percent difference (%D) values were within the required control limits. When the CCAL %D values indicate a potential low bias, associated results are estimated (J/UJ-5BL). When the CCAL %D values indicate a potential high bias, only associated positive results are estimated (J-5BH).

The following CCAL outliers were noted:

CCAL Date	Compound	Potential Bias	Action
7/7/23 @ 16:23	Indeno(1,2,3-cd)pyrene	Low	J-5BL
	Benzo(g,h,i)perylene		
7/8/23 @ 03:30	Pyene	High	None, reported from dilution
	Benzofluoranthenes, total	High	J-5BH
	Indeno(1,2,3-cd)pyrene	Low	J-5BL
	Benzo(g,h,i)perylene		

Field Blanks

No field blanks were submitted.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed at the appropriate frequency. No action is taken unless both the MS and MSD percent recovery (%R) values are outside the control limits for MS/MSD %R outliers. MS/MSD %R values are not evaluated when the parent concentration is greater than 4x the spike concentration. Precision is evaluated using the relative percent difference (RPD) values calculated between the MS and MSD results. Any RPD values outside the control limits indicate uncertainty in the measured results for the sample. Qualifiers were only issued to the parent sample.

Sample LDW20-SC148A was used for the MS/MSD analyses. The %R values for chrysene were less than the lower control limit and less than 10% for the MS/MSD. The positive result in the parent sample was estimated (J-8L).

Field Duplicates

No field duplicates were submitted.

Certified Reference Material

Certified reference material (CRM 143 BNAs – Sandy Loam) was analyzed with this sample. All acceptance criteria were met.

Reported Results

Sample LDW20-SC148A was analyzed at 1x and 10x dilution due to some results exceeding the calibration range of the instrument; these results were "E-flagged" by the laboratory. Both sets of data were reported. Results that exceeded the calibration range were qualified as do-not-report (DNR-20) and should be reported from the 10X dilution. All other results in the 10x analysis were qualified as do-not-report (DNR-11).

OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the noted exceptions, accuracy was acceptable as demonstrated by the surrogate, LCS/LCSD, MS/MSD, and CRM recovery values. Precision was acceptable as demonstrated by the RPD values for the LCS/LCSD and MS/MSD.

Results were estimated due to holding time outliers and CCAL outliers. One result was estimated due to an MS/MSD accuracy outlier.

Results were qualified as do-not-report (DNR) to indicate which set of multiple results should be used. Data qualified as do-not-report should not be used for any reason.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
ADDENDUM
LOWER DUWAMISH WATERWAY 2023 AOC4 Phase 3
PCB Aroclors by SW8082A

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, LLC (ARL), Tukwila, Washington. Refer to the Sample Index for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
23B0494	4 Sediment	EPA Stage 2B
23C0107	3 Sediment	EPA Stage 2B
23D0557	9 Sediment	EPA Stage 2B
23F0536	1 Sediment	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDG 23D0577: The case narrative discussed results being "P1-flagged" to indicate that the results between the two analytical columns were greater than 40%. No outliers were found on the summary forms and no results were P1 flagged in the EDD; no action was taken.

EDD TO HARDCOPY VERIFICATION

All sample IDs reported in the electronic data deliverable (EDD) were verified (100%) by comparing the EDD to the hardcopy laboratory data package. Sample results and laboratory quality control sample results were also verified (10%).

TECHNICAL DATA VALIDATION

The quality control (QC) requirements that were reviewed are listed in the following table:

2	Sample Receipt, Preservation, and Holding Times	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
1	Continuing Calibration (CCAL)	1	Internal Standards
✓	Laboratory Blanks	1	Standard Reference Material
1	Field Blanks	1	Reporting Limits
✓	Surrogate Compounds	✓	Reported Results
✓	Laboratory Control Samples (LCS/LCSD)	✓	Compound Identification
2	Matrix Spike/Matrix Spike Duplicates (MS/MSD)		

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

SDG 23B0494: All samples were extracted past the one-year holding time for frozen samples at 592 days. Results were estimated (J/UJ-1).

Samples in this analytical data set are archived samples stored frozen from the following SDG:

CLIENT ID	ARL ORIGINAL SDG	ARL ORIGINAL SAMPLE #
LDW21-IT635A	21G0244	16
LDW21-IT635B		17
LDW21-IT635C		18
LDW21-IT635D		19

SDG 23C0107: Samples LDW21-IT608C and LDW21-IT608D were extracted past the one-year holding time for frozen samples at 605 days. Results were estimated (J/UJ-1).

Samples in this analytical data set are archived samples stored frozen from the following SDGs:

CLIENT ID	ARL ORIGINAL SDG	ARL ORIGINAL SAMPLE #
LDW21-IT608C	21G0229	02
LDW21-IT608D		03

SDG 23D0577: Samples LDW21-SC572J, LDW21-SC572K and LDW21-SC572L were extracted past the one-year holding time for frozen samples at 671 days. Results were estimated (J/UJ-1).

Samples in this analytical data set are archived samples stored frozen from the following SDGs:

CLIENT ID	ARI ORIGINAL SDG	ARI SAMPLE #
LDW22-SC778G	22L0254	02
LDW22-SC777J		06
LDW22-SC777K		07
LDW22-SC777L		08
LDW22-SC777M		09
LDW22-SC760I	22L0156	29
LDW21-SC572J	21G0014	23
LDW21-SC572K		24
LDW21-SC572L		25

SDG 23F0536: Sample LDW20-SC148A was extracted past the one-year holding time for frozen samples at 1,116 days. Positive results were estimated (J-1). Because PCB compounds are persistent and stable, and samples were stored frozen, reporting limits for PCBs that were not detected were estimated (UJ-1) rather than rejected for this sample. The sample was from the frozen archived SDG 20F0160.

Continuing Calibration (CCAL)

CCALs were analyzed at the appropriate frequency. With the noted exceptions, the percent drift (%D) values were within ±20%.

SDG 23B0494: For the CCALs analyzed on 3/2/23 at 17:45 and 23:42 and the CCALs analyzed on 3/3/23 at 15:28 and 20:43, the %D values for Aroclor 1260 were greater than the upper control limit on column 1. The %D values on column 2 were acceptable. Results for Aroclor 1260 in the associated samples were reported from column 2; no qualifiers were assigned.

SDG 23C0107: For the CCALs analyzed on 3/15/23 at 17:09 and 17:30, the %D values for decachlorobiphenyl were less than the lower control limit on column 1; no qualifiers were assigned for surrogate outliers.

For the CCAL analyzed on 3/15/23 at 23:44, the %D value for Aroclor 1260 was greater than the upper control limit on column 1. The %D values on column 2 were acceptable. Positive results for Aroclor 1260 in the associated samples were reported from column 2; no qualifiers were assigned.

SDG 23D0577: For the CCAL analyzed on 5/26/23 at 23:24, the %D value for tetrachloro-m-xylene was greater than the upper control limit on column 2; no qualifiers were assigned for QC surrogate outliers.

Field Blanks

Field blanks were not collected with these samples.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed at the appropriate frequency. No action is taken unless both the MS and MSD percent recovery (%R) values are outside the control limits for MS/MSD %R outliers. MS/MSD %R values are not evaluated when the parent concentration is greater than 4x the spike concentration. Precision is evaluated using the relative percent difference (RPD) values calculated between the MS and MSD results. Any RPD values outside the control limits indicate uncertainty in the measured results for the sample. Qualifiers were only issued to the parent sample.

When the MS/MSD %R values indicate a potential low bias, associated results are estimated (J/UJ-8L). Only the associated positive results are estimated (J-8H) if the %R values indicate a potential high bias. Associated positive results are estimated (J-9) if the RPD values indicate uncertainty.

SDG 23B0494: Sample LDW21-IT635B was used for the MS/MSD analyses for batch BLB0718. The %R values for Aroclor 1260 were less than the lower control limit for the MS/MSD. The result for Aroclor 1260 in the parent sample was estimated (J-8L).

SDG 23F0536: Sample LDW20-SC148A was used for the MS/MSD analyses. The %R value for Aroclor 1016 was less than the lower control limit for the MS but within control limits for the MSD; no qualifiers were assigned for the single outlier.

Field Duplicates

No field duplicates were submitted.

Internal Standards

Internal standards (IS) hexabromobiphenyl (HBBP) and 1-bromo-2-nitrobenzene (BNB) were added to all samples and laboratory QC samples. When the IS area is less than 50%, associated positive results and reporting limits are estimated (J/UJ-19). When the IS area is greater than 200%, only associated positive results are estimated (J-19). All samples were analyzed on two columns. In cases where there was an outlier on only one column, and the associated result was reported from the column with acceptable IS recovery, no qualifiers were assigned. HBBP is associated with Aroclor 1260 results, and BNB is associated with Aroclors 1016, 1221, 1232, 1242, 1248, and 1254 results. With the noted exceptions, all internal standard areas were within 50 – 200% of the associated initial calibration midpoint standard.

SDG 23C0107: For Sample LDW22-SS826, the area for HBBP was less than the lower control limit on column 1. The area for HBBP on column 2 was acceptable. Results for the associated Aroclors were reported from column 2; no qualifiers were assigned.

SDG 23D0577: For batch BLD0718, the area of HBBP was greater than the upper control limit on column 1 for the blank, laboratory control sample and laboratory control sample duplicate. No qualifiers were assigned for internal standard outliers for laboratory QC samples.

