

**Port of Seattle
Lora Lake Apartments Site**

**Remedial Investigation/
Feasibility Study**

Volume II

**Appendix G
Lora Lake Parcel
Remedial Investigation Data Report**

**Attachment G.4
EcoChem Data Validation Reports**

FINAL



EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

Port of Seattle
Lora Lake Parcel RI/FS
Subsurface Sediments

Revision 1

Prepared for:

Floyd/Snider
601 Union Street, Suite 600
Seattle, WA 98101


Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C15212-1

Date Revised: June 23, 2011

Approved for Release:



Christine Ransom
Project Manager

PROJECT NARRATIVE

Basis for the Data Validation

This report summarizes the results of data validation performed on sediment and quality control (QC) sample data for the Remedial Investigation/Feasibility Study at Lora Lake Parcel, Burien, WA. The dioxin data received full validation (EPA Stage 4); all other parameters received summary validation (EPA Stage 2B). A complete list of samples is provided in the **Sample Index**.

Frontier Analytical Laboratory (El Dorado Hills, California) performed the dioxin/furan analyses. Analytical Resources, Inc. (Tukwila, Washington) performed all other analyses. The analytical methods and EcoChem project chemists are listed in the table below.

Analysis	Method	Primary Review	Secondary Review
Dioxin Furan Compounds	EPA 1613	M. Swanson	C. Ransom
Polynuclear Aromatic Hydrocarbons	SW8270D SIM	G. Esler	
Pentachlorophenol	SW8041		
Metals	SW6010B	J. Maute	
Total Solids, Preserved Total Solids, Sulfide, TOC	EPA 160.3M, EPA 376.2 Plumb 1981		

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Port of Seattle Lora Lake Parcel, Remedial Investigation/Feasibility Study Work Plan* (February 11, 2011); *National Functional Guidelines for Inorganic Data Review* (USEPA 1994 & 2004); *National Functional Guidelines for Organic Data Review* (USEPA 1999 & 2008); and *USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA, September 2005).

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 above.

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
Lora Lake Parcel RI/FS
Subsurface Sediments
Analytical Resources Inc.

SDG	Sample ID	Laboratory ID	PAH	PCP	Metals	TOC	Sulfide	Total Solids	Preserved Total Solids
SN54	LL-SED3-0-36-031511	11-5925-SN54A	✓	✓	✓	✓		✓	
	LL-SED3-36-141-031511	11-5926-SN54B	✓	✓	✓	✓	✓	✓	✓
	LL-SED3-141-167-031511	11-5927-SN54C	✓	✓	✓	✓	✓	✓	✓
	LL-SED2-0-56-031511	11-5928-SN54D	✓	✓	✓	✓		✓	
	LL-SED2-56-112-031511	11-5929-SN54E	✓	✓	✓	✓		✓	
	LL-SED2-112-168-031511	11-5930-SN54F	✓	✓	✓	✓		✓	
	LL-SED2-0-56-031511-D	11-5931-SN54G	✓	✓	✓	✓		✓	
	LL-SED1-0-56-031511	11-5932-SN54H	✓	✓	✓	✓		✓	

Sample Index
Lora Lake Parcel RI/FS
Subsurface Sediments
Frontier Analytical Laboratory

SDG	Sample ID	Laboratory ID	Dioxins
6678	LL-SED3-0-36-031511	6678-001-SA	✓
	LL-SED3-36-141-031511	6678-002-SA	✓
	LL-SED3-141-167-031511	6678-003-SA	✓
	LL-SED2-0-56-031511	6678-004-SA	✓
	LL-SED2-56-112-031511	6678-005-SA	✓
	LL-SED2-112-168-031511	6678-006-SA	✓
	LL-SED2-0-56-031511-D	6678-007-SA	✓
	LL-SED1-0-56-031511	6678-008-SA	✓

DATA VALIDATION REPORT

Lora Lake Parcel – Subsurface Sediments

Polycyclic Aromatic Hydrocarbons by SW846 Method 8270D SIM

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, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SN54	8 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

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

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 2° to 6°C. The cooler was received outside of these limits, with a temperature 1.5°C. The temperature outlier did not impact data quality and no data were qualified.

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5X the reporting limit (RL). For concentrations less than 5X the RL, the difference between the sample result and the duplicate result must be less than 2X the RL.

One field duplicate pair was submitted, LL-SED2-0-56-031511 & LL-SED2-0-56-031511-D. All field precision criteria were met.

Internal Standards

The recoveries for the internal standard perylene-d12 were less than the lower control limit in the initial analyses and re-analyses of samples LL-SED2-112-168-031511, LL-SED2-0-56-031511-D, and LL-SED1-0-56-031511. The results for the associated compounds, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene from the initial analyses were estimated (J/UJ-19).

Reporting Limits

Percent moisture values were high in all samples. The reporting limits were adjusted accordingly.

Reported Results

The laboratory reanalyzed samples LL-SED2-112-168-031511, LL-SED2-0-56-031511-D, and LL-SED1-0-56-031511 at dilution to verify interference from the internal standard perylene-d12. Both sets of data were reported. Results from the initial analyses should be used. Results from the re-analyses were labeled do-not-report (DNR-11).

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) recoveries. Precision was also acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate RPD values.

Data were estimated due to internal standard outliers. Results were labeled DNR to indicate which result, from multiple analyses, should not be used.

Data labeled as DNR should not be used for any purpose. All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Subsurface Sediments Pentachlorophenol by EPA Method 8041

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, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SN54	8 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)	1 Field Duplicates
	Continuing Calibration (CCAL)	Target Analyte List
	Laboratory Blanks	Compound Quantitation
	Surrogate Compounds	2 Reporting Limits
	Laboratory Control Samples (LCS)	Reported Results

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

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. The cooler was received outside of these limits, with a temperature 1.5°C. The temperature outlier did not impact data quality and no data were qualified.

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5X the reporting limit (RL). For concentrations less than 5X the RL, the difference between the sample result and the duplicate result must be less than 2X the RL.

One field duplicate pair was submitted: LL-SED2-0-56-031511& LL-SED2-0-56-031511-D. Pentachlorophenol was not detected in either sample; field precision was acceptable.

Reporting Limits

Percent moisture values were high in all samples. The reporting limits were adjusted accordingly.

The reporting limit (RL) was elevated in Sample LL-SED1-0-56-031511 because of matrix interference. The laboratory flagged this result with a "Y". This "Y" flagged result was qualified as not-detected (U-22) to indicate that the compound was not detected at the elevated RL.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample, and matrix spike/matrix spike duplicate (MS/MSD) recoveries. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values.

One reporting limit was elevated due to matrix interference.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Subsurface Sediments Dioxin/Furan Compounds by Method 1613

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 Frontier Analytical Laboratory, El Dorado Hills, California. Full validation (EPA Stage 4) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
6678	8 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The quality control (QC) requirements reviewed are summarized in the following table:

1	Sample Receipt, Preservation, and Holding Times	Ongoing Precision and Recovery (OPR)
	System Performance and Resolution Checks	1 Field Duplicates
	Initial Calibration (ICAL)	Target Analyte List
	Calibration Verification	2 Reported Results
	Method Blanks	Compound Identification
2	Labeled Compound Recovery	1 Calculation Verification
	Matrix Spike/Matrix Spike Duplicates (MS/MSD)	

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 samples were transferred from Analytical Resources, Inc (ARI) to Frontier Analytical Laboratory. As stated in validation guidance documents, samples should be maintained within the advisory temperature range of 2°C to 6°C. The temperatures recorded by Frontier were as low as 0.0°C, which is less than the lower control limit. The temperature outliers did not impact data quality and no data were qualified.

Labeled Compound Recovery

The labeled compound percent recovery (%R) values were within the QAPP specified control limits of 70% - 130%, with the exceptions noted below. All recovery outliers were less than the lower control limit, indicating a potential low bias. Associated positive results and non-detects were estimated (J/UJ-13). Outliers in the following samples resulted in qualification of data.

Sample ID	Number of Outliers	Bias
LL-SED3-0-36-031511	1	Low
LL-SED3-141-167-031511	12	Low
LL-SED2-0-56-031511	10	Low
LL-SED2-0-56-031511-D	2	Low

Field Duplicates

The control limit for relative percent difference (RPD) is 30% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than 2x the RL.

The data for one field duplicate set, LL-SED2-0-56-031511 and LL-SED2-0-56-031511-D, were submitted. The RPD values for all analytes except 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, and 1,2,3,7,8,9-HxCDF were greater than the control limit. No data were qualified based on these outliers; however, users of the data should consider the impact of field precision on the reported results.

Reported Results

Several samples were reanalyzed at dilution due to analyte concentrations that exceeded the calibration range of the instrument. In each case, the laboratory reported only the most appropriate positive result for each congener from either the original or diluted analysis.

The laboratory assigned "D and/or M" flags to several of the reported homologue group totals to indicate that a diphenyl ether (D) or some other interference (M) was present, resulting in a high bias in the reported result. All analytes that were "D" and/or "M" flagged were estimated (J-14).

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the above noted exceptions, accuracy was acceptable, as demonstrated by the labeled compound, OPR, and matrix spike/matrix spike duplicate (MS/MSD) %R values. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values, with the exceptions previously noted.

Data were estimated based on labeled compound recovery outliers and interference from diphenyl ether.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Subsurface Sediments Total Arsenic and Lead by EPA 6010B

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 Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all sediment data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SN54	8 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Sample Receipt, Preservation, and Holding Times	Reference Materials
Initial Calibration	Laboratory Duplicates
Continuing Calibration Verification	1 Field Duplicates
CRDL Standards	Interference Check Samples
Laboratory Blanks	Target Analyte List
Field Blanks	1 Reporting Limits
Laboratory Control Samples (LCS)	Reported Results
Matrix Spikes (MS)	

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

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. One cooler was received with a temperature less than the lower control limit, at 1.5°C. The temperature outliers did not impact data quality and no data were qualified..

Field Duplicates

The relative percent difference (RPD) control limit is 20% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL.

One set of field duplicates, LL-SED2-0-56-031511 and LL-SED2-0-56-031511-D, were submitted. All field precision criteria were met.

Reported Results

The reporting limits were elevated due to high moisture content. No action was taken on this basis.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the laboratory control sample and matrix spike sample percent recovery values. Precision was also acceptable as demonstrated by the laboratory and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Subsurface Sediments

Total Solids and Preserved Total Solids by 160.3M, Sulfide by 376.2, and Total Organic Carbon by Plumb, 1981

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 Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SN54	8 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

- | | |
|--|---|
| <ul style="list-style-type: none"> 1 Sample Receipt, Preservation, and Holding Times Initial Calibration Calibration Verification Laboratory Blanks Laboratory Control Samples (LCS) 1 Reference Materials | <ul style="list-style-type: none"> 2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD) Laboratory Replicates 1 Field Duplicates 1 Reporting Limits Reported Results |
|--|---|

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

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. One cooler was received with a temperature less than the lower control limit, at 1.5°C. The temperature outlier did not impact data quality and no data were qualified.

Reference Materials

The certified reference material NIST 1941B was analyzed with all TOC samples. All recoveries were within the certified acceptance ranges.

Matrix Spikes

The sulfide matrix spike (MS) analysis was performed using Sample LL-SED3-141-167-031511. The MS percent recovery (%R) for sulfide (62.8%) was less than the QAPP specified lower control limit of 80%. Sulfide was not detected in the associated samples; detection limits were estimated (UJ-8) to indicate a potential low bias.

Field Duplicates

The relative percent difference (RPD) value control limit is 20% for TOC and 25% for total solids. For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL.

One set of field duplicates, LL-SED2-0-56-031511 and LL-SED2-0-56-031511-D, were submitted. The RPD for TOC (35.6%) was greater than the control limit. No data were qualified based on the field duplicate precision outlier; however data users should consider the impact of field precision on the reported results.

Reported Results

The reporting limits were elevated due to high moisture content. No action was taken on this basis.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the exception noted above, accuracy was acceptable as demonstrated by the laboratory control sample, matrix spike, and reference material percent recovery values. Precision was acceptable as demonstrated by the laboratory replicate and field duplicate RPD and percent relative standard deviation (%RSD) values, with the exception previously noted.

Sulfide detection limits were estimated based on a matrix spike %R outlier.

All data, as qualified, are acceptable for use.



EcoChem, INC.
Environmental 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

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with "R" and "DNR" only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	<u>Water:</u> J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) <u>Solids/Wastes:</u> J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD (if required)	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless < 10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT > 30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD < 50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD < 35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	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	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT (EcoChem PJ)	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts For full DV, use PJ based on examination of raw data	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)/R(-) if %D > 90% PJ for resolution	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) ----- U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD (if required)	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. compd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% EcoChem PJ - See TM-08	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate (Qualify if required by project QAPP)	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler/Storage Temperature	Waters/Solids < 4°C Tissues <-10°C	EcoChem PJ, see TM-05	1
Holding Time	Extraction - Water: 30 days from collection <i>Note:</i> Under CWA, SDWA, and RCRA the HT for H2O is 7 days* Extraction - Soil: 30 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext > 30 days J(+)/UJ(-) if analysis > 40 Days EcoChem PJ, see TM-05	1
Mass Resolution	>=10,000 resolving power at m/z 304.9824 Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift	R(+/-) if not met	14
Window Defining Mix and Column Performance Mix	Window defining mixture/Isomer specificity std run before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) x = ht. of TCDD y = baseline to bottom of valley For all isomers eluting near 2378-TCDD/TCDF isomers (TCDD only for 8290)	J(+) if valley > 25%	5A (ICAL) 5B (CCAL)
Initial Calibration	Minimum of five standards %RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD <35% for labeled compounds under 1613b)	J(+) natives if %RSD > 20%	5A
	Abs. RT of ¹³ C ₁₂ -1234-TCDD >25 min on DB5 >15 min on DB-225	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10 for all native and labeled compounds in CS1 std.	If <10, elevate Det. Limit or R(-)	

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Continuing Calibration	Analyzed at the start and end of each 12 hour shift. %D +/-20% for native compounds %D +/-30% for labeled compounds (Must meet limits in Table 6, Method 1613B) (If %Ds in the closing CCAL are w/in 25%/35% the avg RF from the two CCAL may be used to calculate samples per Method 8290, Section 8.3.2.4)	Do not qualify labeled compounds. Narrate in report for labeled compound %D outliers. For native compound %D outliers: 8290: J(+)/UJ(-) if %D = 20% - 75% J(+)/R(-) if %D > 75% 1613: J(+)/UJ(-) if %D is outside Table 6 limits J(+)/R(-) if %D is +/- 75% of Table 6 limit	5B
	Abs. RT of ¹³ C ₁₂ -1234-TCDD and ¹³ C ₁₂ -123789-HxCDD +/- 15 sec of ICAL.	EcoChem PJ, see ICAL section of TM-05	
	RRT of all other compounds must meet Table 2 of 1613B.	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10	If <10, elevate Det. Limit or R(-)	
Method Blank	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	7
Field Blanks (Not Required)	No positive results	If sample result <5X action level, qualify U at reported value.	6
LCS / OPR	Concentrations must meet limits in Table 6, Method 1613B or lab limits.	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
MS/MSD (recovery)	May not analyze MS/MSD %R should meet lab limits.	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	May not analyze MS/MSD RPD < 20%	J(+) in parent sample if RPD > CL	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Lab Duplicate	RPD <25% if present.	J(+)/UJ(-) if outside limits	9
Labeled Compounds / Internal Standards	<i>Method 8290</i> : %R = 40% - 135% in all samples	J(+)/UJ(-) if %R = 10% to LCL J(+) if %R > UCL J(+)/R(-) if %R < 10%	13
	<i>Method 1613B</i> : %R must meet limits specified in Table 7, Method 1613		
Quantitation/ Identification	Ions for analyte, IS, and rec. std. must max w/in 2 sec. S/N >2.5 IA ratios meet limits in Table 9 of 1613B or Table 8 of 8290 RRTs w/in limits in Table 2 of 1613B	If RT criteria not met, use PJ (see TM-05) If S/N criteria not met, J(+). if unlabelled ion abundance not met, change to EMPC If labelled ion abundance not met, J(+).	21
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	If laboratory correctly reported an EMPC value, qualify with U to indicate that the value is a detection limit.	14
Interferences	PCDF interferences from PCDEPE	If both detected, change PCDF result to EMPC	14
Second Column Confirmation	All 2378-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC specs in this table must be met for the confirmation analysis.	Report lower of the two values. If not performed use PJ (see TM-05).	3
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used	11

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B
Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run blank < IDL (MDL)	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level (Refer to TM-02 for additional information)	7
Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R < 50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb, Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements ICSA < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R > 120% J(+)/UJ(-) if %R = 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R > 120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
 (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times with Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B
Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV every ten samples and end of run blank < IDL (MDL)	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level refer to TM-02 for additional details	7
Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements ICSA < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
 (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% or J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5 x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

DATA VALIDATION CRITERIA

Table No.: NFG-HG
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Mercury Analysis by CVAA (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	28 days from date sampled Frozen tissues: HT extended to 6 months	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards, one at RL r > 0.995	J(+)/UJ(-) if r < 0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5B
Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV every ten samples and end of run blank < IDL (MDL)	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level refer to TM-02 for additional details	7
Reporting Limit Standard (CRA)	conc at RL - analyzed beginning of run %R = 70-130%	R(-),(+) < 2xRL if %R < 50% J(+)<2x RL, UJ(-) if %R 50-69% J(+) < 2x RL if %R 130-180% R(+)<2x RL if %R>180%	14
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R > 120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

DATA VALIDATION CRITERIA

Table No.: NFG-HG
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Mercury Analysis by CVAA (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5x RL: Water: Diff<RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must be less than 110% of high standard	J values over range	20

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for cooler temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	Use professional judgment J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B
Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method After each ICV and CCV every ten samples and end of run blank < MDL	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level refer to TM-02 for additional details	7
Method Blank	One per matrix per batch (not to exceed 20 samples) blank < MDL	Action level is 5x absolute value of blank conc. For (+) blk value, U(+) results < action level For (-) blk value, J(+)/UJ(-) results < action level	7
Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2X RL	J(+)/JJ(-) in parent samples only	9



EcoChem, INC.
Environmental Data Quality

APPENDIX B QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Lora Lake Apartments RI/FS Groundwater Monitoring

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Lab Qual	DV Qual	DV Reason
6678	LL-SED3-0-36-031511	6678-001-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDF	102	pg/g	D,M	J	14
6678	LL-SED3-0-36-031511	6678-001-SA	EPA 1613 D/F	OCDF	3280	pg/g		J	13
6678	LL-SED3-0-36-031511	6678-001-SA	EPA 1613 D/F	Total TCDF	387	pg/g	D,M	J	14
6678	LL-SED3-0-36-031511	6678-001-SA	EPA 1613 D/F	Total PeCDF	627	pg/g	D,M	J	14
6678	LL-SED3-0-36-031511	6678-001-SA	EPA 1613 D/F	Total HxCDF	1590	pg/g	D,M	J	14
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	2,3,7,8-TCDD	0.93	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDD	1.05	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDD	1.27	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,4,6,7,8-HpCDD	2.08	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	OCDD	14.8	pg/g		J	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDF	0.812	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDF	0.752	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	2,3,4,6,7,8-HxCDF	0.82	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,7,8,9-HxCDF	0.796	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,4,6,7,8-HpCDF	1.13	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	1,2,3,4,7,8,9-HpCDF	1.54	pg/g	U	UJ	13
6678	LL-SED3-141-167-031511	6678-003-SA	EPA 1613 D/F	OCDF	3.08	pg/g	U	UJ	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	2,3,7,8-TCDD	7.13	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDD	28.2	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDD	104	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	2,3,7,8-TCDF	9.24	pg/g	F	J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDF	50.3	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDF	31.2	pg/g	D,M	J	13,14
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	2,3,4,6,7,8-HxCDF	34.3	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	1,2,3,7,8,9-HxCDF	5.91	pg/g	J	J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	1,2,3,4,6,7,8-HpCDF	693	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	OCDF	1780	pg/g		J	13
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	Total PeCDD	337	pg/g	M	J	14
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	Total TCDF	203	pg/g	D,M	J	14
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	Total PeCDF	315	pg/g	D,M	J	14
6678	LL-SED2-0-56-031511	6678-004-SA	EPA 1613 D/F	Total HxCDF	812	pg/g	D,M	J	14
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	OCDD	41000	pg/g		J	13
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDF	82.9	pg/g	D,M	J	14
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	OCDF	2630	pg/g		J	13
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	Total PeCDD	559	pg/g	M	J	14
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	Total TCDF	302	pg/g	D,M	J	14
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	Total PeCDF	492	pg/g	D,M	J	14
6678	LL-SED2-0-56-031511-D	6678-007-SA	EPA 1613 D/F	Total HxCDF	1310	pg/g	D,M	J	14
6678	LL-SED1-0-56-031511	6678-008-SA	EPA 1613 D/F	Total PeCDF	63.4	pg/g	D,M	J	14
6678	LL-SED1-0-56-031511	6678-008-SA	EPA 1613 D/F	Total HxCDF	187	pg/g	D,M	J	14
SN54	LL-SED3-36-141-031511	11-5926-SN54B	EPA 376.2	Sulfide	< 7.85	ug/kg	U	UJ	8
SN54	LL-SED3-141-167-031511	11-5927-SN54C	EPA 376.2	Sulfide	< 7.91	ug/kg	U	UJ	8
SN54	LL-SED1-0-56-031511	11-5932-SN54H	SW8041	Pentachlorophenol	110	ug/kg	Y	U	22
SN54	LL-SED2-112-168-031511	11-5930-SN54F	SW8270D SIM	Benzo(a)pyrene	15	ug/kg	U	UJ	19
SN54	LL-SED2-112-168-031511	11-5930-SN54F	SW8270D SIM	Indeno(1,2,3-cd)pyrene	15	ug/kg	U	UJ	19
SN54	LL-SED2-112-168-031511	11-5930-SN54F	SW8270D SIM	Dibenz(a,h)anthracene	15	ug/kg	U	UJ	19
SN54	LL-SED2-112-168-031511	11-5930-SN54FDL	SW8270D SIM	Benzo(a)anthracene	150	ug/kg	U	DNR	11
SN54	LL-SED2-112-168-031511	11-5930-SN54FDL	SW8270D SIM	Chrysene	150	ug/kg	U	DNR	11
SN54	LL-SED2-112-168-031511	11-5930-SN54FDL	SW8270D SIM	Benzo(a)pyrene	150	ug/kg	U	DNR	11

Qualified Data Summary Table
Lora Lake Apartments RI/FS Groundwater Monitoring

SDG	Sample ID	Laboratory ID	Method	Analyte	Result	Units	Lab Qual	DV Qual	DV Reason
SN54	LL-SED2-112-168-031511	11-5930-SN54FDL	SW8270D SIM	Indeno(1,2,3-cd)pyrene	150	ug/kg	U	DNR	11
SN54	LL-SED2-112-168-031511	11-5930-SN54FDL	SW8270D SIM	Dibenz(a,h)anthracene	150	ug/kg	U	DNR	11
SN54	LL-SED2-112-168-031511	11-5930-SN54FDL	SW8270D SIM	Total Benzofluoranthenes	150	ug/kg	U	DNR	11
SN54	LL-SED2-0-56-031511-D	11-5931-SN54G	SW8270D SIM	Benzo(a)pyrene	400	ug/kg		J	19
SN54	LL-SED2-0-56-031511-D	11-5931-SN54G	SW8270D SIM	Indeno(1,2,3-cd)pyrene	280	ug/kg		J	19
SN54	LL-SED2-0-56-031511-D	11-5931-SN54G	SW8270D SIM	Dibenz(a,h)anthracene	74	ug/kg		J	19
SN54	LL-SED2-0-56-031511-D	11-5931-SN54GDL	SW8270D SIM	Benzo(a)anthracene	240	ug/kg		DNR	11
SN54	LL-SED2-0-56-031511-D	11-5931-SN54GDL	SW8270D SIM	Chrysene	570	ug/kg		DNR	11
SN54	LL-SED2-0-56-031511-D	11-5931-SN54GDL	SW8270D SIM	Benzo(a)pyrene	330	ug/kg		DNR	11
SN54	LL-SED2-0-56-031511-D	11-5931-SN54GDL	SW8270D SIM	Indeno(1,2,3-cd)pyrene	270	ug/kg		DNR	11
SN54	LL-SED2-0-56-031511-D	11-5931-SN54GDL	SW8270D SIM	Dibenz(a,h)anthracene	96	ug/kg		DNR	11
SN54	LL-SED2-0-56-031511-D	11-5931-SN54GDL	SW8270D SIM	Total Benzofluoranthenes	1000	ug/kg		DNR	11
SN54	LL-SED1-0-56-031511	11-5932-SN54H	SW8270D SIM	Benzo(a)pyrene	55	ug/kg		J	19
SN54	LL-SED1-0-56-031511	11-5932-SN54H	SW8270D SIM	Indeno(1,2,3-cd)pyrene	38	ug/kg		J	19
SN54	LL-SED1-0-56-031511	11-5932-SN54H	SW8270D SIM	Dibenz(a,h)anthracene	5.8	ug/kg		J	19
SN54	LL-SED1-0-56-031511	11-5932-SN54HDL	SW8270D SIM	Benzo(a)anthracene	31	ug/kg		DNR	11
SN54	LL-SED1-0-56-031511	11-5932-SN54HDL	SW8270D SIM	Chrysene	70	ug/kg		DNR	11
SN54	LL-SED1-0-56-031511	11-5932-SN54HDL	SW8270D SIM	Benzo(a)pyrene	46	ug/kg		DNR	11
SN54	LL-SED1-0-56-031511	11-5932-SN54HDL	SW8270D SIM	Indeno(1,2,3-cd)pyrene	34	ug/kg		DNR	11
SN54	LL-SED1-0-56-031511	11-5932-SN54HDL	SW8270D SIM	Dibenz(a,h)anthracene	14	ug/kg	U	DNR	11
SN54	LL-SED1-0-56-031511	11-5932-SN54HDL	SW8270D SIM	Total Benzofluoranthenes	130	ug/kg		DNR	11



EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

**Port of Seattle
Lora Lake Parcel RI/FS
Surface Sediments**

Revision 1

Prepared for:

Floyd/Snider
601 Union Street, Suite 600
Seattle, WA 98101

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C15212-2

Date Revised: June 23, 2011

Approved for Release:

Christine Ransom
Project Manager

PROJECT NARRATIVE

Basis for the Data Validation

This report summarizes the results of data validation performed on sediment and quality control (QC) sample data for the Remedial Investigation/Feasibility Study at Lora Lake Parcel, Burien, WA. The dioxin data received full validation (EPA Stage 4); all other parameters received summary validation (EPA Stage 2B). A complete list of samples is provided in the **Sample Index**.

Frontier Analytical Laboratory (El Dorado Hills, California) performed the dioxin/furan analyses. Analytical Resources, Inc. (Tukwila, Washington) performed all other analyses. The analytical methods and EcoChem project chemists are listed in the table below.

Analysis	Method	Primary Review	Secondary Review
Dioxin Furan Compounds	EPA 1613	M. Swanson	C. Ransom
Polynuclear Aromatic Hydrocarbons	SW8270D SIM	G. Esler	
Pentachlorophenol	SW8041		
Metals	SW6010B	J. Maute	
Total Solids, Preserved Total Solids	EPA 160.3M		
Sulfide	EPA 376.2		
TOC	Plumb 1981		
N-Ammonia	EPA 350.1		
Grain Size	PSEP		

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Port of Seattle Lora Lake Parcel, Remedial Investigation/Feasibility Study Work Plan* (February 11, 2011); *National Functional Guidelines for Inorganic Data Review* (USEPA 1994 & 2004); *National Functional Guidelines for Organic Data Review* (USEPA 1999 & 2008); and *USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA, September 2005).

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 above.

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
Lora Lake Parcel - Surface Sediments
Analytical Resources Inc.

SDG	Sample ID	Laboratory ID	Matrix	VOC	SIM	PCP	Metals	Conventionals
SP34	LL-SED1-0-15-032911	11-6950-SP34A	Sediment	✓				✓
SP34	LL-SED2-0-15-032911	11-6951-SP34B	Sediment	✓				✓
SP34	LL-SED3-0-15-032911	11-6952-SP34C	Sediment	✓				✓
SP34	LL-SED4-0-15-032911	11-6953-SP34D	Sediment	✓				✓
SP34	LL-SED1-0-15-032911-D	11-6954-SP34E	Sediment	✓				✓
SP34	LL-SED5-0-15-032911	11-6955-SP34F	Sediment	✓				✓
SP34	MC-SED1-0-10-032911	11-6956-SP34G	Sediment	✓	✓	✓	✓	✓
SP34	MC-SED2-0-10-032911	11-6957-SP34H	Sediment	✓	✓	✓	✓	✓
SP34	MC-SED3-0-10-032911	11-6958-SP34I	Sediment	✓	✓	✓	✓	✓
SP34	LL-SED-032911-TB	11-6960-SP34K	Water	✓				
SP34	LL-SED1-0-15-032911-ER	11-6959-SP34J	Water		✓	✓	✓	
SQ22	LL-SED1-0-15-032911	11-7355-SQ22A	Sediment		✓	✓	✓	✓
SQ22	LL-SED2-0-15-032911	11-7356-SQ22B	Sediment		✓	✓	✓	✓
SQ22	LL-SED3-0-15-032911	11-7357-SQ22C	Sediment		✓	✓	✓	✓
SQ22	LL-SED4-0-15-032911	11-7358-SQ22D	Sediment		✓	✓	✓	✓
SQ22	LL-SED1-0-15-032911-D	11-7359-SQ22E	Sediment		✓	✓	✓	✓
SQ22	LL-SED5-0-15-032911	11-7360-SQ22F	Sediment		✓	✓	✓	✓

Sample Index
Lora Lake Parcel - Surface Sediments
Frontier Analytical Laboratory

SDG	Sample ID	Laboratory ID	Dioxins
6701	LL-SED1-0-15-032911	6701-001-SA	✓
6701	LL-SED2-0-15-032911	6701-002-SA	✓
6701	LL-SED3-0-15-032911	6701-003-SA	✓
6701	LL-SED4-0-15-032911	6701-004-SA	✓
6701	LL-SED1-0-15-032911-D	6701-005-SA	✓
6701	LL-SED5-0-15-032911	6701-006-SA	✓
6701	MC-SED1-0-10-032911	6701-007-SA	✓
6701	MC-SED2-0-10-032911	6701-008-SA	✓
6701	MC-SED3-0-10-032911	6701-009-SA	✓
6701	LL-SED1-0-15-032911-ER	6701-010-SA	✓

DATA VALIDATION REPORT
Lora Lake Parcel – Surface Sediments
Volatile Organic Compounds by SW846 Method 8260C

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, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all sediment data and compliance screening (EPA Stage 2A) was performed on all trip blank data. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples
SP34	9 Sediment & 1 Trip Blank

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

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

¹ *Quality control results are discussed below, but no data were qualified.*

Trip Blanks

One trip blank, LL-SED-032911-TB was submitted. No target analytes were detected in this blank.