SDG 23F0536: For Sample LDW20-SC148A, the area for HBBP was less than the lower control limit on column 1. The area for HBBP on column 2 was acceptable. Results for the associated Aroclors were reported from column 2; no qualifiers were assigned.

For batch BLF0716 MS/MSD, the area of HBBP was less than the upper control limit on column 1. No qualifiers were assigned for internal standard outliers for laboratory QC samples.

Standard Reference Material

Puget Sound Reference Material was analyzed with each batch. All concentrations were within the advisory limits of 41 – 180 ug/Kg for AR1260.

SDG 23D0577: The reference material expired on 4/12/23 but was extracted on 5/2/23. The SRM concentration was within advisory limits. No action was taken.

SDG 23F0536: The reference material expired on 5/17/23 but was extracted on 6/8/23. The SRM concentration was within advisory limits. No action was taken.

Reporting Limits

SDG 23B0494: Three samples were analyzed at dilutions due to the high concentration of some target analytes. Reporting limits were adjusted accordingly. Some reporting limits for non-detected analytes were greater than the QAPP-required reporting limits.

OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the noted exceptions, accuracy was acceptable as demonstrated by the surrogate, LCS/LCSD, MS/MSD and SRM %R values. Precision was acceptable as demonstrated by the MS/MSD and LCS/LCSD RPD values.

Data were qualified based on holding time outliers and MS/MSD accuracy outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway: AOC4 Phase 3
Total Metals by SW6020B
Total Mercury by SW7471B

This report documents the review of analytical data from the analyses of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, LLC (ARL), Tukwila, Washington. Refer to the Sample Index for a complete list of samples.

SDG	Number of Samples and Matrix	Validation Level
23B0494	2 Sediment (Arsenic only)	EPA Stage 2B
23F0536	1 Sediment	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs and results reported in the electronic data deliverable (EDD) were verified (100% verification) by comparing the EDD to the hardcopy laboratory data package. Ten percent (10%) of the laboratory QC results were also verified.

TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2	Sample Receipt, Preservation, and Holding Times	2	Laboratory Duplicates
✓	ICP-MS Tune	1	Reference Materials
✓	Initial Calibration	✓	ICP-MS Internal standards
✓	Calibration Verification	✓	Interference Check Samples
✓	CRDL Standards	✓	Serial Dilutions
✓	Laboratory Blanks	1	Field Duplicates
1	Field Blanks	✓	Reporting Limits
✓	Laboratory Control Samples (LCS)	✓	Reported Results
2	Matrix Spikes (MS) and Matrix Spike Duplicates (MSD)		

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
1 Quality control outliers are discussed below, but no data were qualified.
2 Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

SDG 23F0536: The sample was pulled from frozen archive and analyzed past the 2-year holding time, at 1110-1113 days. All field sample and laboratory duplicate results were estimated (J-1).

Field Blanks

Field blanks were not submitted.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate samples (MS/MSD) were analyzed at the proper frequency. With the exceptions noted below, recoveries were within the control limits of 75%-125%. If the percent recovery values indicate a potential low bias, associated results are estimated (J/UJ-8L). If the %R values indicate a potential high bias, only the associated positive results are estimated (J-8H). Qualifiers are assigned to all samples in the QC batch. No action is taken if only one of the MS/MSD recoveries is outside of the control limits.

Precision is evaluated using the relative percent difference (RPD) between the MS and MSD values. Associated positive results are estimated (J-9) if the RPD is greater than the control limit of 20%.

SDG 23F0536: Sample LDW20-SC148A was used for the MS/MSD analyses. The MS recovery for lead was greater than the upper control limit. The MSD recovery was acceptable; no action was taken based on the single outlier. The RPD value for lead was greater than the control limit; the associated lead result was estimated (J-9). The MS/MSD recoveries for silver were less than the lower control limit; the silver results in associated field sample and laboratory duplicate were estimated (J-8L).

Laboratory Duplicates

The RPD control limit is 20% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the difference between the sample and duplicate should be less than 2x the RL. With the exception noted below, precision criteria were met.

SDG 23F0536: Sample LDW20-SC148A was used for the duplicate analyses. The RPD values for arsenic and lead were greater than the control limit; lead and arsenic results in the associated field sample and laboratory duplicate were estimated (J-9).

Reference Materials

SDG 23F0536: The reference material D112-540 (Metals in Soil) was analyzed. The recoveries were within the control limits.

Field Duplicates

No field duplicates were submitted.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. With the exceptions noted above, accuracy was acceptable as demonstrated by the LCS, SRM, and MS/MSD %R values and precision was acceptable as demonstrated by the laboratory duplicate and MS/MSD relative percent difference values.

Results were estimated based on exceeded holding times, MS/MSD recovery outliers, and MS/MSD and laboratory duplicate precision outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
ADDENDUM
LDW: AOC4 Phase 3
TOC by 9060A and Total Solids by SM 2540 G-97

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, LLC (ARL), Tukwila, Washington. Refer to the Sample Index for a list of samples reviewed.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
23B0494	6 Sediment	EPA Stage 2B
23C0107	3 Sediment	EPA Stage 2B
23D0577	9 Sediment	EPA Stage 2B
23F0536	1 Sediment	EPA Stage 2B

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

All sample IDs reported in the electronic data deliverable (EDD) were verified (100%) by comparing the EDD to the hardcopy laboratory data package. Sample results and laboratory quality control sample results were also verified (10%).

TECHNICAL DATA VALIDATION

The QC requirements for review are listed below.

2	Sample Receipt, Preservation, and Holding Times	✓	Laboratory Duplicates/Triplicates
✓	Laboratory Blanks	1	Field Duplicates
1	Field Blanks	1	Reporting Limits
1	Reference Materials	✓	Reported Results
2	Matrix Spike (MS)		

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, Holding Times

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of ≤ 6°C.

SDG 23B0494: Samples LDW21-IT635A, LDW21-IT635B, LDW21-IT635C, and LDW21-IT635D were

analyzed past the 6-month holding time at 588-595 days for the total solids and total organic carbon analyses; all results for these samples were estimated (J-1).

Samples in this analytical data set are archived samples stored frozen from the following SDGs:

CLIENT ID	ARI ORIGINAL SDG	ARI SAMPLE #
LDW21-IT635A	21G0244	16
LDW21-IT635B		17
LDW21-IT635C		18
LDW21-IT635D		19
LDW22-IT789M	22L0247	18
LDW22-IT789N		19

SDG 23C0107: Samples LDW21-IT608C and LDW21-IT608D were analyzed past the 6-month holding time at 604-633 days for the total solids and total organic carbon analyses; all results for these samples were estimated (J-1).

Two samples in this analytical data set are archived samples stored frozen from the following SDG:

CLIENT ID	ARI ORIGINAL SDG	ARI SAMPLE #
LDW21-IT608C	21G0229	2
LDW21-IT608D		3

SDG 23D0577: All samples were analyzed past the 6-month holding time at 194-721 days; all results for these samples were estimated (J-1).

Samples in this analytical data set are archived samples stored frozen from the following SDG:

CLIENT ID	ARI ORIGINAL SDG	ARI SAMPLE #
LDW22-SC778G	22L0254	02
LDW22-SC777J	22L0254	06
LDW22-SC777K	22L0254	07
LDW22-SC777L	22L0254	08
LDW22-SC777M	22L0254	09
LDW22-SC760I	22L0156	29
LDW21-SC572J	21G0014	23
LDW21-SC572K	21G0014	24
LDW21-SC572L	21G0014	25

SDG 23F0536: Sample LDW20-SC148A was analyzed past the 6-month holding time at 1113-1124 days for the total solids and total organic carbon analyses; results for these samples were estimated (J-1).

The sample in this analytical data set is an archived sample stored frozen from SDG 20F0160.

Field Blanks

Field blanks were not submitted.

Reference Material

A standard reference material, NIST 1941B, was analyzed with each batch of total organic carbon analyses. The acceptance criteria of 2.99% ± 0.24% were met.

SDG 23B0494: SRM BLC0025-SRM1 expired 2/7/23 but was analyzed 3/2/23. All acceptance criteria were met. No action was taken.

SDG 23C0107: SRM BLD0117-SRM1 expired 2/7/23 but was analyzed 4/6/23. All acceptance criteria were met. No action was taken.

SDG 23D0577: SRM BLF0522-SRM1 expired 4/14/23 but was analyzed 6/24/23. All acceptance criteria were met. No action was taken.

SDG 23F0536: SRM BLG0049-SRM1 was analyzed with this sample. All acceptance criteria were met.

Matrix Spike

Matrix spike samples (MS) were analyzed at the proper frequency of one per 20 samples or one per batch for TOC sediment samples, with the exception noted below. MS %R values are not evaluated when the parent concentration is greater than 4x the spike concentration. Qualifiers were applied to all samples in an analytical batch.

When the MS %R values indicate a potential low bias, associated results are estimated (J/UJ-8L). Only the associated positive results are estimated (J-8H) if the %R values indicate a potential high bias.

SDG 23C0107: For Batch BLD0117, batch QC using Sample LDW23-SS1000 (from another SDG), was analyzed as the MS sample. The TOC %R value was greater than the upper control limit; positive results in the associated samples were estimated (J-8H).

Field Duplicates

No field duplicate samples were submitted.