Field Duplicates

The relative percent difference (RPD) value control limit is 50% for results greater than five times the reporting limit (RL). For results less than 5x the RL, the difference between the sample and duplicate must be less than 2x the RL.

One set of field duplicates, LL-SED1-0-15-032911 and LL-SED1-0-15-032911-D, was submitted. No target analytes were detected in either sample; field precision was acceptable.

Internal Standards

The percent recovery (%R) values for internal standard 1,4-dichlorobenzene-d4 were less than the lower control limit in Samples LL-SED1-0-15-032911 and LL-SED1-0-15-032911-D. This internal standard is only associated with a surrogate compound; no qualification of data was necessary.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample (LCS/LCSD), and matrix spike sample (MS/MSD) recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Surface Sediments

Polycyclic Aromatic Hydrocarbons by SW846 Method 8270D SIM

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, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all sediment data. Compliance screening (EPA Stage 2A) was performed on all field blank data. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples
SP34	3 Sediment & 1 Equipment Rinsate
SQ22	6 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

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

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.*

Field Blanks

SDG SP34: One equipment rinsate blank, LL-SED1-0-15-032911-ER, was submitted. No target analytes were detected in the field blank.

Surrogate Compounds

SDG SP34: The percent recovery (%R) value for 2-methylnaphthalene-d10 was less than the lower control limit in Sample MC-SED1-0-10-032911. No target analytes were detected in this sample; results were estimated (UJ-13) to indicate a potential low bias.

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than the RL.

Duplicate samples and any outliers are noted below. No data were qualified based on field duplicate precision outliers; however data users should consider the impact of field precision on the reported results.

SDG SQ22: The data for one set of field duplicates were submitted: LL-SED1-0-15-032911 and LL-SED1-0-15-032911-D. All field precision criteria were met.

Internal Standards

SDG SQ22: The responses for the internal standards naphthalene-d8, acenaphthene-d10, phenanthrene-d10, and chrysene-d12 were greater than the upper control limit in Sample LL-SED5-0-15-032911. The results for the associated compounds chrysene and benzo(a)anthracene were estimated (J-19) in this sample.

Reported Results

SDG SQ22: The samples in this SDG were centrifuged prior to extraction due to extremely high moisture content.

III. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) %R values,. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

Data were estimated based on a surrogate %R outlier and internal standard outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Surface Sediments

Pentachlorophenol by EPA Method 8041A

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, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all sediment data. Compliance screening (EPA Stage 2A) was performed on all field blank data. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples
SP34	3 Sediment & 1 Equipment Rinsate
SQ22	6 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Sample Receipt, Preservation, and Holding Times	1	Field Duplicates
Initial Calibration (ICAL)		Retention Time Window
Continuing Calibration (CCAL)		Target Analyte List
Laboratory Blanks		Compound Identification
1 Field Blanks		Compound Quantitation
Surrogate Compounds		Reporting Limits
Laboratory Control Samples (LCS)	2	Reported Results
1 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)		

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.*

Field Blanks

SDG SP34: One equipment rinsate blank, LL-SED1-0-15-032911-ER, was submitted. Pentachlorophenol was not detected in the field blank.

Matrix Spike/Matrix Spike Duplicates

SDG SQ22: Matrix spike/matrix spike duplicate (MS/MSD) analyses were performed using Sample LL-SED2-0-15-032911. The relative percent difference (RPD) value was greater than the 50% control limit. Pentachlorophenol was not detected in the parent sample; therefore no qualification was necessary.

Field Duplicate

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than 2x the RL.

Duplicate samples and any outliers are noted below. No data were qualified based on field duplicate precision outliers; however data users should consider the impact of field precision on the reported results.

SDG SQ22: One set of field duplicates were submitted: LL-SED1-0-15-032911 & LL-SED1-0-15-032911-D. Pentachlorophenol was detected in the sample, but not detected in the duplicate. The difference between the positive result and the RL was less than 2x the RL; field precision was acceptable.

Reported Results

SDG SQ22: The samples in this SDG were centrifuged prior to extraction due to extremely high moisture content.

The pentachlorophenol result in Sample LL-SED1-0-15-032911 was “P” flagged by the laboratory to indicate that the percent difference (%D) between columns was greater than 40%. The pentachlorophenol result was estimated (J-3) for this sample.

Sample LL-SED2-0-15-032911 was at both 1x and 10x dilutions. Both sets of results were reported. Pentachlorophenol was not detected in either analysis. The result from the 10x dilution was qualified do-not-report (DNR-11); the result from the 1x dilution should be used.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate, laboratory control sample and MS/MSD recoveries. With the exception noted above, precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values.

One result for pentachlorophenol was estimated based on a confirmation column %D outlier.

One result for pentachlorophenol was flagged DNR to indicate which result from multiple dilutions should not be used.

Data flagged as DNR should not be used for any purpose. All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Surface Sediments

Dioxin/Furan Compounds by Method 1613

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 Frontier Analytical Laboratory, El Dorado Hills, California. Full validation (EPA Stage 4) was performed on all sediment data. The equipment rinsate received a compliance level review (EPA Stage 2A). The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
6701	9 Sediment & 1 Equipment Rinsate

I. 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.

II. TECHNICAL DATA VALIDATION

The quality control (QC) requirements reviewed are summarized in the following table:

<ul style="list-style-type: none"> 1 Sample Receipt, Preservation, and Holding Times System Performance and Resolution Checks Initial Calibration (ICAL) Calibration Verification (CVER) Method Blanks 1 Field Blanks 2 Labeled Compound Recovery 	<ul style="list-style-type: none"> Matrix Spike/Matrix Spike Duplicates (MS/MSD) Ongoing Precision and Recovery (OPR) 1 Field Duplicates Target Analyte List 2 Reported Results Compound Identification 1 Calculation Verification
--	---

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 samples were transferred from Analytical Resources, Inc (ARI) to Frontier Analytical Laboratory. As stated in validation guidance documents, samples should be maintained within the advisory temperature range of 2°C to 6°C. The temperatures recorded by Frontier were as low as 0.0°C, which is less than the lower control limit. The temperature outliers did not impact data quality; therefore no action was taken.

Field Blanks

One equipment rinsate, Sample LL-SED1-0-15-032911-ER, was submitted. The target analyte OCDD was detected in this blank. To evaluate the effect on the sample data, an action level of 5x the blank concentration was established. All associated OCDD results were greater than the action level; therefore no qualification of data was necessary.

Labeled Compound Recovery

Several labeled compound percent recovery (%R) values were outside of the QAPP specified control limits of 70% - 130%. For recoveries less than the lower control limit, the results for the associated compounds were estimated (J/UJ-13) to indicate a potential low bias. For recoveries greater than the upper control limit, positive results for the associated compounds were estimated (J-13) to indicate a potential high bias. Outliers in the following samples resulted in qualification of data.

Sample ID	Number of Outliers	Bias
LL-SED1-0-15-032911	7	Low
LL-SED1-0-15-032911-D	1	High
MC-SED3-0-10-032911	4	Low
LL-SED1-0-15-032911-ER	9	Low

Field Duplicates

The RPD value control limit is 30% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than the RL. No data were qualified based on field duplicate precision outliers; however users of the data should consider the impact of field precision on the reported results.

The data for one field duplicate set, LL-SED1-0-15-032911 and LL-SED1-0-15-032911-D, were submitted. Field precision was acceptable for all analytes.

Reported Results

Several samples were reanalyzed at dilution due to analyte concentrations that exceeded the calibration range of the instrument. In each case, the laboratory reported only the most appropriate positive result for each congener from either the original or diluted analysis.

The laboratory assigned "D and/or M" flags to several of the reported homologue group totals to indicate that a diphenyl ether (D) or some other interference (M) was present, resulting in a high bias in the reported result. All analytes that were "D" and/or "M" flagged were estimated (J-14).

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the above noted exceptions, accuracy was acceptable as demonstrated by the labeled compound, OPR, and matrix spike/matrix spike duplicate (MS/MSD) %R values. Precision was also acceptable as demonstrated by the MS/MSD and field duplicate RPD values.

Data were estimated based on labeled compound recovery outliers and interference from diphenyl ether.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Surface Sediments

Total Arsenic and Lead by EPA 6010B

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 Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all sediment data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SP34	3 Sediment & 1 Equipment Rinsate
SQ22	6 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Sample Receipt, Preservation, and Holding Times	Reference Materials
Initial Calibration	1 Laboratory Duplicates
Continuing Calibration Verification	1 Field Duplicates
CRDL Standards	Interference Check Samples
Laboratory Blanks	Target Analyte List
1 Field Blanks	Reporting Limits
Laboratory Control Samples (LCS)	1 Reported Results
1 Matrix Spikes (MS)	

¹ *Quality control results are discussed below, but no data were qualified*

Field Blanks

SDG SP34: One equipment rinsate blank, LL-SED1-0-15-032911-ER, was submitted. No target analytes were detected in this blank.

Matrix Spikes

SDG SP34: Matrix spike samples (MS) were not analyzed for the rinsate blank sample. The laboratory control sample (LCS) was used to evaluate laboratory accuracy.

Laboratory Duplicates

SDG SP34: Laboratory duplicate samples were not analyzed for the rinsate blank sample. Laboratory precision could not be assessed.

Field Duplicates

The relative percent difference (RPD) control limit is 20% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL.

SDG SQ22: One set of field duplicates, LL-SED1-0-15-032911 and LL-SED1-0-15-032911-D, were submitted. All field precision criteria were met.

Reported Results

SDG SQ22: The samples in this SDG were centrifuged prior to extraction due to extremely high moisture content.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the laboratory control sample and matrix spike sample percent recovery values. Precision was also acceptable as demonstrated by the laboratory and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Surface Sediments

Total Solids and Preserved Total Solids by 160.3M, Total Organic Carbon by Plumb, 1981, Sulfide by Method EPA 376.2, N-Ammonia by Method EPA 350.1M, and Grain Size by Method PSEP

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 Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SP34	9 Sediment
SQ22	6 Sediment

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

Sample Receipt, Preservation, and Holding Times	2	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Initial Calibration		Laboratory Replicates
Calibration Verification	1	Field Duplicates
Laboratory Blanks	1	Reporting Limits
Laboratory Control Samples (LCS)	1	Reported Results
1 Reference Materials		

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.*

Reference Materials

The certified reference material NIST 1941B was analyzed with all TOC samples. The certified reference material SPEX 28-24AS was analyzed with all N-Ammonia samples. All recoveries were within the certified acceptance ranges.

Matrix Spikes/Matrix Spike Duplicates

SDG SQ22: The matrix spike (MS) analysis for total organic carbon (TOC) was performed using Sample LL-SED2-0-15-032911. The MS percent recovery (%R) for TOC (130.2%) was greater

than the QAPP specified upper control limit of 120%. All TOC results were estimated (J-8) to indicate a potential high bias.

Field Duplicates

The relative percent difference (RPD) value control limit is 20% for TOC and 25% for the remaining analyses. For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL. No data were qualified based on RPD outliers; however data users should take field precision into account when interpreting sample results.

SDGs SP34 & SQ22: One set of field duplicates were submitted: LL-SED1-0-15-032911 and LL-SED1-0-15-032911-D. The RPD value for coarse sand (37.5%) was greater than the control limit. Field precision was acceptable for all other analytes.

Reporting Limits

SDG SP34: The reporting limits were elevated due to high moisture content. No action was taken on this basis.

Reported Results

SDG SQ22: The sediment samples in this SDG were centrifuged prior to analysis of TOC due to high moisture content. All other analyses were reported in **SDG SP34**.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the laboratory control sample, matrix spike, and reference material percent recovery values; and recision was acceptable as demonstrated by the laboratory replicate and field duplicate RPD and percent relative standard deviation (%RSD) values.

Data were estimated based on an MS %R outlier.

All data, as qualified, are acceptable for use.



EcoChem, INC.
Environmental 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

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with "R" and "DNR" only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

EcoChem Validation Guidelines for Volatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Hold Time	Waters: 14 days preserved 7 Days: unpreserved (for aromatics) Solids: 14 Days	J(+)/UJ(-) if hold times exceeded If exceeded by > 3X HT: J(+)/R(-) (EcoChem PJ)	1
Tuning	BFB Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Storage Blank	One per SDG <CRQL	U(+) the specific analyte(s) results in all assoc.samples using the 5x or 10x rule	7
Trip Blank	Frequency as per project QAPP	Same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned	18
Field Blanks (if required in QAPP)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Volatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS <i>low conc. H2O VOA</i>	One per lab batch Within method control limits	J(+) assoc. compd if > UCL J(+)/R(-) assoc. compd if < LCL J(+)/R(-) all compds if half are < LCL	10
LCS <i>regular VOA (H2O & solid)</i>	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD <i>(if required)</i>	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. compd. in all samples	9
Surrogates	Added to all samples Within method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL but > 10% (see PJ ¹) J(+)/R(-) if < 10%	13
Internal Standard (IS)	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT > 30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD < 50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD < 35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	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	See Technical Director if outliers	14 21 (false +)

PJ¹ No action if there are 4+ surrogates and only 1 outlier.

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	<u>Water:</u> J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) <u>Solids/Wastes:</u> J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD (if required)	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless < 10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT > 30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD < 50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD < 35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	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	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT (EcoChem PJ)	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts For full DV, use PJ based on examination of raw data	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)/R(-) if %D > 90% PJ for resolution	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) ----- U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD (if required)	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. compd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% EcoChem PJ - See TM-08	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate (Qualify if required by project QAPP)	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler/Storage Temperature	Waters/Solids < 4°C Tissues <-10°C	EcoChem PJ, see TM-05	1
Holding Time	Extraction - Water: 30 days from collection <i>Note:</i> Under CWA, SDWA, and RCRA the HT for H2O is 7 days* Extraction - Soil: 30 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext > 30 days J(+)/UJ(-) if analysis > 40 Days EcoChem PJ, see TM-05	1
Mass Resolution	>=10,000 resolving power at m/z 304.9824 Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift	R(+/-) if not met	14
Window Defining Mix and Column Performance Mix	Window defining mixture/Isomer specificity std run before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) x = ht. of TCDD y = baseline to bottom of valley For all isomers eluting near 2378-TCDD/TCDF isomers (TCDD only for 8290)	J(+) if valley > 25%	5A (ICAL) 5B (CCAL)
Initial Calibration	Minimum of five standards %RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD <35% for labeled compounds under 1613b)	J(+) natives if %RSD > 20%	5A
	Abs. RT of ¹³ C ₁₂ -1234-TCDD >25 min on DB5 >15 min on DB-225	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10 for all native and labeled compounds in CS1 std.	If <10, elevate Det. Limit or R(-)	