Reporting Limits

For TOC analyses, the QAPP-required method detection limit (MDL) of 0.018% was not met. The method reporting limit (MRL) of 0.02% was met. No action was taken.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical methods. With the noted exceptions, accuracy was acceptable as demonstrated by the LCS, CRM, and MS recoveries

and precision was acceptable as indicated by the laboratory duplicate RPD values as well as the laboratory triplicate RSD values.

Results were estimated based on holding time outliers and MS recovery outliers.

All data, as qualified, are acceptable for use.

ECOCHEM
Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

Draft Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2016 and Method EPA 1613B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments [3]
Sample Handling					
Cooler/Storage Temperature Preservation	Waters/Solids ≤ 6°C & in the dark Tissues <-10°C & in the dark **Preservation Aqueous:** If Cl_2 is present Thiosulfate must be added and if pH > 9 it must be adjusted to 7 - 9	NFG [(1)] Method[(2)]	J(pos)/R(ND) if thiosulfate not added if Cl_2 present; J(pos)/UJ(ND) if pH not adjusted J(pos)/UJ(ND) if temp > 20°C	1	**EcoChem PJ, see TM-05**
Holding Time	**If properly stored, 1 year or:** **Extraction (all matrices):** 30 days from collection **Analysis (all matrices)**: 45 days from extraction	NFG [(1)] Method[(2)]	If not properly stored or HT exceedance: J(pos)/UJ(ND)	1	**EcoChem PJ, see TM-05** Gross exceedance = > 1 year 2011 NFG **Note:** Under CWA, SDWA, and RCRA the HT for H2O is 7 days.
Instrument Performance					
Mass Resolution (PFK)(Tuning)	PFK (Perfluorokerosene) Analyzed prior to ICAL and at the beginning and end of each 12 hr. shift. ≥10,000 resolving power at m/z low and high mass (e.g. 304.9824 and 380.9760) Lock-mass for each descriptot w/in 5 ppm of theoretical value	NFG [(1)] Method[(2)]	R(pos/ND) all analytes in all samples associated with the tune	24	
Windows Defining Mix (WDM)	Peaks for first and last eluters must be within established retention time windows for each selector group (chlorination level)	NFG [(1)] Method[(2)]	If peaks are not completely within windows (clipped): If natives are ok, J(pos)/UJ(ND) homologs (Totals) If natives are affected, R all results for that selector group	24	
AND Isomer Specificity Check (ISC)	Both mixes must be analyzed before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) where x = ht. of TCDD (or TCDF) & y = baseline to bottom of valley For all isomers eluting near the 2378-TCDD (TCDF) peak	NFG [(1)] Method[(2)]	J(pos) if valley > 25%	24	**EcoChem PJ, see TM-05, Rev. 2**; Note: TCDF is evaluated only if second column confirmation is performed
OR Column Performance Solution (CPS) (combined WDM and ISC)	Peaks for first and last eluters must be within established retention time windows for each selector group (chlorination level) Both mixes must be analyzed before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) where x = ht. of TCDD (or TCDF) & y = baseline to bottom of valley For all isomers eluting near the 2378-TCDD (TCDF) peak	NFG [(1)] Method[(2)]	If peaks are not completely within windows (clipped): If natives are ok, J(pos)/UJ(ND) homologs (Totals) If natives are affected, R all results for that selector group J(pos) if valley > 25%	24	**EcoChem PJ, see TM-05, Rev. 2**; Note: TCDF is evaluated only if second column confirmation is performed

Draft Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2016 and Method EPA 1613B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments [3]
Initial Calibration **Sensitivity**	S/N ratio > 10 for all native and labeled compounds in CS1 std.	NFG [(1)] Method[(2)]	If <10, elevate Det. Limit or R(ND)	5A	
Initial Calibration **Selectivity**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG [(1)] Method[(2)]	If 2 or more ion ratios are out for one compound in ICAL, J(pos)	5A	**EcoChem PJ, see TM-05, Rev. 2**
Initial Calibration (Minimum 5 stds.) **Stability**	%RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD < 35% for labeled compounds under 1613b)	NFG [(1)] Method[(2)]	J(pos) natives if %RSD > 20%	5A	
	Absolute RT of $^{13}C_{12}$-1234-TCDD >25 min on DB5 & >15 min on DB-225	NFG [(1)] Method[(2)]	Narrate, no action		**EcoChem PJ, see TM-05, Rev. 2**
Continuing Calibration (Prior to each 12 hr. shift) **Sensitivity**	S/N ratio for CS3 standard > 10	NFG [(1)] Method[(2)]	If <10, elevate Det. Limit or R(ND)	5B	
Continuing Calibration (Prior to each 12 hr. shift) **Selectivity**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Tables 8 and 9 of method 1613B)	NFG [(1)] Method[(2)]	For congener with ion ratio outlier, J(pos) natives in all samples associated with CCAL. No action for labeled congener ion ratio outliers.	25	**EcoChem PJ, see TM-05**

Draft Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2016 and Method EPA 1613B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments [3]
Continuing Calibration (Prior to each 12 hr. shift) **Stability**	%D+/-20% for native compounds %D +/-30% for labeled compounds **(Must meet limits in Table 6, Method 1613B)**	NFG [(1)] Method[(2)]	**Labeled compounds:** Narrate, no action. **Native compounds:** 1613: J(pos)/UJ(ND)if %D is outside Table 6 limits J(pos)/R(ND) if %D is +/-75% of Table 6 limits	5B (H,L)[4]	
	Absolute RT of $^{13}C_{12}$-1234-TCDD and $^{13}C_{12}$-123789-HxCDD should be +/- 15 seconds of ICAL RRT for all other compounds must meet criteria listed in Table 2 Method 1316.	NFG [(1)] Method[(2)]	Narrate, no action	5B	**EcoChem PJ, see TM-05**
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG (1) Method(2)	U(pos) if result is < 5X action level.	7	**Hierarchy of blank review:** **#1 - Review MB, qualify as needed** **#2 - Review FB , qualify as needed**
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL		U(pos) if result is < 5X action level.	6	
Precision and Accuracy					
MS/MSD (recovery)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) if both %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	8 (H,L)[4]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only unless other QC indicates systematic problems.
MS/MSD (RPD)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only.
LCS (or OPR)	One per lab batch (of ≤ 20 samples) Use most current laboratory control limits **or** Limits from Table 6 of 1613B	NFG [(1)] Method [(2)] Ecochem standard policy	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	10 (H,L)[4]	No action if only one spike %R is outside criteria, when LCSD is analyzed. Qualify all associated samples.
LCS/LCSD (RPD)	**LCSD not typically required for HRMS analyses.** One set per matrix and batch of 20 samples RPD < 35%	Method [(2)] Ecochem standard policy	J(pos) assoc. compound in all samples if RPD > CL	9	Qualify all associated samples.
Lab Duplicate (RPD)	**Lab Dup not typically required for HRMS analyses.** One per lab batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos)/UJ(ND) if RPD > CL	9	

Draft Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2016 and Method EPA 1613B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments [3]
Precision and Accuracy (continued)					
Labeled Compounds (Internal Standards and cleanup standards)	Added to all samples %R = 40% - 135% in all samples 8290 %R must meet limits in Table 7 Method 1613B	NFG [1] Method [2,3]	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	13 (H,L)[4]	
	Ion Abundance Ratio Method 1613B: Table 8 (required m/z to monitor) Table 9 (QC limits) Method 8290A: Table 8				
Field Duplicates	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy and default criteria	Narrate and qualify (J/UJ) if required by project	9	**QAPP may have other specified control limits** **Control limit for this project is 75%**
Compound ID and Calculation					
Quantitation/ Identification	All ions for each isomer must maximize within +/- 2 seconds. S/N ratio >2.5 Table 9 of 1613B; RRTs w/in limits in Table 2 of 1613B	NFG [1] Method [2,3]	Narrate in report; qualify if necessary U(pos) for retention time outliers. J(pos) for ion ratio outliers.	25	**EcoChem PJ, see TM-05**
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	NFG [1] Method [2,3]	If laboratory correctly reported an EMPC value, qualify the native compound J(pos) to indicate that the value is a detection limit and qualify total homolog groups J (pos)	25	**Projec SAP/QAPP may require EMPCS to be considered ND; in that csae U-25 natives, J-25 Totals professional judgment See TM-18**
Interferences	Interferences from chlorodiphenyl ether compounds	NFG [1] Method [2,3]	J(pos)/UJ(ND) if present	23	**See TM-16**
	Lock masses must not deviate +/- 20% from values in Table 8 of 1613B	Method [2,3]	J(pos)/UJ(ND) if present	24	**See TM-17**
Second Column Confirmation	All 2,3,7,8-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC criteria must also be met for the confirmation analysis.	NFG [1] Method [2,3]	Report the DB-225 value. If not performed use PJ.		DNR-11 DB5 result if both results from both columns are reported. **EcoChem PJ, see TM-05**
Calculation Check	Check 10% of field & QC sample results	EcoChem standard policy	Contact laboratory for resolution and/or corrective action	na	Full data validation only.

Draft Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2016 and Method EPA 1613B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments [3]
Electronic Data Deliverable (EDD)					
Verification of EDD to hardcopy data	EcoChem verify @ 10% unless problems noted; then increase level up to 100% for next several packages.		Depending on scope of problem, correct at EcoChem (minor issues) to resubmittal by laboratory (major issues).	na	EcoChem Project Manager and/or Database Administrator will work with lab to provide long-term corrective action.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	Standard reporting policy	Use "DNR" to flag results that will not be reported.	11	

[1] National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) & Chlorinated Dibenzofurans (CDFs) Data Review, September 2016
National Functional Guidelines for High Resolution Superfunds Methods Data Review, April 2016

[2] EPA Method 1613, Rev.B, Tetra-through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGS/HRMS, October 1994
NFG suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

[3] Tech Memos (TM) on file at EcoChem

(pos) - positive (detected) results;
(ND) - not detected results

DATA VALIDATION CRITERIA

Semivolatile Organic Compounds by Gas Chromatography-Mass Spectroscopy (GC-MS)
(Based on Organic NFG 2017 and SW-846 Method 8270E)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	<6°C sediment/tissues may require storage at -20°C	NFG [1] Method [2]	**If required by project:** J (pos)/UJ (ND) if greater than 6° C	1	Use **PJ** for temp outliers; see **TM20**
Holding Time	**Extraction Aqueous:** 7 days from collection **Extraction Solid:** 14 days from collection **Analysis (all matrices)**: 40 days from extraction Extraction Holding Time may be extended to 1 year for frozen sediments/tissues	NFG [1] Method [2]	J (pos)/UJ (ND) if HT exceeded J (pos)/R (ND) if gross exceedance (> 2x HT)	1	Use PJ for Gross Exceedence Gross exceedance = > 2x HT
Instrument Performance					
Tuning	DFTPP Beginning of each 12 hour period Use method criteria	NFG [1] Method [2]	R (pos/ND) all analytes in all samples associated with the tune	24	tune requirement waived if opening CCV passes
Initial Calibration **Sensitivity**	RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders *	NFG [1] Method [2] EcoChem standard policy	Use **PJ** to qualify J (pos)/UJ (ND)	5A	**PJ:** No action if response is stable (ICAL RSD and CCAL %D acceptable)
Initial Calibration **Stability**	Minimum 5 standards %RSD ≤ 20.0% except: %RSD ≤ 40.0% poor responders * **or** co-efficient of determination (r^2) > 0.99	NFG [1] Method [3]	J (pos) if %RSD > limit **or** r^2 value <0.99	5A	
Initial Calibration Verification Check	Prepared from second source; analyze after each ICAL Percent recovery limits = 70-130%	Method [2]	J (pos) %R > UCL J (pos)/UJ (ND) %R < LCL	5A (H,L)[4]	QAPP may have overriding accuracy limits.
Instrument Performance (continued)					
Continuing Calibration **Sensitivity**	RRF ≥ 0.05 except: RRF ≥ 0.01 poor responders *	NFG [1] Method [2]	Use **PJ** to qualify J (pos)/UJ (ND)	5B	see ICAL RRF guidance
Continuing Calibration **Stability**	Prior to sample analysis and every 12 hours %D ≤ 25% except: %D ≤ 40.0% poor responders *	NFG [1] Method [2]	J (pos) - %D > control limit (high bias) J (pos)/UJ (ND) - %D < -control limit (low bias)	5B (H,L)[4]	

DATA VALIDATION CRITERIA

Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > MDL	NFG [1] Method [2]	U(pos) if result is < 5X or 10X action level	7	10X action level applies to phthalates only. 5X for all other target analytes **Hierarchy of blank review:** **#1 - Review MB, qualify as needed #2 - Review FB , qualify as needed** **Note: Actions as per 1999 NFG**
	No TICs present		R (pos) TICs using 10X rule	7	
Field Blank (FB)	No detected compounds > MDL	NFG [1] Method [2]	U (pos) if result is < 5X or 10X action level	6	
Precision and Accuracy					
LCS/LCSD (recovery)	One per matrix per batch (of ≤ 20 samples) LCSD not required by NFG or method Use method acceptance criteria/laboratory limits	NFG [1] Method [2] EcoChem standard policy	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND)%R < 10%	10 (H,L)[4]	No action if only one spike %R is outside criteria when LCSD is analyzed, unless one recovery is<10%. IF UCL is < 100% and %R is > UCL but less than 100%, don't qualify for high bias QAPP may have overriding accuracy limits. Qualify all associated samples.
LCS/LCSD (RPD)	If LCSD analyzed RPD < lab limits	Method [2]	J (pos)	9	Qualify all associated samples. QAPP may have overriding precision limits.
Precision and Accuracy (continued)					
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[4]	QAPP may have overriding accuracy limits. Some manufacturers have different RM control limits
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2] EcoChem standard policy	J (pos) %R > UCL J (pos)/UJ (ND) if both %R < LCL J (pos)/R (ND) if both %R < 10% J (pos)/UJ (ND) if one > UCL & one < LCL, with no bias	8 (H,L)[4]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only.
MS/MSD (RPD)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2]	J (pos) in parent sample if RPD > CL	9	Qualify parent sample only
Surrogates	Minimum of 3 acid & 3 base/neutral (B/N) compounds added to all samples Within method control limits	NFG [1] Method [2] EcoChem standard policy	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND) if %R < 10%	13 (H,L)[4]	Qualify all compounds in associated fraction. Do not qualify if only 1 acid and/or 1 B/N surrogate is out, unless <10%. If 1 surrogate outlier < 10% then J (pos)/R (ND)

Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	NFG [1] Method [2]	J (pos) if > 200% J (pos)/UJ (ND) if < 50% J (pos)/R (ND) if < 25% if RT >30 seconds use **PJ**	19	Qualify compounds quantified using particular internal standard
Field Duplicates	**Solids:** RPD < 50% OR difference < 2X RL (for results < 5X RL) **Aqueous:** RPD < 35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	Use project limits if specified
Compound Identification and Quantitation and Calculation					
Retention times and relative ion intensities	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	NFG [1] Method [2]	U (pos) if identification criteria not met	25	
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NFG [1] Method [2]	NJ the TIC unless: R (pos) common laboratory contaminants	4	
Calibration Range	Results greater than highest calibration standard	EcoChem standard policy	Qualify J (pos)	20	If result from dilution analysis is not reported.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Organic Data Review, January 2017
[2] Method SW846 8270E Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
NFG 2013 suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

(pos): Positive Result
(ND): Not detected

* "Poor responder" compounds: acetophenone, atrazine, benzaldehyde, 1,1'-biphenyl, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, caprolactam, carbazole, 4-chloroaniline, diethylphthalate, di-n-butylphthalate, 3-3'-dichlorobenzidine, dimethylphthalate, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, di-n-octylphthalate, hexachlorobutadiene, hexachlorocyclopentadiene, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, N-nitrosodiphenylamine, 2,2'-oxybis-(1-chloropropane), 1,2,4,5-tetrachlorobenzene use a 0.010 RRF criterion.

PCB Aroclors by GC
(Based on Organic NFG 2017 and SW-846 Method 8082A)

QC Element	Acceptance Criteria (NFG)	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	0-6°C Tissue/sediments (may be frozen -20°C)	NFG [1] Method [2]	**If required by project:** J (pos)/UJ (ND) if greater than 6° C	1	Use Professional Judgment (PJ) to qualify for temperature outlier. Current SW846 criterion is ≤ 6° C [3]
Holding Time	**Extraction Aqueous:** 7 days from collection **Extraction Solid:** 14 days from collection **Exraction Tissue/Sediment (frozen):** 1 year **Analysis (all matrices)**: 40 days from extraction	NFG [1] Method [2]	**If required by project:** J (pos)/UJ (ND) if ext/analyzed > HT	1	Use PJ to qualify for holding times Current SW846 does not have an extraction holding time limit, but recommends one year.[3]
Instrument Performance					
Retention Times	Surrogates: TCMX (± 0.05); DCB (± 0.10) Aroclors (± 0.07)	NFG [1]	NJ (pos)/R (ND) results for analytes with RT shifts	24	
Initial Calibration	Minimum 5 point with RSD ≤ 20% OR correlation coefficient (r-value) ≥ 0.995 OR Minimum 6-point with co-efficient of determination (r2-value) ≥ 0.99	NFG [1] Method [4]	J (pos) if %RSD greater than 20% OR r-value < 0.995 OR r^2-value < 0.99	5A	Refer to TM-01 for additional information. Use bias flags (H,L)[5] where appropriate
Initial Calibration Verification (ICV)	No NFG criteria. Project specific.	Project	J (pos) if > UCL J (pos)/UJ (ND) if < LCL	5B	Use bias flags (H,L) where appropriate
Continuing Calibration (Prior to each 12 hr. shift)	%D ± 20%	Method [2]	If > 20% (high bias): J (pos) If <20% (low bias: J (pos)/UJ (ND)	5B	Refer to TM-01 for additional information. Use bias flags (H,L) where appropriate
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG [1] Method [2]	U (pos) if result is less than appropriate 5X action level.	7	**Hierarchy of blank review:** **#1 - Review MB and IB, qualify as needed** **#2 - Review FB , qualify as needed** Note: Actions as per NFG 1999 Note: IB not required by method
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL	NFG [1] Method [2]	U (pos) if result is less than appropriate 5X action level.	6	
Instrument Blanks (IB)	Analyzed at the beginning and end of every 12 hour sequence No analyte > CRQL	NFG [1]	U (pos) if result is less than appropriate 5X action level.	7	
Precision and Accuracy					
MS/MSD (recovery)	One set per matrix per batch (of ≤ 20 samples) AR1016 and AR1260: %R = 29% - 135%, or project limits	NFG [1] Method [2] EcoChem Standard Policy	Qualify parent only unless other QC indicates systematic problems. J (pos) if both %R > upper control limit (UCL) J (pos)/UJ (ND) if both %R < lower control limit (LCL) J (pos)/R (ND) if both %R < 10%	8	No action if only one spike %R is outside criteria. No action if native analyte conc. > 5x the amount spiked. Use bias flags (H,L) where appropriate. Actions apply to all Aroclors in parent sample.