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Continuing Calibration	Analyzed at the start and end of each 12 hour shift. %D +/-20% for native compounds %D +/-30% for labeled compounds (Must meet limits in Table 6, Method 1613B) (If %Ds in the closing CCAL are w/in 25%/35% the avg RF from the two CCAL may be used to calculate samples per Method 8290, Section 8.3.2.4)	Do not qualify labeled compounds. Narrate in report for labeled compound %D outliers. For native compound %D outliers: 8290: J(+)/UJ(-) if %D = 20% - 75% J(+)/R(-) if %D > 75% 1613: J(+)/UJ(-) if %D is outside Table 6 limits J(+)/R(-) if %D is +/- 75% of Table 6 limit	5B
	Abs. RT of ¹³ C ₁₂ -1234-TCDD and ¹³ C ₁₂ -123789-HxCDD +/- 15 sec of ICAL.	EcoChem PJ, see ICAL section of TM-05	
	RRT of all other compounds must meet Table 2 of 1613B.	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10	If <10, elevate Det. Limit or R(-)	
Method Blank	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	7
Field Blanks (Not Required)	No positive results	If sample result <5X action level, qualify U at reported value.	6
LCS / OPR	Concentrations must meet limits in Table 6, Method 1613B or lab limits.	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
MS/MSD (recovery)	May not analyze MS/MSD %R should meet lab limits.	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	May not analyze MS/MSD RPD < 20%	J(+) in parent sample if RPD > CL	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Lab Duplicate	RPD <25% if present.	J(+)/UJ(-) if outside limits	9
Labeled Compounds / Internal Standards	<p><i>Method 8290:</i> %R = 40% - 135% in all samples</p> <hr style="border-top: 1px dashed black;"/> <p><i>Method 1613B:</i> %R must meet limits specified in Table 7, Method 1613</p>	<p>J(+)/UJ(-) if %R = 10% to LCL J(+) if %R > UCL J(+)/R(-) if %R < 10%</p>	13
Quantitation/ Identification	<p>Ions for analyte, IS, and rec. std. must max w/in 2 sec. S/N >2.5</p> <p>IA ratios meet limits in Table 9 of 1613B or Table 8 of 8290 RRTs w/in limits in Table 2 of 1613B</p>	<p>If RT criteria not met, use PJ (see TM-05) If S/N criteria not met, J(+). If unlabelled ion abundance not met, change to EMPC If labelled ion abundance not met, J(+).</p>	21
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	If laboratory correctly reported an EMPC value, qualify with U to indicate that the value is a detection limit.	14
Interferences	PCDF interferences from PCDEPE	If both detected, change PCDF result to EMPC	14
Second Column Confirmation	All 2378-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC specs in this table must be met for the confirmation analysis.	Report lower of the two values. If not performed use PJ (see TM-05).	3
Field Duplicates	<p>Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL)</p> <p>Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)</p>	Narrate and qualify if required by project (EcoChem PJ)	9
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used	11

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B
Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run blank < IDL (MDL)	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level (Refer to TM-02 for additional information)	7
Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R < 50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb, Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements ICSA < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R > 120% J(+)/UJ(-) if %R = 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R > 120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for cooler temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	Use professional judgment J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B
Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method After each ICV and CCV every ten samples and end of run blank < MDL	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level refer to TM-02 for additional details	7
Method Blank	One per matrix per batch (not to exceed 20 samples) blank < MDL	Action level is 5x absolute value of blank conc. For (+) blk value, U(+) results < action level For (-) blk value, J(+)/UJ(-) results < action level	7
Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9



EcoChem, INC.
Environmental Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Lora Lake Parcel - Surface Sediments

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qual	DV Qual	DV Reason
SP34	MC-SED1-0-10-032911	11-6956-SP34G	SW8270D SIM	Benzo(a)anthracene	4.6	ug/kg	U	UJ	13
SP34	MC-SED1-0-10-032911	11-6956-SP34G	SW8270D SIM	Chrysene	4.6	ug/kg	U	UJ	13
SP34	MC-SED1-0-10-032911	11-6956-SP34G	SW8270D SIM	Benzo(a)pyrene	4.6	ug/kg	U	UJ	13
SP34	MC-SED1-0-10-032911	11-6956-SP34G	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.6	ug/kg	U	UJ	13
SP34	MC-SED1-0-10-032911	11-6956-SP34G	SW8270D SIM	Dibenz(a,h)anthracene	4.6	ug/kg	U	UJ	13
SP34	MC-SED1-0-10-032911	11-6956-SP34G	SW8270D SIM	Total Benzofluoranthenes	4.6	ug/kg	U	UJ	13
SQ22	LL-SED1-0-15-032911	11-7355-SQ22A	SW8041	Pentachlorophenol	50	ug/kg	P	J	3
SQ22	LL-SED1-0-15-032911	11-7355-SQ22A	Plumb,1981	Total Organic Carbon	8	Percent		J	8
SQ22	LL-SED2-0-15-032911	11-7356-SQ22B	SW8041	Pentachlorophenol	33	ug/kg	U	DNR	11
SQ22	LL-SED2-0-15-032911	11-7356-SQ22B	Plumb,1981	Total Organic Carbon	7.16	Percent		J	8
SQ22	LL-SED3-0-15-032911	11-7357-SQ22C	Plumb,1981	Total Organic Carbon	9.18	Percent		J	8
SQ22	LL-SED4-0-15-032911	11-7358-SQ22D	Plumb,1981	Total Organic Carbon	8.86	Percent		J	8
SQ22	LL-SED1-0-15-032911-D	11-7359-SQ22E	Plumb,1981	Total Organic Carbon	8.42	Percent		J	8
SQ22	LL-SED5-0-15-032911	11-7360-SQ22F	Plumb,1981	Total Organic Carbon	1.3	Percent		J	8
SQ22	LL-SED5-0-15-032911	11-7360-SQ22F	SW8270D SIM	Benzo(a)anthracene	25	ug/kg		J	19
SQ22	LL-SED5-0-15-032911	11-7360-SQ22F	SW8270D SIM	Chrysene	66	ug/kg		J	19
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	2,3,7,8-TCDD	4.31	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	1,2,3,7,8-PeCDD	20.7	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDD	53.8	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDD	188	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDF	42.3	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	2,3,4,6,7,8-HxCDF	56.4	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	OCDF	3830	pg/g		J	13
6701	LL-SED1-0-15-032911	6701-001-SA	EPA 1613 D/F	Total HxCDF	1500	pg/g	D,M	J	14
6701	LL-SED2-0-15-032911	6701-002-SA	EPA 1613 D/F	Total HxCDF	1680	pg/g	D,M	J	14
6701	LL-SED3-0-15-032911	6701-003-SA	EPA 1613 D/F	Total TCDF	293	pg/g	D,M	J	14
6701	LL-SED3-0-15-032911	6701-003-SA	EPA 1613 D/F	Total PeCDF	394	pg/g	D,M	J	14
6701	LL-SED3-0-15-032911	6701-003-SA	EPA 1613 D/F	Total HxCDF	1080	pg/g	D,M	J	14
6701	LL-SED4-0-15-032911	6701-004-SA	EPA 1613 D/F	Total HxCDF	1120	pg/g	D,M	J	14
6701	LL-SED1-0-15-032911-D	6701-005-SA	EPA 1613 D/F	OCDD	67000	pg/g	*	J	13
6701	LL-SED1-0-15-032911-D	6701-005-SA	EPA 1613 D/F	Total HxCDF	1500	pg/g	D,M	J	14
6701	MC-SED3-0-10-032911	6701-009-SA	EPA 1613 D/F	2,3,7,8-TCDD	0.159	pg/g	U	UJ	13
6701	MC-SED3-0-10-032911	6701-009-SA	EPA 1613 D/F	1,2,3,7,8-PeCDD	0.204	pg/g	U	UJ	13
6701	MC-SED3-0-10-032911	6701-009-SA	EPA 1613 D/F	OCDD	5.93	pg/g	J	J	13
6701	MC-SED3-0-10-032911	6701-009-SA	EPA 1613 D/F	OCDF	0.646	pg/g	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	2,3,7,8-TCDD	1.56	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	1,2,3,7,8-PeCDD	1.53	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDD	1.44	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	OCDD	15.3	pg/L	J	J	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	1,2,3,4,7,8-HxCDF	1.14	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	1,2,3,6,7,8-HxCDF	1.12	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	2,3,4,6,7,8-HxCDF	1.1	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	1,2,3,7,8,9-HxCDF	1.22	pg/L	U	UJ	13
6701	LL-SED1-0-15-032911-ER	6701-010-SA	EPA 1613 D/F	OCDF	4.82	pg/L	U	UJ	13



EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

**Port of Seattle
Lora Lake Parcel RI/FS
Soils**

Prepared for:

Floyd/Snider
601 Union Street, Suite 600
Seattle, WA 98101

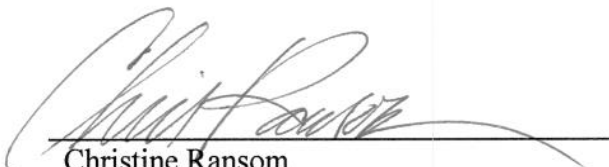
Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C15212-4

July 5, 2011

Approved for Release:



Christine Ransom
Project Manager
EcoChem, Inc.

PROJECT NARRATIVE

Basis for the Data Validation

This report summarizes the results of data validation performed on soil and quality control (QC) sample data for the Remedial Investigation/Feasibility Study at Lora Lake Parcel, Burien, WA. The dioxin data received full validation (EPA Stage 4); all other parameters received summary validation (EPA Stage 2B). A complete list of samples is provided in the **Sample Index**.

Frontier Analytical Laboratory (El Dorado Hills, California) performed the dioxin/furan analyses. Analytical Resources, Inc. (Tukwila, Washington) performed all other analyses. The analytical methods and EcoChem project chemists are listed in the table below.

Analysis	Method	Primary Review	Secondary Review
Dioxin Furan Compounds	EPA 1613	M. Swanson	C. Ransom
Volatile Organic Compounds	SW8060C	M. Brindle	
BTEX	SW8021-Mod		
Polycyclic Aromatic Hydrocarbons	SW8270D-SIM		
Pentachlorophenol	SW8041		
Total Petroleum Hydrocarbons – Diesel Range Organics	NWTPH-Dx		
Total Petroleum Hydrocarbons – Gasoline Range Organics	NWTPH-Gx		
Metals	SW6010B	J. Maute	
Total Organic Carbon	Plumb, 1981		
Total Solids	EPA 160.3		

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Port of Seattle Lora Lake Parcel, Remedial Investigation/Feasibility Study Work Plan* (February 11, 2011); *National Functional Guidelines for Inorganic Data Review* (USEPA 1994 & 2004); *National Functional Guidelines for Organic Data Review* (USEPA 1999 & 2008); and *USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA, September 2005).

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 above.

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
Lora Lake Parcel - Soil
Analytical Resources Inc.

SDG	Sample ID	Laboratory ID	Matrix	VOC	PAH	PCP	BTEX	TPH-Gx	TPH-Dx	Metals	TOC/TS
SS71	LL-SB6-0-0.5-041811	11-8654-SS71A	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB6-1.5-2-041811	11-8655-SS71B	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB6-2-4-041811	11-8656-SS71C	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB5-1.5-2-041811	11-8658-SS71E	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB5-2-4-041811	11-8659-SS71F	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB4-0-0.5-041911	11-8660-SS71G	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB4-1.5-2-041911	11-8661-SS71H	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB4-2-4-041911	11-8662-SS71I	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB3-0-0.5-041911	11-8663-SS71J	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB3-2-4-041911	11-8665-SS71L	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB2-0-0.5-041911	11-8666-SS71M	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB2-1.5-2-041911	11-8667-SS71N	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB2-2-3.5-041911	11-8668-SS71O	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB1-0-0.5-041911	11-8669-SS71P	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB1-0-0.5-041911-D	11-8670-SS71Q	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB1-1.5-2-041911	11-8671-SS71R	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-SB1-2-4-041911	11-8672-SS71S	Soil	✓	✓	✓	✓	✓	✓	✓	✓
SS71	LL-ER-041911	11-8673-SS71T	Rinsate		✓	✓			✓	✓	

Sample Index
Lora Lake Parcel - Soil
Frontier Analytical Laboratory

SDG	Sample ID	Laboratory ID	Matrix	Dioxins
6733	LL-SB6-0-0.5-041811	6733-001-SA	Soil	✓
6733	LL-SB6-1.5-2-041811	6733-002-SA	Soil	✓
6733	LL-SB6-2-4-041811	6733-003-SA	Soil	✓
6733	LL-SB5-0-0.5-041811	6733-004-SA	Soil	✓
6733	LL-SB5-1.5-2-041811	6733-005-SA	Soil	✓
6733	LL-SB5-2-4-041811	6733-006-SA	Soil	✓
6733	LL-SB4-0-0.5-041911	6733-007-SA	Soil	✓
6733	LL-SB4-1.5-2-041911	6733-008-SA	Soil	✓
6733	LL-SB4-2-4-041911	6733-009-SA	Soil	✓
6733	LL-SB3-0-0.5-041911	6733-010-SA	Soil	✓
6733	LL-SB3-1.5-2-041911	6733-011-SA	Soil	✓
6733	LL-SB3-2-4-041911	6733-012-SA	Soil	✓
6733	LL-SB2-0-0.5-041911	6733-013-SA	Soil	✓
6733	LL-SB2-1.5-2-041911	6733-014-SA	Soil	✓
6733	LL-SB2-2-3.5-041911	6733-015-SA	Soil	✓
6733	LL-SB1-0-0.5-041911	6733-016-SA	Soil	✓
6733	LL-SB1-0-0.5-041911-D	6733-017-SA	Soil	✓
6733	LL-SB1-1.5-2-041911	6733-018-SA	Soil	✓
6733	LL-SB1-2-4-041911	6733-019-SA	Soil	✓

DATA VALIDATION REPORT
Lora Lake Parcel - Soils
Volatile Organic Compounds by SW846 Method 8260C

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

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

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

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, ranging down to 1.6°C. The temperature outliers did not impact data quality; therefore no action was taken.

Field Blank

No field blanks were submitted.

Field Duplicates

The relative percent difference (RPD) control limit is 50% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than 2x the RL.

One set of field duplicates were submitted: LL-SB-0-0.5-0041911 and LL-SB-0-0.5-0041911-D. No target analytes were detected in either sample; field precision was acceptable.

Internal Standards

The recoveries for the internal standard 1,4-dichlorobenzene-d4 were less than the lower control limit in Samples LL-SB5-0-0.5-041811, LL-SB5-2-4-041811, and LL-SB4-0-0.5-041911. This internal standard was not used to quantitate the analytes of interest for this project. No qualifiers were required.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample/laboratory control sample (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel - Soils

Polycyclic Aromatic Hydrocarbons by SW846 Method 8270D- SIM

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all soil data. Compliance screening (EPA Stage 2A) was performed on all field blank data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil, 1 Equipment Rinsate

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

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

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

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, ranging down to 1.6°C. The temperature outliers did not impact data quality; therefore no action was taken.

Field Blanks

One equipment rinsate blank, LL-ER-041911, was submitted. No target analytes were detected in this blank.

Surrogate Compounds

The percent recovery (%R) value for dibenzo(a,h)anthracene-d14 was less than the lower control limit of 40% in Sample LL-SB5-0-0.5-041811. The %R value for 2-methylnaphthalene-d10 was less than the control limit in Sample LL-SB3-1.5-2-041911. All results for these samples were estimated (J/UJ-13) to indicate a potential low bias.

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than 2x the RL.

One set of field duplicates were submitted: LL-SB-0-0.5-0041911 and LL-SB-0-0.5-0041911-D. No target analytes were detected in either sample; field precision was acceptable.

III. OVERALL ASSESSMENT

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

Data were estimated due to surrogate recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel - Soils

Pentachlorophenol by EPA Method 8041A

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all soil data and compliance screening (EPA Stage 2A) was performed on all field blank data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil, 1 Equipment Rinsate

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

- | | | | |
|---|---|---|-------------------------|
| 1 | Sample Receipt, Preservation, and Holding Times | 1 | Field Duplicates |
| | Initial Calibration (ICAL) | | Retention Time Window |
| | Continuing Calibration (CCAL) | | Target Analyte List |
| | Laboratory Blanks | | Compound Identification |
| 1 | Field Blanks | | Compound Quantitation |
| | Surrogate Compounds | | Reporting Limits |
| | Laboratory Control Samples (LCS) | | Reported Results |
| | Matrix Spikes/Matrix Spike Duplicates (MS/MSD) | | |

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

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, ranging down to 1.6°C. The temperature outliers did not impact data quality; therefore no action was taken.

Field Blanks

One equipment rinsate, LL-ER-041911, was submitted. No target analytes were detected in this blank.

Field Duplicates

The field duplicate relative percent difference (RPD) control limit is 50% for concentrations greater than 5x the reporting limit (RL). For concentrations less than 5x the RL, the difference between the sample result and the duplicate result must be less than 2x the RL.

One set of field duplicates were submitted: LL-SB-0-0.5-0041911 and LL-SB-0-0.5-0041911-D. No target analytes were detected in either sample; field precision was acceptable.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) recoveries. Precision was also acceptable as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel - Soils

Diesel Range Organics by NWTPH-Dx

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all soil data and compliance screening (EPA Stage 2A) was performed on all field blank data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil, 1 Equipment Rinsate

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

- | | | |
|---|---|--|
| 1 | Sample Receipt, Preservation, and Holding Times | Laboratory Control Samples (LCS/LCSD) |
| | Initial Calibration (ICAL) | Matrix Spikes/Matrix Spike Duplicates (MS/MSD) |
| | Continuing Calibration (CCAL) | 1 Field Duplicates |
| | Laboratory Blanks | Reporting Limits |
| 1 | Field Blanks | Reported Results |
| | Surrogate Compounds | |

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

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, ranging down to 1.6°C. The temperature outliers did not impact data quality; therefore no action was taken.

Field Blanks

One equipment rinsate, LL-ER-041911, was submitted. No target analytes were detected in this blank.

Field Duplicates

The relative percent difference (RPD) value control limit is 50% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL.

One set of field duplicates were submitted: LL-SB-0-0.5-0041911 and LL-SB-0-0.5-0041911-D. No target analytes were detected in either sample; field precision was acceptable.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD), and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries. Precision was also acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Parcel -Soil
BETX by Method SW8021B Mod and
Gasoline Range Organics by NWTPH-Gx

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	Laboratory Control Samples (LCS)
	Initial Calibration (ICAL)	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
	Continuing Calibration (CCAL)	1 Field Duplicates
	Blanks	Target Analyte List
1	Field Blanks	Reporting Limits
	Surrogate Compounds	Reported Results

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

As stated in validation guidance documents, sample coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, ranging down to 1.6°C. The temperature outliers did not impact data quality and no action was taken.

Field Blanks

No field blanks were submitted.

Field Duplicate

The RPD value control limit is 50% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than 2x the RL.

One set of field duplicates were submitted: LL-SB-0-0.5-0041911 and LL-SB-0-0.5-0041911-D. No target analytes were detected in either sample; field precision was acceptable.

IV. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries. Precision was acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Lora Lake Parcel – Soils
Dioxin/Furan Compounds by Method 1613

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Frontier Analytical Laboratory, El Dorado Hills, California. Full validation (EPA Stage 4) was performed on all soil data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
6733	19 Soil

I. 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.

II. TECHNICAL DATA VALIDATION

The quality control (QC) requirements reviewed are summarized in the following table:

1	Sample Receipt, Preservation, and Holding Times	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	System Performance and Resolution Checks	Ongoing Precision and Recovery (OPR)
	Initial Calibration (ICAL)	1 Field Duplicates
	Calibration Verification (CVER)	Target Analyte List
	Method Blanks	2 Reported Results
1	Field Blanks	Compound Identification
2	Labeled Compound Recovery	1 Calculation Verification

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 samples were transferred from Analytical Resources, Inc (ARI) to Frontier Analytical Laboratory. As stated in validation guidance documents, samples should be maintained within the advisory temperature range of 2°C to 6°C. The temperatures recorded by Frontier were as low as 0.0°C, which is less than the lower control limit. The temperature outliers did not impact data quality; therefore no action was taken.

Field Blanks

No equipment rinsate samples were submitted with this data package.

Labeled Compound Recovery

Several labeled compound percent recovery (%R) values were outside of the QAPP specified control limits of 70% - 130%. For recoveries less than the lower control limit, the results for the associated compounds were estimated (J/UJ-13) to indicate a potential low bias. For recoveries greater than the upper control limit, positive results for the associated compounds were estimated (J-13) to indicate a potential high bias. Outliers in the following samples resulted in qualification of data.

Sample ID	Labeled Compounds	Bias
LL-SB5-0-0.5-041811	13C-1,2,3,4,7,8,9-HpCDF	High
LL-SB4-2-4-041911	13C-OCDD	Low
LL-SB2-2-3.5-041911		
LL-SB3-1.5-2-041911	13C-OCDD & 13C-OCDF	Low
LL-SB3-2-4-041911		
LL-SB2-1.5-2-041911		
LL-SB1-0-0.5-041911		
LL-SB1-0-0.5-041911-D		
LL-SB1-1.5-2-041911		
LL-SB1-2-4-041911	13C-OCDD, 13C-OCDF, & 13C-2,3,4,6,7,8-HxCDF	Low
LL-SB2-0-0.5-041911		

Field Duplicates

The RPD value control limit is 30% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than 2x the RL.

The data for one field duplicate set, LL-SB1-0-0.5-041911 and LL-SB1-0-0.5-041911-D, were submitted. The RPD values for OCDD and total HpCDD were greater than the control limit, at 107.6% and 73.9%, respectively. No data were qualified based on field duplicate precision outliers; however users of the data should consider the impact of field precision on the reported results.

Reported Results

The laboratory assigned “D and/or M” flags to several of the reported homologue group totals to indicate that a diphenyl ether (D) or some other interference (M) was present, resulting in a high bias in the reported result. All analytes that were “D” and/or “M” flagged were estimated (J-14).

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. With the above noted exceptions, accuracy was acceptable as demonstrated by the labeled compound, ongoing precision and recovery (OPR) standard, and matrix spike/matrix spike duplicate (MS/MSD) %R values; and precision was acceptable as demonstrated by the MS/MSD and field duplicate RPD values.

Data were estimated based on labeled compound recovery outliers and interference from diphenyl ether.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Soils

Total Arsenic and Lead by EPA 6010B

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all soil data. Compliance screening (EPA Stage 2A) was performed on all field blank data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil, 1 Equipment Rinsate

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

<ul style="list-style-type: none"> 1 Sample Receipt, Preservation, and Holding Times Initial Calibration Continuing Calibration Verification CRDL Standards Laboratory Blanks 1 Field Blanks Laboratory Control Samples (LCS) Matrix Spikes (MS) 	<ul style="list-style-type: none"> Reference Materials Laboratory Duplicates 1 Field Duplicates Interference Check Samples Target Analyte List Reporting Limits Reported Results
--	---

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 coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, the lowest at 1.6°C. The temperature outliers did not impact data quality and no action was taken.

Field Blanks

One equipment rinsate blank, LL-ER-041911, was submitted. No target analytes were detected in the field blank.

Field Duplicates

The relative percent difference (RPD) control limit is 20% for results greater than five times the reporting limit (RL). For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL.

One set of field duplicates, LL-SB1-0-0.5-041911 and LL-SB1-0-0.5-041911-D, were submitted. All field precision criteria were met.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the laboratory control sample and matrix spike sample percent recovery values. Precision was also acceptable as demonstrated by the laboratory and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT

Lora Lake Parcel – Soils

Total Solids by 160.3M & Total Organic Carbon by Plumb, 1981

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources Incorporated, Tukwila, Washington. Summary validation (EPA Stage 2B) was performed on all data. The **Sample Index** contains a complete list of samples.

SDG	Number of Samples
SS71	19 Soil

I. 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.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

- | | |
|--|---|
| <ul style="list-style-type: none"> 1 Sample Receipt, Preservation, and Holding Times Initial Calibration Calibration Verification Laboratory Blanks Laboratory Control Samples (LCS) 1 Reference Materials | <ul style="list-style-type: none"> Matrix Spikes/Matrix Spike Duplicates (MS/MSD) Laboratory Replicates 1 Field Duplicates Reporting Limits Reported Results |
|--|---|

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 coolers should arrive at the laboratory within the advisory temperature range of 2°C to 6°C. Several coolers were received with temperatures less than the lower limit, the lowest at 1.6°C. The temperature outliers did not impact data quality and no action was taken.

Reference Materials

The certified reference material NIST 1941B was analyzed with the TOC samples. The reference material recovery was within the certified acceptance ranges.

Field Duplicates

The relative percent difference (RPD) value control limit is 20% for TOC and 25% for total solids. For results less than five times the RL, the difference between the sample and duplicate must be less than two times the RL.

One set of field duplicates, LL-SB1-0-0.5-041911 and LL-SB1-0-0.5-041911-D, was submitted. All field precision criteria were met.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the laboratory control sample, matrix spike, and reference material percent recovery values. Precision was acceptable as demonstrated by the laboratory replicate percent relative standard deviation (%RSD) and field duplicate RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.



EcoChem, INC.
Environmental 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

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with "R" and "DNR" only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

EcoChem Validation Guidelines for Volatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Hold Time	Waters: 14 days preserved 7 Days: unpreserved (for aromatics) Solids: 14 Days	J(+)/UJ(-) if hold times exceeded If exceeded by > 3X HT: J(+)/R(-) (EcoChem PJ)	1
Tuning	BFB Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Storage Blank	One per SDG <CRQL	U(+) the specific analyte(s) results in all assoc.samples using the 5x or 10x rule	7
Trip Blank	Frequency as per project QAPP	Same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned	18
Field Blanks (if required in QAPP)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Volatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS <i>low conc. H2O VOA</i>	One per lab batch Within method control limits	J(+) assoc. compd if > UCL J(+)/R(-) assoc. compd if < LCL J(+)/R(-) all compds if half are < LCL	10
LCS <i>regular VOA (H2O & solid)</i>	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD <i>(if required)</i>	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. compd. in all samples	9
Surrogates	Added to all samples Within method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL but > 10% (see PJ ¹) J(+)/R(-) if < 10%	13
Internal Standard (IS)	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT > 30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD < 50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD < 35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	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	See Technical Director if outliers	14 21 (false +)

PJ¹ No action if there are 4+ surrogates and only 1 outlier.

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	<u>Water:</u> J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) <u>Solids/Wastes:</u> J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
 (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD (if required)	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	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	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT (EcoChem PJ)	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts For full DV, use PJ based on examination of raw data	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)/R(-) if %D > 90% PJ for resolution	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) ----- U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD (if required)	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. compd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% EcoChem PJ - See TM-08	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate (Qualify if required by project QAPP)	9

DATA VALIDATION CRITERIA

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range (Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors $\leq 20\%$	Narrate if fewer than 5 calibration levels or if %R > 15% J(+)/UJ(-) if $R^2 < 0.990$ J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R > 115%	5B
Method Blank	At least one per batch (≤ 20 samples) No results > RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is \geq RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. > 5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤ 10 samples) RPD \leq lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R < 10% (EcoChem PJ)	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range
 (Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx,
 June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range
 (Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx,
 June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Waters: 14 days preserved 7 days unpreserved Solids: 14 Days	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: R ² ≥ 0.990 If used, RSD of response factors ≤ 20%	Narrate if fewer than 5 calibration levels or if %R > 15% J(+)/UJ(-) if R ² < 0.990 J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 80% to 120%	Narrate if frequency not met. J(+)/UJ(-) if %R < 80% J(+) if %R > 120%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Trip Blank (if required by project)	No results >RL	Action is same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned.	18
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in field blank after method and trip blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range
 (Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx,
 June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10
Surrogates	Bromofluorobenzene and/or 1,4-difluorobenzene added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R >UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate outliers If required by project, qualify with J(+)/UJ(-)	9
Two analyses for one sample (e.g., dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler/Storage Temperature	Waters/Solids < 4°C Tissues <-10°C	EcoChem PJ, see TM-05	1
Holding Time	Extraction - Water: 30 days from collection <i>Note:</i> Under CWA, SDWA, and RCRA the HT for H2O is 7 days* Extraction - Soil: 30 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext > 30 days J(+)/UJ(-) if analysis > 40 Days EcoChem PJ, see TM-05	1
Mass Resolution	>=10,000 resolving power at m/z 304.9824 Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift	R(+/-) if not met	14
Window Defining Mix and Column Performance Mix	Window defining mixture/Isomer specificity std run before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) x = ht. of TCDD y = baseline to bottom of valley For all isomers eluting near 2378-TCDD/TCDF isomers (TCDD only for 8290)	J(+) if valley > 25%	5A (ICAL) 5B (CCAL)
Initial Calibration	Minimum of five standards %RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD <35% for labeled compounds under 1613b)	J(+) natives if %RSD > 20%	5A
	Abs. RT of ¹³ C ₁₂ -1234-TCDD >25 min on DB5 >15 min on DB-225	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10 for all native and labeled compounds in CS1 std.	If <10, elevate Det. Limit or R(-)	

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Continuing Calibration	Analyzed at the start and end of each 12 hour shift. %D +/-20% for native compounds %D +/-30% for labeled compounds (Must meet limits in Table 6, Method 1613B) (If %Ds in the closing CCAL are w/in 25%/35% the avg RF from the two CCAL may be used to calculate samples per Method 8290, Section 8.3.2.4)	Do not qualify labeled compounds. Narrate in report for labeled compound %D outliers. For native compound %D outliers: 8290: J(+)/UJ(-) if %D = 20% - 75% J(+)/R(-) if %D > 75% 1613: J(+)/UJ(-) if %D is outside Table 6 limits J(+)/R(-) if %D is +/- 75% of Table 6 limit	5B
	Abs. RT of ¹³ C ₁₂ -1234-TCDD and ¹³ C ₁₂ -123789-HxCDD +/- 15 sec of ICAL.	EcoChem PJ, see ICAL section of TM-05	
	RRT of all other compounds must meet Table 2 of 1613B.	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10	If <10, elevate Det. Limit or R(-)	
Method Blank	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	7
Field Blanks (Not Required)	No positive results	If sample result <5X action level, qualify U at reported value.	6
LCS / OPR	Concentrations must meet limits in Table 6, Method 1613B or lab limits.	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
MS/MSD (recovery)	May not analyze MS/MSD %R should meet lab limits.	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	May not analyze MS/MSD RPD < 20%	J(+) in parent sample if RPD > CL	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
 (Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Lab Duplicate	RPD <25% if present.	J(+)/UJ(-) if outside limits	9
Labeled Compounds / Internal Standards	<p><i>Method 8290:</i> %R = 40% - 135% in all samples</p> <hr style="border-top: 1px dashed black;"/> <p><i>Method 1613B:</i> %R must meet limits specified in Table 7, Method 1613</p>	<p>J(+)/UJ(-) if %R = 10% to LCL J(+) if %R > UCL J(+)/R(-) if %R < 10%</p>	13
Quantitation/ Identification	<p>Ions for analyte, IS, and rec. std. must max w/in 2 sec. S/N >2.5</p> <p>IA ratios meet limits in Table 9 of 1613B or Table 8 of 8290 RRTs w/in limits in Table 2 of 1613B</p>	<p>If RT criteria not met, use PJ (see TM-05) If S/N criteria not met, J(+). if unlabelled ion abundance not met, change to EMPC If labelled ion abundance not met, J(+).</p>	21
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	If laboratory correctly reported an EMPC value, qualify with U to indicate that the value is a detection limit.	14
Interferences	PCDF interferences from PCDEPE	If both detected, change PCDF result to EMPC	14
Second Column Confirmation	All 2378-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC specs in this table must be met for the confirmation analysis.	Report lower of the two values. If not performed use PJ (see TM-05).	3
Field Duplicates	<p>Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL)</p> <p>Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)</p>	Narrate and qualify if required by project (EcoChem PJ)	9
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used	11