PCB Aroclors by GC
(Based on Organic NFG 2017 and SW-846 Method 8082A)

QC Element	Acceptance Criteria (NFG)	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy					
MS/MSD (RPD)	One set per matrix per batch (of ≤ 20 samples) AR1016: RPD < 15%, AR1260: RPD < 20% or project limits	NFG [1] Method [2]	Qualify parent only unless other QC indicates systematic problems. J (pos) if RPD > control limit	9	No action if parent is ND.
LCS	One per lab batch (of ≤ 20 samples) AR1016 and AR1260: %R = 50% - 150%, or project limits	NFG [1] EcoChem Standard Policy	J (pos) if %R > UCL J (pos)/UJ (ND) if %R < LCL J (pos)/R (ND) if %R < 10%	10	Use bias flags (H,L) where appropriate. Actions apply to all Aroclors in associated samples.
LCS/LCSD (RPD)	if analyzed use MS/MSD RPD criteria	NFG [1]	J (pos) assoc. compound in all samples	9	LCSD not required by method or NFG
Surrogates	TCMX and DCBP added to every sample %R = 30% - 150% or project limits	NFG [1] Method [2]	J (pos) if either %R > UCL J (pos)/UJ (ND) if either %R < LCL J (pos)/R (ND) if either %R < 10%	13	If %R < 10% (sample dilution is a factor), use PJ Use bias flags (H,L) where appropriate
Internal Standards (if used)	Acceptable Range: IS area = 50% to 200% of CCAL area RT within 30 seconds of CC RT	Method [2]	J (pos) if area > 200% J (pos)/UJ (ND) if area < 50% J (pos)/R (ND) if area < 25% RT > 30 seconds, narrate	19	
Field Duplicates	**Solids:** RPD < 50% OR difference < 2X RL (for results < 5X RL) **Aqueous:** RPD < 35% OR difference < 1X RL (for results < 5X RL)	EcoChem Standard Policy	J (pos)/UJ (ND) Qualify only parent and field duplicate samples	9	QAPP may have overriding limits
Compound Identification/Quantification					
Quantitation/ Identification	Between two columns: RPD < 40% or %D < 25% Within Retention Time Windows on both columns.	NFG [1] Method [2]	J (pos) if RPD = 40% - 60% (25% - 60% for %D) NJ (pos) if > 60% R (pos) if RTW criterion not met	3	See TM-08 for additional info.
Calibration Range	on column concentration < high calibration standard	NFG [1] Method [2]	J (pos) if conc > high standard and sample was not diluted	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	Standard reporting policy	Use "DNR" to flag results that will not be reported.	11	TM-04 Rev. 1 for additional info.
Sample Clean-up					
GPC/Sulfur/ Florisil/Acid	No criteria - cleanups are optional	NFG [1] Method [2]	Use Professional Judgment	14	special cleanups may be required for project cleanup standards may be associated with GPC/florisil cleanups

[1] National Functional Guidelines for Organic Data Review, January 2017

[2] Polychlorinated Biphenyls (PCBs) by Gas Chromatography USEPA Method SW846 8082A, Feb 2007, Rev. 1

[3] SW846, Chapter 4, Organic Analytes

[4] Determinative Chromatographic Separations , Method 8000C , March 2003, Rev.3

[5] "H" = high bias indicated; "L" = low bias indicated

(pos): Positive Result

(ND): Not detected

Metals by ICP-MS
(Based on Inorganic NFG 2017 and SW-846 6020B)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler / Storage Temperature Preservation	**Solid:** Cooler temperature ≤ 6° C **Aqueous:** Nitric Acid to pH < 2 **Dissolved Metals:** 0.45 µm filter, preserve to pH < 2 after filtration	NFG (1) Method (2)	Cooler Temps: **If required by project** J (pos)/UJ (ND) if greater than 6° C Aqueous: J (pos)/UJ (ND) if pH > 2	1	Use PJ to qualify for temperature outlier. No quals for pH if samples preserved by lab upon receipt and within 1 day of collection.
Holding Time	All matrices: 180 days from date sampled Frozen soils, sediments, tissues (-20°C) - HT extended to 1 year	NFG (1) Method (2) EcoChem standard policy	J (pos)/UJ (ND) if holding time exceeded	1	Use PJ for gross exceedences (>2x HT)
Instrument Performance					
Tune	Analyzed prior to ICAL Mass Cal < 0.1 amu difference from target mass Peak Resolution < 0.9 amu @ 10% peak height	NFG (1) Method (2)	J(pos)/UJ(ND) if tune criteria not met	5A	Use **PJ** to evaluate tune. Alternate Resolution critteria may apply based on instrument specs (i.e <0.75 amu at 5% peak height)
Initial Calibration (ICAL)	Based on instrument requirements, blank + 1 standard minimum requirement for calibration If more than 1 standard used, r ≥ 0.995	NFG (1) Method (2)	J (pos)/UJ (ND) if r < 0.995	5A	
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ± 10% of true value	NFG (1) Method (2)	R (pos/ND) if %R < 75% J (pos)/UJ (ND) if %R 75% - 89% J (pos) if %R >111%	5A (H,L)[3]	Qualify all samples in run
Reporting Limit (RL) Standard Low Level ICV/CCV	concentration at RL %R = 80%-120%	Method (2)	J (pos) < 2x RL / R (ND) if %R <50% J (pos) < 2x RL / UJ (ND) if %R 50 - 79% J (pos) < 2x RL if %R > 120%	5A (H,L)[3]	for ICVL, qualify all samples in run for CCVL, qualify bracketed samples
Continuing Calibration Verification (CCV)	Immediately following ICV/ICB, then every two hours or ten samples, and at end of run. %R within ± 10% of true value	NFG (1) Method (2)	R (pos/ND) if %R < 75% J (pos)/UJ (ND) if %R 75% - 89% J (pos) if %R >111%	5B (H,L)[3]	Qualify samples bracketed by CCV outliers
Interference Check Samples (ICSA / ICSAB)	ICSAB %R 80% - 120% for all spiked elements | ICSA | < MDL for all unspiked elements	NFG (1) Method (2)	For samples with interfereing elements> ICS levels: **ICSAB**: J(pos)/R (ND) if %R < 50% J (pos)/UJ (ND) if %R = 50% - 79% J (pos) if %R > 120% **ICSA:** J (pos)< 2x RL/UJ (ND) for ICSA <Neg MDL J (pos) < 2x RL for ICSA >MDL	17 (H,L)[3]	Method may only require ICSA (or SIC) Use **PJ** and molecular interferences to evaluate ICSA to determine if bias is present. Due to low levels of some target analytes in the supplier stock solutions, there may be a true value for some unspike analytes in the ICSA Refer to **TM-14** for additional information.
Spectral Interference Check (SIC)	Interferents: Al, Ca, Fe, Mg, Na P, K, S, C, Cl, Mo, Ti daily SIC - unspiked analytes < +/- 2x LOQ	NFG (1) Method (2)	For samples with Interfering elements > SIC levels: J (pos)< 2x SIC/UJ (ND) for SIC <Neg 2x LOQ J (pos) < 2x SIC for SIC > 2x LOQ	17 (H,L)[3]	Use **PJ** and molecular interferences (Table 1 in method) to evaluate SIC to determine if bias is present. Refer to **TM-14** for additional information.

Metals by ICP-MS
(Based on Inorganic NFG 2017 and SW-846 6020B)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Blank Contamination					
Method Blank (MB)	One per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG [1] Method [2]	U (pos) if result is < 5X method blank concentration	7	Refer to **TM-02** for additional information. Blank Evaluation based on NFG 1994
Instrument Blanks (ICB/CCB)	After each ICV & CCV | blank concentration | < MDL	NFG [1] Method [2]	Action level is 5x absolute value of blank conc. For positive blanks: U (pos) results < action level For negative blanks: J (pos)/UJ (ND) results < action level	Pos Blks: 7 Neg Blks: 7L[3]	Use blanks bracketing samples for Qualification Refer to **TM-02** for additional information. **Hierarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review IB , qualify as needed** **#3 - Review FB , qualify as needed**
Field Blank (FB)	Blank conc < MDL	EcoChem standard policy	U (pos) if result is < 5x action level, as per analyte.	6	Qualify in associated field samples only. Refer to **TM-02** for additional information.
Precision and Accuracy					
Internal Standards (IS)	Added to all samples. All analytes must be associated with an internal standard %R > 30% compared to cal blank IS	NFG [1] Method [2]	J(pos)/UJ(ND) all analytes associated with IS outlier	19	NFG criteria 65%-125%
LCS (recovery)	One per matrix per batch (of ≤ 20 samples); LCSD not required %R between 80-120%	Method [2]	J (pos)/R (ND) if %R <50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L)[3]	Qualify all samples in batch QAPP may have overriding accuracy limits. NFG Limits 70% -130%
LCS/LCSD (RPD)	LCSD not required, if analyzed: RPD ≤ 20%	Method [2]	J (pos)/UJ (ND) if RPD > 20%	9	Qualify all samples in batch QAPP may have overriding precision limits.
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples); MSD not required %R between 75-125%	NFG [1] Method [2]	J (pos) if %R > 125% J (pos)/UJ (ND) if %R <75% J (pos)/R (ND) if %R < 30%, unless post digestion spike analyzed, J (pos)/UJ (ND) if post digestion spike %R OK	8 (H,L)[3]	No action if only one spike %R is outside criteria. NA if parent concentration >4x the amount spiked. Qualify all samples in batch. QAPP may have overriding accuracy limits.
MS/MSD (RPD)	MSD not required, if analyzed: RPD ≤ 20%	NFG [1] Method [2]	J (pos)/UJ (ND) if RPD > 20%	9	QAPP may have overriding precision limits.
Post Digestion Spikes	If MS is outside 75-125%, post-spike should be analyzed %R 75%-125%	NFG [1] Method [2]	Only used to support MS qualification decisions	NA	No qualifiers assigned based solely on this element.
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG [1] Method [2]	J (pos)/UJ (ND) if RPD > 20% or if difference > control limit	9	Qualify all samples in batch. QAPP may have overriding precision limits.