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B
Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV every ten samples and end of run blank < IDL (MDL)	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level (Refer to TM-02 for additional information)	7
Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R < 50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb, Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements ICSA < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R > 120% J(+)/UJ(-) if %R = 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R > 120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

DATA VALIDATION CRITERIA

Table No.: NFG-ICP
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Metals Analysis by ICP (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 1 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for cooler temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	Use professional judgment J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B
Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method After each ICV and CCV every ten samples and end of run blank < MDL	Action level is 5x absolute value of blank conc. For (+) blanks, U(+) results < action level For (-) blanks, J(+)/UJ(-) results < action level refer to TM-02 for additional details	7
Method Blank	One per matrix per batch (not to exceed 20 samples) blank < MDL	Action level is 5x absolute value of blank conc. For (+) blk value, U(+) results < action level For (-) blk value, J(+)/UJ(-) results < action level	7
Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

DATA VALIDATION CRITERIA

Table No.: Eco-Conv
 Revision No.: 0
 Last Rev. Date: 6/17/2009
 Page: 2 of 2

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9



EcoChem, INC.
Environmental Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Lora Lake Parcel - Soils

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qual	DV Qual	DV Reason
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	SW8270D SIM	Benzo(a)anthracene	12	ug/kg		J	13
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	SW8270D SIM	Benzo(a)pyrene	17	ug/kg		J	13
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	SW8270D SIM	Chrysene	37	ug/kg		J	13
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	SW8270D SIM	Dibenz(a,h)anthracene	4.5	ug/kg	U	UJ	13
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	SW8270D SIM	Indeno(1,2,3-cd)pyrene	7.2	ug/kg		J	13
SS71	LL-SB5-0-0.5-041811	11-8657-SS71D	SW8270D SIM	Total Benzofluoranthenes	61	ug/kg		J	13
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	SW8270D SIM	Benzo(a)anthracene	4.5	ug/kg	U	UJ	13
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	SW8270D SIM	Benzo(a)pyrene	4.5	ug/kg	U	UJ	13
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	SW8270D SIM	Chrysene	4.5	ug/kg	U	UJ	13
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	SW8270D SIM	Dibenz(a,h)anthracene	4.5	ug/kg	U	UJ	13
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	SW8270D SIM	Indeno(1,2,3-cd)pyrene	4.5	ug/kg	U	UJ	13
SS71	LL-SB3-1.5-2-041911	11-8664-SS71K	SW8270D SIM	Total Benzofluoranthenes	4.5	ug/kg	U	UJ	13
6733	LL-SB5-0-0.5-041811	6733-004-SA	EPA 1613 D/F	1,2,3,4,7,8,9-HpCDF	2.03	pg/g	J	J	13
6733	LL-SB4-2-4-041911	6733-009-SA	EPA 1613 D/F	OCDD	10.3	pg/g		J	13
6733	LL-SB3-1.5-2-041911	6733-011-SA	EPA 1613 D/F	OCDD	150	pg/g		J	13
6733	LL-SB3-1.5-2-041911	6733-011-SA	EPA 1613 D/F	OCDF	9.58	pg/g	J	J	13
6733	LL-SB3-2-4-041911	6733-012-SA	EPA 1613 D/F	OCDD	239	pg/g		J	13
6733	LL-SB3-2-4-041911	6733-012-SA	EPA 1613 D/F	OCDF	14.8	pg/g		J	13
6733	LL-SB2-0-0.5-041911	6733-013-SA	EPA 1613 D/F	2,3,4,6,7,8-HxCDF	2.72	pg/g	J	J	13
6733	LL-SB2-0-0.5-041911	6733-013-SA	EPA 1613 D/F	OCDD	978	pg/g		J	13
6733	LL-SB2-0-0.5-041911	6733-013-SA	EPA 1613 D/F	OCDF	72.6	pg/g		J	13
6733	LL-SB2-0-0.5-041911	6733-013-SA	EPA 1613 D/F	Total PeCDF	51.7	pg/g	D,M	J	14
6733	LL-SB2-0-0.5-041911	6733-013-SA	EPA 1613 D/F	Total TCDF	47	pg/g	D,M	J	14
6733	LL-SB2-1.5-2-041911	6733-014-SA	EPA 1613 D/F	OCDD	13.3	pg/g		J	13
6733	LL-SB2-1.5-2-041911	6733-014-SA	EPA 1613 D/F	OCDF	1.51	pg/g	U	UJ	13
6733	LL-SB2-2-3.5-041911	6733-015-SA	EPA 1613 D/F	OCDD	15.3	pg/g		J	13
6733	LL-SB1-0-0.5-041911	6733-016-SA	EPA 1613 D/F	OCDD	18.6	pg/g		J	13
6733	LL-SB1-0-0.5-041911	6733-016-SA	EPA 1613 D/F	OCDF	1.18	pg/g	U	UJ	13
6733	LL-SB1-0-0.5-041911-D	6733-017-SA	EPA 1613 D/F	OCDD	61.9	pg/g		J	13
6733	LL-SB1-0-0.5-041911-D	6733-017-SA	EPA 1613 D/F	OCDF	1.31	pg/g	U	UJ	13
6733	LL-SB1-1.5-2-041911	6733-018-SA	EPA 1613 D/F	OCDD	112	pg/g		J	13
6733	LL-SB1-1.5-2-041911	6733-018-SA	EPA 1613 D/F	OCDF	7.18	pg/g	J	J	13
6733	LL-SB1-2-4-041911	6733-019-SA	EPA 1613 D/F	OCDD	251	pg/g		J	13
6733	LL-SB1-2-4-041911	6733-019-SA	EPA 1613 D/F	OCDF	15.2	pg/g		J	13