Metals by ICP-MS
(Based on Inorganic NFG 2017 and SW-846 6020B)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[3]	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Serial Dilution	Analyze one sample per matrix at a 5x dilution %D <20% for original sample conc. > 25X LLOQ (RL)	Method [(2)]	J(pos)/UJ(ND) if %D > 20%	16	Note: make sure comparing like units for soils samples Qualify all samples in batch. NFG stil uses 10% D for results >50x MDL
Field Duplicate	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Narrate and qualify if required by project **(EcoChem PJ)** Qualify only field duplicate samples J(pos)/UJ(ND)	9	QAPP may have overriding precision limits.
Compound Quantitation					
Total and Dissolved Comparison	Total > Dissolved	EcoChem standard policy	J (pos)/UJ (ND) if Dissolved > Total and results fall outside of standard duplicate precision criteria	14	
Calibration Range	Results < instrument linear range	NFG [(1)] Method [(2)]	if result exceeds linear range and sample was not diluted J (pos)	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Inorganic Superfund Data Review (2017)

[2] Method SW846 6020B Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), Revision 2, July 2014.

[3] "H" = high bias indicated; "L" = low bias indicated

[4] SW846, Chapter 3, Inorganic Analytes

(pos): Positive Result

(ND): Not detected

Mercury by CVAA
(Based on Inorganic NFG 2017 and SW846 7470A & 7471B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler / Storage Temperature Preservation	**Solid:** Cooler temperature 0-6°C **Aqueous:** Nitric Acid to pH < 2 **Dissolved Metals:** 0.45 µm filter, preserve to pH < 2 after filtration	NFG (1) Method (2)	Cooler Temps: **If required by project** J (pos)/UJ (ND) if greater than 6° C Aqueous: J (pos)/UJ (ND) if pH > 2	1	Use **PJ** to qualify for temperature outlier. Current SW846 criterion is ≤ 6° C (4) No quals for pH if samples preserved by lab immediately upon receipt and within 1 day of collection.
Holding Time	28 days from date sampled Frozen solids and tissues HT extended to 6 months	NFG (1) Method (2) EcoChem standard policy	J (pos)/UJ (ND) if HT exceeded	1	
Instrument Performance					
Initial Calibration (ICAL)	Daily Calibration Blank + 5 standards, one ≤ RL Correlation coefficient (r) ≥ 0.995	NFG (1) Method (2)	J (pos)/UJ (ND) if r < 0.995	5A (H,L)[3]	
Initial Calibration Verification (ICV)	Independent source analyzed immediately after ICAL %R within ± 15% of true value	NFG (1) Method (2)	R(pos/ND) if %R <70% J(pos)/UJ(ND) if %R = 70-84% J(pos) if %R = > 116%	5A (H,L)[3]	Qualify all samples in run
Reporting Limit (RL) Standard	Conc = RL %R = 70-130%	Method (2)	J (pos) < 2x RL / R (ND) if %R <50% J (pos) < 2x RL / UJ (ND) if %R 50 - 69% J (pos) < 2x RL if %R > 130%	5A (H,L)[3]	Qualify all samples in run
Continuing Calibration Verification (CCV)	At beginning of run, every ten samples, and again after last sample. %R within ± 15% of true value	NFG (1) Method (2)	R(pos/ND) if %R <70% J(pos)/UJ(ND) if %R = 70-84% J(pos) if %R = > 116%	5B (H,L)[3]	Qualify samples bracketed by CCV outliers
Blank Contamination					
Method Blank (MB)	One per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG (1) Method (2)	U (pos) if result is < 5X method blank concentration	7	Refer to **TM-02** for additional information. Blank Evaluation based on NFG 1994
Instrument Blanks (ICB/CCB)	After each ICV & CCV | blank concentration | < MDL	NFG (1) Method (2)	Action level is 5x absolute value of blank conc. For positive blanks: U (pos) results < action level For negative blanks: J (pos)/UJ (ND) results < action level	Pos Blanks: 7 Neg Blanks: 7L[3]	Use blanks bracketing samples for Qualification Refer to **TM-02** for additional information. **Hierarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review IB , qualify as needed** **#3 - Review FB , qualify as needed**

Mercury by CVAA
(Based on Inorganic NFG 2017 and SW846 7470A & 7471B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Field Blank (FB)	Blank conc < MDL	EcoChem standard policy	U (pos) if result is < 5x action level, as per analyte.	6	Qualify in associated field samples only. Refer to **TM-02** for additional information.
Precision and Accuracy					
Laboratroy Control Sample (recovery)	One per matrix per batch (of ≤ 20 samples); LCSD not required %R between 80-120%	Method [2] EcoChem standard policy	J (pos)/R (ND) if %R <50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L)[3]	No action if only one spike %R is outside criteria. Qualify all samples in batch QAPP may have overriding accuracy limits.
LCS/LCSD (RPD)	LCSD not required, if analyzed: RPD ≤ 20%	Method [2]	J (pos)/UJ (ND) if RPD > 20%	9	Qualify all samples in batch QAPP may have overriding precision limits.
Matris Spike/Matrix Spike Duplicate MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples); MSD not required %R between 75-125%	NFG [1] Method [2] EcoChem standard policy	J (pos) if %R > 125% J (pos)/UJ (ND) if %R <75% J (pos)/R (ND) if %R < 30%	8 (H,L)[3]	No action if only one spike %R is outside criteria. NA if parent concentration >4x the amount spiked. Qualify all samples in batch. QAPP may have overriding accuracy limits.
MS/MSD (RPD)	MSD not required, if analyzed: RPD ≤ 20%	NFG [1] Method [2]	J (pos)/UJ (ND) if RPD > 20%	9	QAPP may have overriding precision limits.
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG [1] Method [2]	J (pos)/UJ (ND) if RPD > 20% or if difference > control limit	9	Qualify all samples in batch. QAPP may have overriding precision limits.
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[3]	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits

Mercury by CVAA
(Based on Inorganic NFG 2017 and SW846 7470A & 7471B)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Field Duplicate	Solids: RPD <50% (for results ≥ 5x RL) OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% (for results ≥ 5x RL) OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Qualify only parent and field duplicate samples J (pos)/UJ (ND)	9	QAPP may have overriding precision limits. Client/QAPP may not require qualification based on field precision.
Compound Quantitation					
Total and Dissolved Comparison	Total > Dissolved	EcoChem standard policy	J (pos)/UJ (ND) if Dissolved > Total and results fall outside of standard duplicate precision criteria	14	
Calibration Range	Results < instrument linear range	NFG [1] Method [2]	if result exceeds linear range and sample was not diluted J (pos)	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Inorganic Superfund Data Review, January 2017.

[2] Method SW846 7470A Mercury in Liquid Waste (Manual Cold-Vapor Technique), Revision 1, September 1994.
Method SW846 7471B Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique), Revision 2, February 2007.

[3] "H" = high bias indicated; "L" = low bias indicated

[4] SW846, Chapter 3, Inorganic Analytes

(pos): Positive Result

(ND): Not Detected

Conventional Methods with Instrument Calibrations (e.g., Ion Chromatography, Total Organic Carbon)
(Based on Inorganic NFG 2017 and EPA methods)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	Cooler temperature: 0-6°C Preservation: Analyte/Method Specific	NFG [1] Method [2]	J (pos)/UJ (ND) if preservation requirements not met	1	Use **PJ** to qualify for cooler temp outliers.
Holding Time	Analyte/Method Specific	NFG [1] Method [2]	J (pos)/UJ (ND) if holding time exceeded	1	
Instrument Performance					
Initial Calibration (ICAL)	blank + multiple standards as per method requirements r ≥ 0.995	NFG [1] Method [2]	J (pos)/UJ (ND) for r < 0.995	5A	
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R method specific	NFG [1] Method [2]	J (pos)/UJ (ND) if %R < lower control limit (LCL) J (pos) if %R > upper control limit (UCL)	5A (H,L)[3]	Qualify all samples in run
Continuing Calibration Verification (CCV)	immediately following ICV, every 10 samples, and end of run %R method specific	NFG [1] Method [2]	J(pos)/UJ(ND) if %R < LCL J(pos) if %R > UCL	5B (H,L)[3]	Qualify samples bracketed by CCV outliers
Blank Contamination					
Method Blank (MB)	One per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG [1] Method [2]	U (pos) if result is < 5X method blank concentration	7	Refer to **TM-02** for additional information. Blank Evaluation based on NFG 1994
Instrument Blanks (ICB/CCB)	After each ICV & CCV | blank concentration | < MDL	NFG [1] Method [2]	Action level is 5x absolute value of blank conc. For positive blanks: U (pos) results < action level For negative blanks: J (pos)/UJ (ND) results < action level	Pos Blanks: 7 Neg Blanks: 7L[3]	Use blanks bracketing samples for Qualification Refer to **TM-02** for additional information. **Hierarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review IB , qualify as needed** **#3 - Review FB , qualify as needed**
Field Blank (FB)	Blank conc < MDL	EcoChem standard policy	U (pos) if result is < 5x action level, as per analyte.	6	Qualify in associated field samples only. Refer to **TM-02** for additional information.
Precision and Accuracy					
Laboratory Control Sample (LCS)	One per matrix per batch (of ≤ 20 samples) %R within Method control limits (or Laboratory control limtis if none specified in method)	NFG [1] Method [2]	J (pos)/UJ (ND) if %R < LCL J (pos) if %R > UCL	10 (H,L)[3]	Qualify all samples in batch QAPP may have overriding accuracy limits.

Conventional Methods with Instrument Calibrations (e.g., Ion Chromatography, Total Organic Carbon)
(Based on Inorganic NFG 2017 and EPA methods)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Reference Materials (RM, CRM, SRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[3]	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	Where applicable to method; MSD may not be required One per matrix per batch (of ≤ 20 samples) For samples <4x spike level, %R within method control limits (or Laboratory control limtis if none specified in method)	NFG [(1)] Method [(2)]	J (pos)/UJ (ND) if %R < LCL J (pos) if %R > UCL	8 (H,L)3	Qualify all samples in batch No action if native analyte concentration ≥ 4x spike added. Qualify all samples in batch. QAPP may have overriding accuracy limits.
Laboratory Duplicate (or MS/MSD)	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG [(1)] Method [(2)]	J (pos)/UJ (ND) if RPD > 20% or if difference > control limit	9	Qualify all samples in batch. QAPP may have overriding precision limits.
Field Duplicate	Solids: RPD <50% (for results ≥ 5x RL) OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% (for results ≥ 5x RL) OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Qualify only parent and field duplicate samples J (pos)/UJ (ND)	9	QAPP may have overriding precision limits. Client/QAPP may not require qualification based on field precision.
Compound Quantitation					
Linear Range	Sample concentrations less than highest calibration standard	NFG [(1)] Method [(2)]	If result exceeds linear range & sample was not diluted J (pos)	20	
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Inorganic Superfund Data Review, January 2017.

[2] SW846 or EPA Standard Methods

[3] "H" = high bias indicated; "L" = low bias indicated

(pos): Positive Result

(ND): Not Detected

Conventional Methods by Gravimetric Analysis (e.g., Total Solids, Total Dissolved Solids, Total Suspended Solids, Grain Size)
(Based on Inorganic NFG 2017 and EPA methods)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	Cooler temperature: 4°C±2°C Preservation: Analyte/Method Specific	Method [1] NFG[2]	J (pos)/UJ (ND) if preservation requirements not met	1	Use **PJ** to qualify for cooler temp outliers.
Holding Time	Analyte/Method Specific	Method NFG[2]	J (pos)/UJ (ND) if holding time exceeded	1	
Blank Contamination					
Method Blank (MB)	If required by method,one per matrix per batch of (of ≤ 20 samples) Blank conc < MDL	NFG [1] Method [2]	U (pos) if result is < 5X method blank concentration	7	Refer to **TM-02** for additional information. Blank Evaluation based on NFG 1994
Precision and Accuracy					
LCS (If appropriate to method)	One per matrix per batch (of ≤ 20 samples) %R between 80-120%	Method [2]	J (pos)/R (ND) if %R <50% J (pos)/UJ (ND) if %R 50% - 79% J (pos) if %R > 120%	10 (H,L)[3]	Qualify all samples in batch QAPP may have overriding accuracy limits.
Reference Material (RM, SRM, or CRM)	Result ±20% of the 95% confidence interval of the true value for analytes	EcoChem standard policy	J (pos)/UJ (ND) if < LCL J (pos) if > UCL	12 (H,L)[3]	QAPP may have overriding accuracy limits. Some manufacturers may have different RM control limits
Laboratory Duplicate	One per matrix per batch (of ≤ 20 samples) RPD ≤ 20% for results ≥ 5x RL Solids: difference < 2X RL for results < 5X RL Aqueous: difference < 1X RL for results < 5X RL	NFG [1] Method [2]	J (pos)/UJ (ND) if RPD > 20% For Grain Size, no action if results for fraction are less than 5%	9	Qualify all samples in batch, except Grain Size - qualify parent only. QAPP may have overriding precision limits.
Field Duplicate	Solids: RPD <50% (for results ≥ 5x RL) OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% (for results ≥ 5x RL) OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Qualify only parent and field duplicate samples J (pos)/UJ (ND)	9	QAPP may have overriding precision limits. Client/QAPP may not require qualification based on field precision.

Conventional Methods by Gravimetric Analysis (e.g., Total Solids, Total Dissolved Solids, Total Suspended Solids, Grain Size)
(Based on Inorganic NFG 2017 and EPA methods)

QC Element	EcoChem Acceptance Criteria	Source of Criteria	EcoChem Action for Non-Conformance	Reason Code	Discussion and Comments
Compound Quantitation					
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte per sample	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	

[1] National Functional Guidelines for Inorganic Superfund Data Review, January 2017.

[2] SW846 or EPA Standard Methods

[3] "H" = high bias indicated; "L" = low bias indicated

(pos): Positive Result

(ND): Not Detected

ECOCHEM
Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
LDW AOC4 Phase 3

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,4,6,7,8-HpCDD	340	ng/kg	H B	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,4,6,7,8-HpCDF	104	ng/kg	H	J	1,10L
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,4,7,8,9-HpCDF	14.8	ng/kg	H	J	1,9
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,4,7,8-HxCDD	2.02	ng/kg	EMPC H	J	1,25
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,4,7,8-HxCDF	18.1	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,6,7,8-HxCDD	10.8	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,6,7,8-HxCDF	4.9	ng/kg	H	J	1,10L
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,7,8,9-HxCDD	5.84	ng/kg	H	J	1,9
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,7,8,9-HxCDF	3.62	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,7,8-PeCDD	2.31	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	1,2,3,7,8-PeCDF	1.54	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	2,3,4,6,7,8-HxCDF	6.34	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	2,3,4,7,8-PeCDF	3.46	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	2,3,7,8-TCDD	0.67	ng/kg	EMPC H J	UJ	1,25
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	2,3,7,8-TCDF	1.96	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	OCDD	3090	ng/kg	H B	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	OCDF	403	ng/kg	H	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total HpCDD	719	ng/kg		J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total HpCDF	452	ng/kg		J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total HxCDD	89.8	ng/kg		J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total HxCDF	141	ng/kg		J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total PeCDD	8.74	ng/kg		J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total PeCDF	50.3	ng/kg		J	1,9
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total TCDD	3.16	ng/kg		J	1,9
23B0494	LDW21-IT635A	23B0494-01	EPA 1613B	Total TCDF	23.3	ng/kg		J	1,9
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1248	704	ug/kg	H D	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1254	792	ug/kg	H D	J	1

Qualified Data Summary Table
LDW AOC4 Phase 3

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23B0494	LDW21-IT635A	23B0494-01	EPA 8082A	Aroclor-1260	283	ug/kg	H D	J	1
23B0494	LDW21-IT635A	23B0494-01	EPA 9060	Total Organic carbon (TOC)	1.72	%	H	J	1
23B0494	LDW21-IT635A	23B0494-01	SM 2540-G	Total Solids	58.74	%		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,4,6,7,8-HpCDD	353	ng/kg	B	J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,4,6,7,8-HpCDF	91.7	ng/kg		J	1,10L
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,4,7,8,9-HpCDF	11	ng/kg	*	J	1,9
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,4,7,8-HxCDD	2.48	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,4,7,8-HxCDF	16	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,6,7,8-HxCDD	11.8	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,6,7,8-HxCDF	4.92	ng/kg		J	1,10L
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,7,8,9-HxCDD	7.52	ng/kg	*	J	1,9
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,7,8,9-HxCDF	2.93	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,7,8-PeCDD	2.48	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	1,2,3,7,8-PeCDF	1.45	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	2,3,4,6,7,8-HxCDF	6.32	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	2,3,4,7,8-PeCDF	3.46	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	2,3,7,8-TCDD	0.799	ng/kg	J	J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	2,3,7,8-TCDF	2.17	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	OCDD	2980	ng/kg	B	J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	OCDF	344	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total HpCDD	679	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total HpCDF	365	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total HxCDD	91.9	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total HxCDF	133	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total PeCDD	10.1	ng/kg		J	1
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total PeCDF	31.5	ng/kg		J	1,9
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total TCDD	5.46	ng/kg		J	1,9
23B0494	LDW21-IT635ADUP1	BLB0709-DUP1	EPA 1613B	Total TCDF	34.3	ng/kg		J	1,9
23B0494	LDW21-IT635ADUP1	BLB0652-DUP1	SM 2540-G	Total Solids	58.9	%		J	1
23B0494	LDW21-IT635ADUP2LT	BLB0652-DUP2	SM 2540-G	Total Solids	58.78	%		J	1
23B0494	LDW21-IT635ADUP3	BLC0025-DUP3	EPA 9060	Total Organic carbon (TOC)	1.59	%	H	J	1