**Port of Seattle
Lora Lake Apartments Site**

**Remedial Investigation/
Feasibility Study**

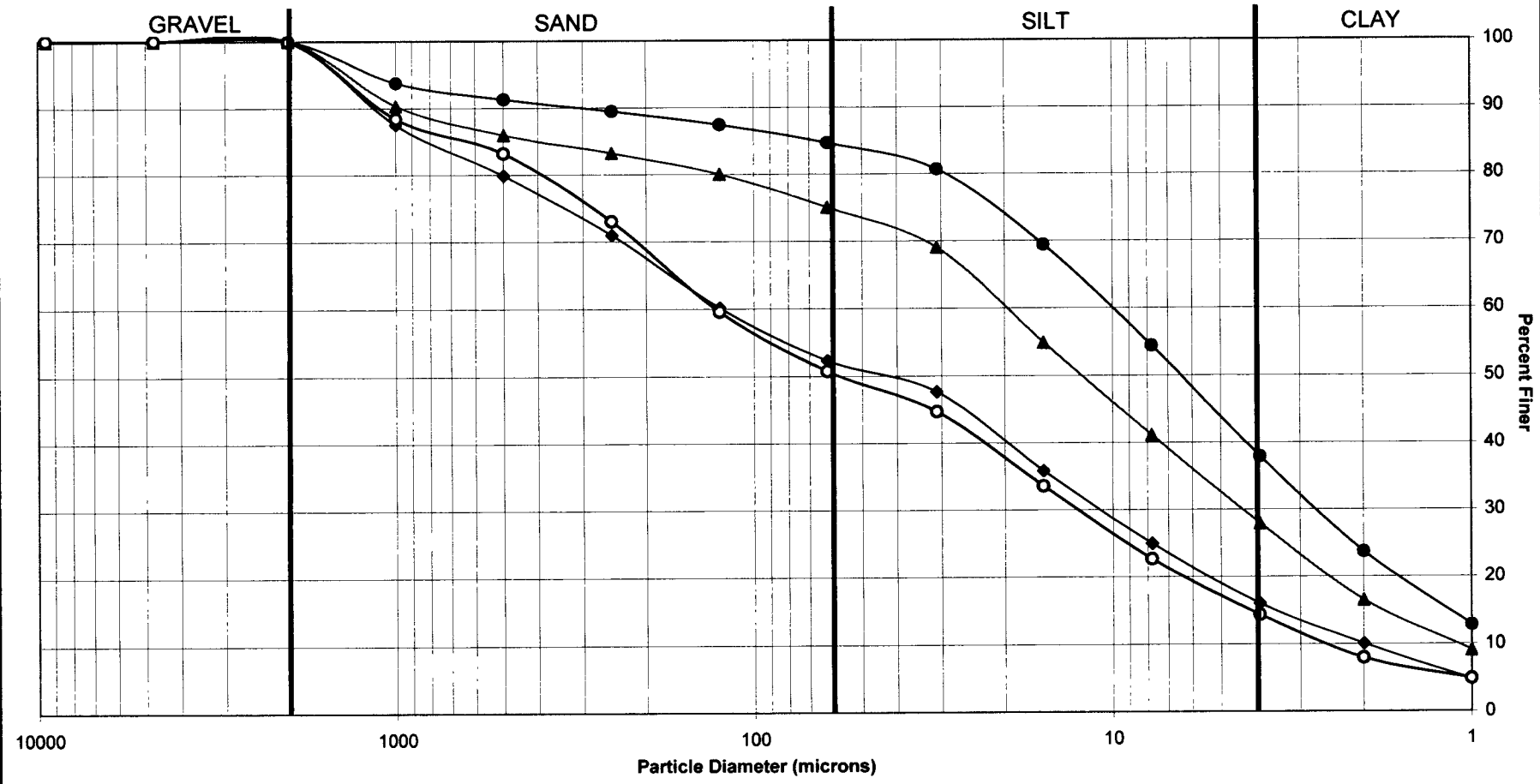
Volume II

**Appendix G
Lora Lake Parcel
Remedial Investigation Data Report**

**Attachment G.5
Surface Sediment Grain Size
Distribution Curves**

FINAL

PSEP Grain Size Distribution

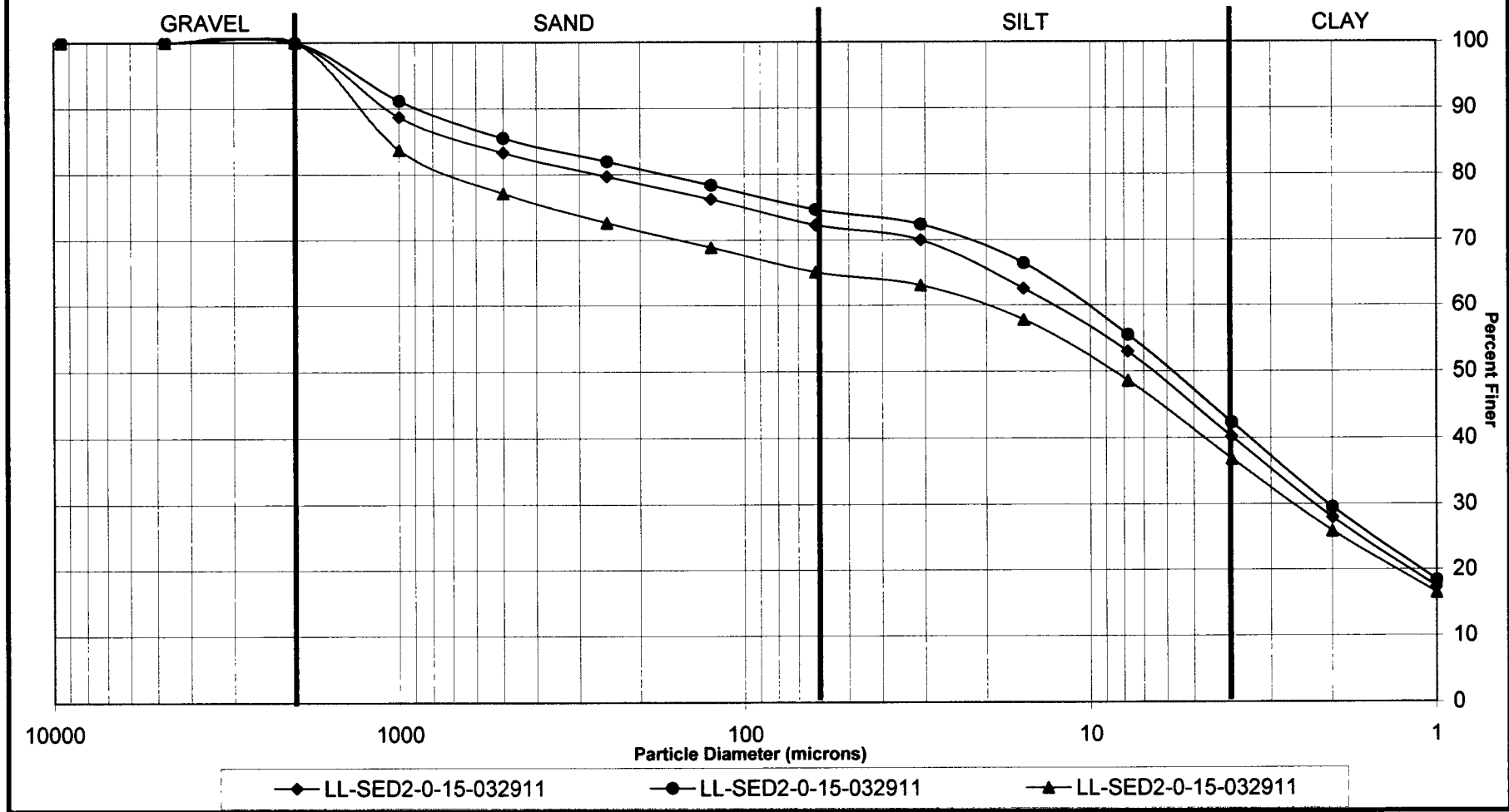


◆ LL-SED1-0-15-032911 ● LL-SED3-0-15-032911 ▲ LL-SED4-0-15-032911 ○ LL-SED1-0-15-032911-D

SP34 : 00238

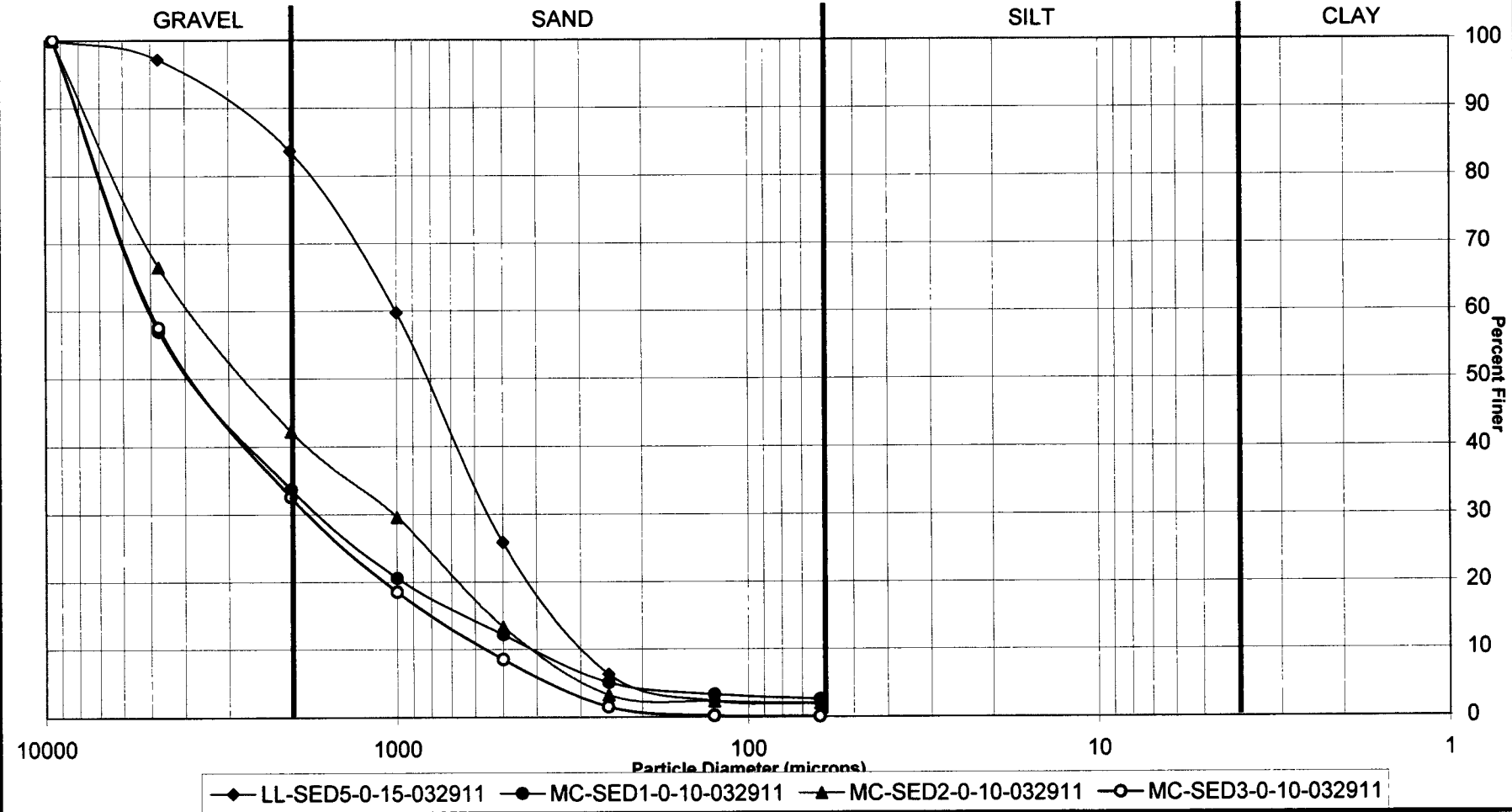
PSEP Grain Size Distribution

Triplicate Sample Plot



SP34 : 00237

PSEP Grain Size Distribution



SP34 : 00239

**Port of Seattle
Lora Lake Apartments Site**

**Remedial Investigation/
Feasibility Study**

Volume II

**Appendix G
Lora Lake Parcel
Remedial Investigation Data Report**

**Attachment G.6
Bioassay Reports**

FINAL



Nautilus Environmental

**Port of Seattle
Lora Lake
Remedial Investigation/Feasibility Study
Sediment Characterization – Toxicological Results**

Final Report

Report date: June 21, 2011

Submitted to:

Washington Laboratory
5009 Pacific Hwy East
Suite 2
Tacoma, WA 98424

Floyd Snider Inc.
601 Union St. Ste. 600
Seattle, WA 98101

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	I
SIGNATURE PAGE	III
1.0 INTRODUCTION.....	1
2.0 SAMPLES	2
3.0 <i>CHIRONOMUS DILUTUS</i> TEST.....	3
3.1 Methods	3
3.2 Results	5
3.3 QA/QC.....	6
3.4 Discussion.....	8
4.0 <i>HYALELLA AZTECA</i> TEST.....	9
4.1 Methods	9
4.2 Results	11
4.3 QA/QC.....	12
4.4 Discussion.....	13
5.0 MICROTOX® TEST	14
5.1 Methods	14
5.2 Results	15
5.3 QA/QC.....	16
5.4 Discussion.....	17
6.0 CONCLUSIONS	17
7.0 REFERENCES	18

TABLE OF CONTENTS

Page

LIST OF TABLES

Table 1	Acceptability criteria for bioassays	1
Table 2	Summary of sample collection and test initiation dates	2
Table 3	Summary of methods for the 20-day test with <i>Chironomus dilutus</i>	5
Table 4	Results of <i>Chironomus dilutus</i> tests. Samples with statistically reduced survival or growth are underlined, and values failing two-hit RSET criteria are shaded gray, while samples failing one-hit RSET criteria are bold. ^{1,2}	6
Table 5	Summary of water quality parameters for <i>C. dilutus</i> tests (means and ranges). Required values are shown in brackets.....	7
Table 6	<i>C. dilutus</i> reference toxicant test results.....	8
Table 7	Summary of methods for the 10-day test with <i>Hyalella azteca</i>	11
Table 8	Results of <i>Hyalella azteca</i> tests.	12
Table 9	Summary of water quality parameters for <i>H. azteca</i> analyses (means and ranges). Required values are shown in brackets.....	13
Table 10	Summary of methods for the Microtox test.....	15
Table 11	Results of Microtox tests.....	16
Table 12	Summary of sites water quality parameters for Microtox analyses.....	16
Table 13	Microtox reference toxicant test results.....	17
Table 14	One-hit/Two-hit criteria summary results table	17

LIST OF APPENDICES

- APPENDIX A – Results Summaries
- APPENDIX B – Statistical Analyses
- APPENDIX C – Water Quality Summaries
- APPENDIX D – Laboratory Bench Sheets
- APPENDIX E – Reference Toxicant Tests
- APPENDIX F – Chain-of-Custody Forms

SIGNATURE PAGE



Cat Curran, M.S.

Washington Laboratory Manager

This report has been prepared based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party.

1.0 INTRODUCTION

On March 29th, 2011 Floyd Snider collected freshwater sediments from Lora Lake and Miller Creek at the Port of Seattle’s Lora Lake Parcel for biological testing. Floyd Snider contracted with Nautilus Environmental to provide toxicity-testing services for the project. The seven sediment samples selected for testing included samples LL-SED1-0-15-032911 (LL-SED1), LL-SED2-0-15-032911 (LL-SED2), LL-SED3-0-15-032911 (LL-SED3), LL-SED4-0-15-032911 (LL-SED4), MC-SED1-0-10-032911 (MC-SED1), MC-SED2-0-10-032911 (MC-SED2), and MC-SED3-0-10-032911 (MC-SED3). No reference sample was collected in conjunction with this project. The freshwater sediment samples were tested for toxicity using the *Chironomus dilutus* (aka *tentans*) 20-day survival and growth bioassay (USEPA 2000 and ASTM 2000), the *Hyalella azteca* 10-day survival bioassay (USEPA 2000 and ASTM 2000), and the 15-minute 100 percent porewater Microtox® bacteria bioluminescence test. The *Hyalella azteca* and microtox tests met negative control criteria, as did *Chironomus dilutus* survival. However, *C. dilutus* growth did not meet negative control criteria. Protocol deviations that occurred were not expected to have impacted the results and are discussed later in this report.

Results were evaluated by comparing test data to the criteria in the Sediment Evaluation Framework for the Pacific Northwest (RSET 2009) guidance document. *C. dilutus*, *H. azteca*, and Microtox results were compared to control results, and examined for statistically significant effects ($\alpha = 0.05$). Acceptability criteria from the literature are summarized in Table 1.

Table 1 Acceptability criteria for bioassays

Test Type	<i>C. dilutus</i> 20-Day	<i>H. azteca</i> 10-Day	Microtox
Endpoint	Survival and Growth	Survival	Luminescence
Source	RSET 2009	RSET 2009	RSET 2009
Test Criteria	One-hit failure is mortality > control mortality + 25% <u>and/or</u> biomass <60% of control biomass <u>and</u> significant difference Two-hit failure is mortality > control mortality + 15% <u>and/or</u> biomass <75% of control biomass <u>and</u> significant difference	One-hit failure is mortality > control mortality + 25% <u>and</u> significant difference Two-hit failure is mortality > control mortality + 10% <u>and</u> significant difference	One-hit failure is Luminescence <75% of control luminescence <u>and</u> significant difference Two-hit failure is Luminescence <85% of control luminescence <u>and</u> significant difference
Control Criteria	Negative control ≤32% mortality and growth ≥0.48 mg/ind. ash-free dry weight ¹	Negative control ≤20% mortality	Negative control final light output > 72% of initial output

¹Criteria is based on testing at 23°C

2.0 SAMPLES

Upon receipt of samples from Floyd Snider, samples were matched with the chain-of-custody form and inspected. Samples were stored at $4 \pm 2^{\circ}\text{C}$ in the dark prior to test initiation. Toxicity tests were initiated within 2 weeks of collection (Table 2). Total ammonia levels in the porewater ranged from <1.0 to 11.9 milligrams per liter (mg/L), while sulfides in the porewater ranged from 0.016 to 0.561 mg/L. Both overlying ammonia and sulfides were also measured during testing, and the results are reported in the QA/QC sections for each test.

Table 2 Summary of sample collection and test initiation dates

Sample ID	Collection Date	<i>C. dilutus</i> Test Initiation Date	<i>H. azteca</i> Test Initiation Date	Microtox Test Initiation Date
LL-SED1-0-15-032911	March 29, 2011	April 13, 2011	April 5, 2011	March 31, 2011
LL-SED2-0-15-032911				
LL-SED3-0-15-032911				
LL-SED4-0-15-032911				
MC-SED1-0-10-032911				
MC-SED2-0-10-032911				
MC-SED3-0-10-032911				

3.0 CHIRONOMUS DILUTUS TEST

3.1 Methods

C. dilutus were exposed to test sediments for 20 days to determine the effects of site sediment on survival and growth. These tests were conducted according to methods presented in USEPA (2000) and ASTM (2000), with modifications from the Lora Lake Parcel RI/FS Workplan (RI/FS workplan; Floyd Snider 2011), and are summarized in Table 3. Per the RI/FS workplan, tests were to be started within a week of sample collection, and every effort was made to meet that requirement. However, the organisms used to start that test appeared to be of low quality due to a low hatching rate and, to prevent waiting 20 days until results confirmed that suspicion, a second test was initiated a week later on April 13, 2011 with a different batch of organisms. Sample holding time is 8 weeks, so while this delayed start was outside the RI/FS Workplan, it was within sample holding time requirements. It is this second test that is reported here, as the initial test started April 6th did not meet control requirements.

C. dilutus egg cases were obtained from Aquatic BioSystems (Fort Collins, Colorado) and arrived at the laboratory on April 12, 2011. The egg cases were transported in insulated containers in oxygen-saturated water contained in 500-mL plastic bottles. Upon arrival at the laboratory, water quality parameters were measured and observations of organism condition were made. The egg cases were 20°C at receipt, and were cultured at 20°C. The organisms emerged from the egg cases on April 13th and tests were initiated the same day.

One day prior to test initiation (Day -1), the sediment samples were homogenized, 100-ml of sediment was distributed to each of eight labeled test chambers for each of the samples, and 175-ml diluted mineral water (prepared by diluting two parts Perrier® into eight parts deionized water) was added to each container. Control sediment consisted of clean, rinsed silica sand (50/50 mix of #30 and #70) mixed with peat moss (1/2 Tbsp) that was rinsed overnight in diluted mineral water. Eight test chambers were also prepared for the control sediment. An additional replicate was included for each sediment sample and the control sediment as a sacrificial test chamber for routine water quality measurements.

The test chambers were randomized and the sediments were left to settle overnight. On Day 0, overlying ammonia, sulfide, hardness, alkalinity, dissolved oxygen (DO), pH, conductivity, and

temperature were measured. Twelve organisms were directly added to each test chamber, in random order.

Each test chamber was provided 1.5 mL of food daily (after the second renewal) starting on Day -1. The food consisted of a mixture of 4 g ground Tetrafin® flakes mixed with 1 L diluted mineral water. The feeding regime was reduced if the presence of excess food was observed on the sediment surface in several test chambers; however, this never occurred. Abnormal conditions or unusual animal behavior, if observed, were noted daily.

Temperature, DO, pH, and conductivity were monitored daily in the water quality replicate for each sample, while alkalinity, hardness, ammonia and sulfides were measured on Days 5, 10, and 15. Water was renewed twice daily.

At test termination, subsamples of overlying water were collected from each water quality replicate for ammonia, hardness, alkalinity, and sulfide analyses. The contents of each test chamber were gently mixed to suspend the sediment and poured through a 0.5-mm Nitex screen. The sediment was rinsed through the screen using dechlorinated tap water. Animals were removed from the screen and the number of survivors counted and recorded. Presence of pupae, flies, or exuviae (molts) were noted. The larvae were rinsed with deionized water and placed into pre-ashed, pre-weighed weigh boats. The weigh boats were placed in an oven at 60°C for at least 24-hours, then placed in a dessicator until dry weight could be measured. The weigh boats were then placed in a muffle furnace at 550°C for two hours, placed in a dessicator to cool, then weighed again to determine the ash weight. The ash weight was subtracted from the dry weight to determine the ash-free dry weight (AFDW). The number and AFDW of surviving chironomids were evaluated statistically by one-tailed t-test, or one-tailed Mann-Whitney U-test, as appropriate, to determine whether the samples exhibited a significant decrease in survival or growth relative to the control ($p < 0.05$). Survival data were arcsine transformed, while growth data was either square root or log transformed as needed to stabilize the variances and improve normality of the data prior to performing the t-test. Data that failed to meet parametric assumptions even after transformations were analyzed with the non-parametric Mann-Whitney U-test. Site performance was evaluated against the sediment acceptability criteria outlined in RSET 2009 (Table 1). The criteria for acceptable test performance were an average of ≤ 32 percent mortality of control organisms, and an average of at least 0.48 mg/individual AFDW per surviving control organism.

A 96-hour reference toxicant test using copper chloride (CuCl₂) was conducted concurrently with the tests on the sediments to determine whether the sensitivity of the test organisms was appropriate. This test was run with four replicates, ten animals per replicate, in diluted mineral water at 23°C (for comparison with control charts), with a small amount of clean control sand as a substrate. Tetrafin® slurry (1.25 mL of 4 g/L Tetrafin) was added to each chamber on days 0 and 2.

Table 3 Summary of methods for the 20-day test with *Chironomus dilutus*

Test initiation date	April 13, 2011
Test termination date	May 3, 2011
Test organism source	Aquatic BioSystems; Fort Collins, Colorado
Organism age at test initiation	< 4 hours post-emergence from egg case
Feeding	1.5 mL of 4.0 g/L Tetrafin mixture every day; frequency reduced if excess food observed
Test chamber	475-mL glass beaker
Test sediment volume	100 mL
Dilution water type & volume	175 mL diluted mineral water
Water renewal	Twice daily
Control sediment	Sand mixed with peat (1/2 Tbsp)
Number of organisms/replicate	12
Number of replicates/sample	8 plus water quality surrogates
Test temperature	20± 1°C ¹
Illumination	16 hours light : 8 hours dark
Aeration	None
Reference toxicant	Copper chloride
Acceptability Criteria	≤32% mortality, 0.48 mg/individual AFDW

¹ Test temperature below the EPA recommended 23°C in order to prevent molting, per the RI/FS workplan

3.2 Results

The results of toxicity tests conducted using *C. dilutus* are provided in Table 4. Statistics were conducted using Biostat software, which follows the flowchart recommended by RSET. Comparisons are shown to the control. A detailed summary of results is provided in Appendix A. Summary and detailed statistical analyses for endpoint measurements are provided in Appendix B. Summaries of water quality data are provided in Appendix C. Benchsheets are provided in Appendix D.