Qualified Data Summary Table
LDW AOC4 Phase 3

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,4,6,7,8-HpCDD	565	ng/kg	H B	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,4,6,7,8-HpCDF	300	ng/kg	H	J	1,10L
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,4,7,8,9-HpCDF	56.7	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,4,7,8-HxCDD	2.44	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,4,7,8-HxCDF	87.3	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,6,7,8-HxCDD	20.1	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,6,7,8-HxCDF	16.1	ng/kg	H	J	1,10L
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,7,8,9-HxCDD	6.04	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,7,8,9-HxCDF	14	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,7,8-PeCDD	2.07	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	1,2,3,7,8-PeCDF	3.98	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	2,3,4,6,7,8-HxCDF	24.3	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	2,3,4,7,8-PeCDF	8.35	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	2,3,7,8-TCDD	0.32	ng/kg	EMPC H J	UJ	1,25
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	2,3,7,8-TCDF	3.33	ng/kg	H X	J	1,23H
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	OCDD	4610	ng/kg	E H B	J	1,20
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	OCDF	718	ng/kg	H	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total HpCDD	1050	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total HpCDF	1200	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total HxCDD	118	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total HxCDF	544	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total PeCDD	12.3	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total PeCDF	150	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total TCDD	8.09	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 1613B	Total TCDF	46.9	ng/kg		J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1248	105	ug/kg	H D	J	1
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1254	209	ug/kg	H D	J	1

Qualified Data Summary Table
LDW AOC4 Phase 3

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23B0494	LDW21-IT635B	23B0494-02	EPA 8082A	Aroclor-1260	212	ug/kg	H D	J	1,8L
23B0494	LDW21-IT635B	23B0494-02	EPA 9060	Total Organic carbon (TOC)	1.8	%	H	J	1
23B0494	LDW21-IT635B	23B0494-02	SM 2540-G	Total Solids	67.23	%		J	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1248		ug/kg	H U	UJ	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1254		ug/kg	H U	UJ	1
23B0494	LDW21-IT635C	23B0494-03	EPA 8082A	Aroclor-1260	222	ug/kg	H D	J	1
23B0494	LDW21-IT635C	23B0494-03	EPA 9060	Total Organic carbon (TOC)	5.09	%	H	J	1
23B0494	LDW21-IT635C	23B0494-03	SM 2540-G	Total Solids	60.38	%		J	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1248		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1254		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 8082A	Aroclor-1260		ug/kg	H U	UJ	1
23B0494	LDW21-IT635D	23B0494-04	EPA 9060	Total Organic carbon (TOC)	4.52	%	H	J	1
23B0494	LDW21-IT635D	23B0494-04	SM 2540-G	Total Solids	38.64	%		J	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1248		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1254		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 8082A	Aroclor-1260		ug/kg	H U	UJ	1
23C0107	LDW21-IT608C	23C0107-02	EPA 9060	Total Organic carbon (TOC)	0.86	%	H	J	1,8H
23C0107	LDW21-IT608C	23C0107-02	SM 2540-G	Total Solids	67.49	%	*	J	1
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1

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SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1248		ug/kg	H U	UJ	1
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1254		ug/kg	H U	UJ	1
23C0107	LDW21-IT608D	23C0107-03	EPA 8082A	Aroclor-1260		ug/kg	H U	UJ	1
23C0107	LDW21-IT608D	23C0107-03	EPA 9060	Total Organic carbon (TOC)	0.37	%	H	J	1,8H
23C0107	LDW21-IT608D	23C0107-03	SM 2540-G	Total Solids	73.57	%	*	J	1
23C0107	LDW22-SS826	23C0107-01	EPA 9060	Total Organic carbon (TOC)	2.37	%		J	8H
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1248		ug/kg	H U	UJ	1
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1254	2.5	ug/kg	H J	J	1
23D0577	LDW21-SC572J	23D0577-07	EPA 8082A	Aroclor-1260	11.2	ug/kg	H	J	1
23D0577	LDW21-SC572J	23D0577-07	EPA 9060	Total Organic carbon (TOC)	1.47	%	H	J	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1248		ug/kg	H U	UJ	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1254	2.8	ug/kg	H J	J	1
23D0577	LDW21-SC572K	23D0577-08	EPA 8082A	Aroclor-1260	11.1	ug/kg	H	J	1
23D0577	LDW21-SC572K	23D0577-08	EPA 9060	Total Organic carbon (TOC)	0.64	%	H	J	1
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1248	2.6	ug/kg	H J	J	1
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1254	6.2	ug/kg	H	J	1

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SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23D0577	LDW21-SC572L	23D0577-09	EPA 8082A	Aroclor-1260	32.9	ug/kg	H	J	1
23D0577	LDW21-SC572L	23D0577-09	EPA 9060	Total Organic carbon (TOC)	0.63	%	H	J	1
23D0577	LDW22-SC760I	23D0577-06	EPA 9060	Total Organic carbon (TOC)	0.07	%	H	J	1
23D0577	LDW22-SC777J	23D0577-02	EPA 9060	Total Organic carbon (TOC)	2.04	%	H	J	1
23D0577	LDW22-SC777K	23D0577-03	EPA 9060	Total Organic carbon (TOC)	2.11	%	H	J	1
23D0577	LDW22-SC777L	23D0577-04	EPA 9060	Total Organic carbon (TOC)	1.46	%	H	J	1
23D0577	LDW22-SC777M	23D0577-05	EPA 9060	Total Organic carbon (TOC)	1.22	%	H	J	1
23D0577	LDW22-SC778G	23D0577-01	EPA 9060	Total Organic carbon (TOC)	1.86	%	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Arsenic	8.38	mg/kg	H	J	1,9
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Cadmium	0.27	mg/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Chromium	18.3	mg/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Copper	36.4	mg/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Lead	18.6	mg/kg	H	J	1,9
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Silver	0.17	mg/kg	H J	J	1,8L
23F0536	LDW20-SC148A	23F0536-01	EPA 6020	Zinc	81.1	mg/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 7471B	Mercury	0.106	mg/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1016		ug/kg	H U	UJ	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1221		ug/kg	H U	UJ	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1232		ug/kg	H U	UJ	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1242		ug/kg	H U	UJ	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1248	17.5	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1254	29.3	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8082A	Aroclor-1260	35.2	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	2-Methylnaphthalene	35.9	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Acenaphthene	149	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Acenaphthylene	140	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Anthracene	129	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Benzo(a)anthracene	179	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Benzo(a)pyrene	240	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Benzo(g,h,i)perylene	77	ug/kg	H Q	J	1,5BL
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Chrysene	999	ug/kg	H	J	1,8L

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SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Dibenzo(a,h)anthracene	28.9	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Fluoranthene	5020	ug/kg	H E	DNR	20
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Fluorene	189	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Indeno(1,2,3-cd)pyrene	86.1	ug/kg	H Q	J	1,5BL
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Naphthalene	26.7	ug/kg	H	J	1
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Phenanthrene	4660	ug/kg	H E	DNR	20
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Pyrene	3940	ug/kg	H E	DNR	20
23F0536	LDW20-SC148A	23F0536-01	EPA 8270E	Total benzofluoranthenes	1020	ug/kg	H	J	1,5BH
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	2-Methylnaphthalene		ug/kg	H U	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Acenaphthene	170	ug/kg	H J D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Acenaphthylene	103	ug/kg	H J D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Anthracene	85.8	ug/kg	H J D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Benzo(a)anthracene	226	ug/kg	H D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Benzo(a)pyrene	253	ug/kg	H D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Benzo(g,h,i)perylene	143	ug/kg	H J D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Chrysene	1140	ug/kg	H D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Dibenzo(a,h)anthracene		ug/kg	H U	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Fluoranthene	7100	ug/kg	H D	J	1
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Fluorene	235	ug/kg	H D	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Indeno(1,2,3-cd)pyrene		ug/kg	H U	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Naphthalene		ug/kg	H U	DNR	11
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Phenanthrene	5910	ug/kg	H D	J	1
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Pyrene	4550	ug/kg	H D	J	1
23F0536	LDW20-SC148A	23F0536-01RE1	EPA 8270E	Total benzofluoranthenes	967	ug/kg	H D	DNR	11
23F0536	LDW20-SC148A	23F0536-01	EPA 9060	Total Organic carbon (TOC)	1.25	%	H	J	1
23F0536	LDW20-SC148A	23F0536-01	SM 2540-G	Total Solids	61.22	%	H	J	1
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Arsenic	6.46	mg/kg	* H	J	1,9
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Cadmium	0.23	mg/kg	H	J	1
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Chromium	15.7	mg/kg	H	J	1
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Copper	32	mg/kg	H	J	1
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Lead	15.2	mg/kg	* H	J	1,9

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SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Validation Reason
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Silver	0.13	mg/kg	H L J	J	1,8L
23F0536	LDW20-SC148ADUP1	BLF0652-DUP1	EPA 6020	Zinc	75.9	mg/kg	H	J	1
23F0536	LDW20-SC148ADUP1	BLF0651-DUP1	EPA 7471B	Mercury	0.0906	mg/kg		J	1
23F0536	LDW20-SC148ADUP2	BLG0049-DUP2	EPA 9060	Total Organic carbon (TOC)	1.32	%	H	J	1