Table 4 Results of *Chironomus dilutus* tests. Samples with statistically reduced survival or growth are underlined, and values failing two-hit RSET criteria are shaded gray, while samples failing one-hit RSET criteria are bold.^{1,2}

Sample	Percent Mortality (Mean ± SD)	Mortality Percent Difference From	Ash-Free Dry Weight per Org (mg)	Ash-Free Dry Weight Percent of Control
Control	7.3 ± 5.3	--	0.41 ± 0.06	--
LL-SED1	31.3 ± 33.6	24.0	1.02 ± 0.35	247
LL-SED2	77.1 ± 18.2	69.8	0.85 ± 0.46	206
LL-SED3	<u>30.2 ± 27.8</u>	22.9	1.41 ± 0.29	341
LL-SED4	<u>31.3 ± 19.3</u>	24.0	1.01 ± 0.53	245
MC-SED1	<u>25.0 ± 12.6</u>	17.7	1.19 ± 0.36	287
MC-SED2	<u>20.8 ± 10.9</u>	13.5	1.22 ± 0.22	294
MC-SED3	<u>30.2 ± 10.9</u>	22.9	1.28 ± 0.21	310

¹Criteria for one-hit failure is significant decrease in mortality (p<0.05), **and** mortality greater than 25% of control (RSET 2009), ²Criteria for two-hit failure is significant decrease in mortality (p<0.05), **and** mortality greater than 15% of control (RSET 2009)

3.3 QA/QC

The *C. dilutus* were received in good condition for the April 13, 2011 test. All water quality parameters remained within acceptable ranges throughout the tests. A summary of the water quality parameters is presented in Table 5. The test was run at 20°C, as agreed to in the RI/FS workplan to prevent molting of larvae into pupae (Floyd Snider 2011). The control growth did not meet the acceptability criteria of 0.48 mg/individual AFDW. However, that growth requirement is based at a test temperature of 23°C, and cooler temperatures are known to reduce growth in organisms, therefore, it does not directly apply to tests run at 20°C. In the past, Nautilus has conducted testing at 20°C for other biological testing programs and met control criteria. However, these previous tests were conducted with clean beach sand as the control instead of the silica sand used in this test. The likely difference between the two control sands is the amount of added organic material the washed beach sand would contain over pure silica. Regardless, in the current test all test sediment organisms grew more than the minimum required, and more than the control. This growth in the test sediments may suggest a lack of extra food source in the clean control sand relative to the test sediments. Historically for this laboratory, the controls often exhibit reduced growth compared with non-toxic sites. Based on this information, it would appear that the organisms responded appropriately at the reduced test temperature. There were no other deviations from the protocols. The toxicity test for mortality with this species met the control acceptability criterion (<32 percent mortality).

Table 5 Summary of water quality parameters for *C. dilutus* tests (means and ranges). Required values are shown in brackets.

Analyte	Control	LL-SED1	LL-SED2	LL-SED3	LL-SED4	MC-SED1	MC-SED2	MC-SED3
	Mean (Min-Max)							
Temp. (°C) [20 ± 1°C]	19.7 (19.4-19.9)	19.6 (19.5-19.8)	19.7 (19.4-19.9)	19.7 (19.4-19.9)	19.6 (19.4-19.8)	19.6 (19.3-19.8)	19.6 (19.3-19.8)	19.7 (19.4-19.9)
DO (mg/L) [>2.5 mg/L]	5.7 (4.0-8.1)	5.1 (3.9-7.0)	5.2 (4.1-6.3)	5.8 (4.1-6.8)	5.2 (4.0-6.6)	5.7 (4.0-6.9)	5.9 (4.0-7.3)	6.0 (4.2-7.8)
pH [6-9]	7.12 (6.75-7.48)	7.12 (6.90-7.40)	7.04 (6.89-7.24)	7.14 (6.91-7.35)	7.16 (6.84-7.53)	7.15 (6.93-7.35)	7.20 (6.90-7.40)	7.25 (6.96-7.48)
Cond. (µS/cm) [NA]	163 (127-221)	172 (166-188)	163 (148-179)	165 (156-172)	169 (151-179)	166 (160-176)	165 (134-175)	166 (155-179)
Alkalinity (mg/L CaCO ₃) [<50% variable]	70 (52-80)	78 (72-88)	74 (64-84)	71 (68-76)	82 (76-88)	78 (72-80)	85 (76-96)	86 (76-100)
Hardness (mg/L CaCO ₃) [<50% variable]	86 (68-96)	93 (84-100)	87 (76-104)	95 (88-100)	94 (8-100)	102 (88-120)	97 (88-104)	90 (80-100)
Total Overlying NH ₃ (mg/L) [<50% variable]	1.5 ^a (<1.0-3.2)	1.4 ^a (<1.0-3.0)	4.3 ^a (<1.0-9.5)	1.4 ^a (<1.0-3.1)	1.5 ^a (<1.0-3.4)	1.4 ^a (<1.0-2.9)	1.3 ^a (<1.0-2.6)	1.5 ^a (<1.0-3.3)
Total Overlying Sulfides (mg/L) [NA]	0.011 ^a (<0.010-0.015)	0.010 ^a (<0.010-0.011)	0.015 ^a (<0.010-0.036)	0.017 ^a (<0.010-0.033)	0.017 ^a (<0.010-0.029)	<0.010 (<0.010- <0.010)	<0.010 (<0.010- <0.010)	0.011 ^a (<0.010-0.015)

^a estimated value

The result of the reference toxicant test conducted in conjunction with this testing program is provided in Table 6. Bench sheets and control charts are provided in Appendix E. This test was run with the same batch of organisms used in the testing program. The result of this test fell within the range of mean ± two standard deviations of historical results, indicating that the sensitivity of the test organisms was appropriate.

Table 6 *C. dilutus* reference toxicant test results.

Species	Test date	Toxicant	LC50	Acceptable Range	CV (%)
<i>Chironomus dilutus</i>	May 2, 2011	Cu	714 µg/L	373 - 1100 µg/L	24.7

3.4 Discussion

Mortality in the samples ranged from 20.8 to 77.1 percent, compared with 7.3 percent in the control. All sediment samples except LL-SED1 and MC-SED2 were significantly different from control and were more than 15 percent higher than the control, failing the two-hit criterion for survival. LL-SED2 was more than 25 percent higher than the control, failing the one-hit criterion for survival. Survival in LL-SED1 was not significantly different from the control, due to high variability in the sample. Growth in the samples ranged from 0.85 to 1.41 mg/individual AFDW, compared with 0.41 mg/individual AFDW in the control. As all samples were greater than the control, no statistical analysis was performed, and the samples do not meet the one- or two- hit criteria.

Upon termination of the test it was discovered that 7 of the 8 replicates of LL-SED2 contained *Chaoborus sp.*, known as the “invisible midge”. It is most likely the eggs and larvae of this organism were present in this sediment sample. *Chaoborus* are carnivorous and could have been responsible for the mortality of *C. dilutus* observed in this sample and, therefore, were possibly the reason the sediment from LL-SED2 failed the one-hit criterion and was found to be more toxic than other Lora Lake sediments. A repeat test of sample LL-SED2 is currently being conducted, using sieved sediments to remove any remaining *Chaoborus*. Results from this repeated test will be presented under separate cover.

Analytical testing of the sediment samples showed that total fines in the LL samples ranged from approximately 51 to 85 percent, while the total fines in the MC samples tested ranged from 0.1 to 2.6 percent. Total organic carbon (TOC) also varied considerably between the LL and MC samples, with the LL samples having TOC range from 5.8 to 10.6 percent, while the MC samples had TOC range from 0.1 to 0.5 percent. There was also a difference in percent fines in the control compared to the test sediments in the current study. However, during a reference site investigation conducted by Washington State Department of Ecology (Ecology), 27 different samples were tested with the 20-day *C. dilutus* test. In the Ecology comparison, percent fines of the samples ranged from 0-100 percent, and no correlation was found between percent fines and toxicity (Ecology 2009).

The total ammonia level reached 9.5 mg/L in the test sediments, which was well below the reported 4-day lethal concentration for 50% of test organisms (LC₅₀) range for *C. dilutus* of 82 to 370 mg/L (USEPA 2000). LL-SED2 had the highest ammonia concentrations of the test sediments, however, with the confounding factor of the *Chaoborus sp.*, it is difficult to say whether the ammonia was related to the toxicity. While sulfide toxicity thresholds are not available for this species, they were measured as part of the Ecology reference site study (Nautilus 2008), and samples with porewater sulfide values similar (0.226 to >0.600 mg/L) to the values found in the current study (0.016 to 0.561 mg/L) did not result in measurable effects. Therefore, it is unlikely that ammonia or sulfide levels caused the observed increases in mortality in the test sediments.

4.0 HYALELLA AZTECA TEST

4.1 Methods

H. azteca were exposed to test sediments for 10 days to determine the effects of site sediments on survival. These tests were conducted according to methods presented in USEPA (2000) and ASTM (2000), and are summarized in Table 7.

H. azteca were obtained from Aquatic Indicators (St. Augustine, Florida) and arrived at the laboratory on April 1, 2011. The organisms were transported in insulated boxes in oxygen-saturated water contained in plastic bags with fine screens as a substrate. Upon arrival at the laboratory, water quality parameters were measured and observations of animal condition were made. The organisms were acclimated to test conditions prior to test initiation over a 96-hour time period. During the acclimation period, the animals were observed for any indication of stress or significant mortality and any observations were recorded.

One day prior to test initiation (Day -1), the sediment samples were homogenized, 100-ml sediment was distributed to each of eight labeled test chambers for each of the samples, and 175-ml diluted mineral water (prepared by diluting two parts Perrier® into eight parts deionized water) was added to each container. Control sediment consisted of clean, rinsed silica sand (50/50 mix of #30 and #70) mixed with peat moss (1/2 Tbsp) that was rinsed overnight in diluted mineral water. Eight test chambers were also prepared for the control

sediment. An additional replicate was included for each sediment sample and the control sediment as a sacrificial test chamber for routine water quality measurements.

The test chambers were randomized and the sediments were left to settle overnight. On Day 0, overlying ammonia, sulfide, hardness, alkalinity, dissolved oxygen (DO), pH, conductivity, and temperature were measured. Organisms were carefully separated into groups of 5 amphipods in 30 mL cups containing diluted mineral water. The number of organisms was then recounted and any animals exhibiting signs of stress were replaced. The organisms were then gently added to the test chambers, two cups for each test chamber for a total of 10 organisms per chamber.

Temperature, DO, pH, and conductivity were monitored daily in the water quality replicate for each sample, while overlying ammonia, sulfide, hardness, and alkalinity were monitored on Day 5. Water was renewed twice daily in all chambers. Abnormal conditions or unusual animal behavior, if observed, were also noted daily. Each test chamber was fed 1 ml of Yeast Trout Chow (YTC) daily after the second renewal.

At test termination, subsamples of overlying water were collected for ammonia, hardness, alkalinity, and sulfides analyses, from each water quality replicate. The contents of each test chamber were gently mixed to suspend the sediment and poured through a 0.5-mm Nitex screen. The sediment was rinsed through the screen using dechlorinated tap water. The screen was then placed in diluted mineral water and the number of survivors counted and recorded. The number of surviving amphipods was evaluated statistically by one-tailed t-test, or one-tailed Mann-Whitey U-test, as appropriate, to determine whether the samples exhibited a significant decrease in survival relative to the control ($p < 0.05$). Survival data was arcsin transformed as needed to stabilize the variances and improve normality of the data. Site performance was evaluated against sediment acceptability criteria outlined by the Northwest Regional Sediment Evaluation Framework (RSET 2009), as presented in Table 1.

A 96-hour reference toxicant test using copper chloride (CuCl_2) was conducted concurrently with the sediment tests to determine whether the sensitivity of the test organisms was within the range typically observed. The test was run with four replicates, ten animals per replicate, in diluted mineral water with a square of nitex screen as a substrate.

Table 7 Summary of methods for the 10-day test with *Hyalella azteca*.

Test initiation date	April 5, 2011
Test termination date	April 15, 2011
Test organism source	Aquatic Indicators, St. Augustine, Florida
Organism age at test initiation	8 days
Feeding	1 ml of YTC daily
Test chamber	475-ml glass beaker
Test sediment volume	100 ml
Dilution water type & volume	175 ml diluted mineral water
Water renewal	Twice daily
Control sediment	Sand mixed with peat (1/2 Tbsp)
Number of organisms/replicate	10
Number of replicates/sample	8 plus water quality surrogate
Test temperature	23 ± 1°C
Illumination	16 hours light: 8 hours dark
Aeration	None
Reference toxicant	Copper chloride
Acceptability criterion for control	≥80% survival

4.2 Results

The results of toxicity tests conducted using *H. azteca* are provided in Table 8. Statistics were conducted using Biostat software, which follows the flowchart recommended by RSET. Comparisons are shown to the control. A detailed summary of results is provided in Appendix A. Summary and detailed statistical analyses for endpoint measurements are provided in Appendix B. Summaries of water quality data are provided in Appendix C. Benchsheets are provided in Appendix D.

Table 8 **Results of *Hyaella azteca* tests.**

Sample	Percent Mortality (Mean ± SD)	Mortality Percent Difference from Control
Control	3.8 ± 5.2	--
LL-SED1	5.0 ± 7.6	1.3
LL-SED2	3.8 ± 5.2	0
LL-SED3	3.8 ± 5.2	0
LL-SED4	0.0 ± 0.0	-3.8
MC-SED1	6.3 ± 7.4	2.5
MC-SED2	3.8 ± 5.2	0
MC-SED3	8.8 ± 6.4	5.0

4.3 QA/QC

The *H. azteca* were received in good condition and the toxicity tests with this species met the control acceptability criterion (<20 percent mortality). A summary of the water quality parameters is provided in Table 9. Test temperature at the start of the test was just below the criteria of $23 \pm 1^\circ\text{C}$; however, this was thought to be due to the delay in taking water temperature. When temperatures were still below range on Day 1, the room temperature was increased and all temperatures remained in range from that point forward. This deviation is not expected to have affected the results of the test. All other water quality parameters remained within acceptable ranges throughout the tests. There were no deviations from the protocol.

Results of reference toxicant tests conducted in conjunction with this testing program did not meet control requirements, with only 82.5% survival in the control (90% is the acute requirement) and exhibited no dose-response curve, with almost complete mortality in all concentrations containing copper. The datasheet for this test is included in Appendix E. While we have no conclusive explanation for these results, possible causes include unclean test containers used for reference toxicant testing or improperly calculated test concentrations. This test was run with the same batch of organisms used in the testing program, but the error in testing was not discovered until after all test organisms had been used, so it was not possible to restart the test. As there was no evidence of toxicity in the test sediments and the associated control, and the organisms in the reference toxicant test were clearly sensitive, the sediment toxicity test results should still be considered valid.

Table 9 Summary of water quality parameters for *H. azteca* analyses (means and ranges). Required values are shown in brackets.

Analyte	Control	LL-SED1	LL-SED2	LL-SED3	LL-SED4	MC-SED1	MC-SED2	MC-SED3
Mean (Min-Max)								
Temp. (°C) [23 ± 1°C]	22.5 (21.0-23.1)	22.6 (21.2-23.0)	22.6 (21.2-23.0)	22.6 (21.2-23.1)	22.5 (21.2-23.0)	22.6 (21.3-23.1)	22.6 (21.2-23.1)	22.6 (21.2-23.2)
DO (mg/L) [>2.5 mg/L]	6.7 (5.8-8.4)	5.6 (4.7-7.2)	5.3 (4.8-6.6)	5.4 (4.8-6.8)	5.4 (4.8-6.8)	6.0 (5.3-7.2)	6.4 (5.8-7.8)	6.5 (5.9-7.8)
pH [6-9]	6.87 (6.54-7.06)	7.16 (7.02-7.33)	7.00 (6.90-7.19)	7.13 (7.04-7.32)	7.17 (7.07-7.37)	7.20 (7.11-7.37)	7.28 (7.16-7.47)	7.31 (7.19-7.46)
Cond. (µS/cm) [NA]	148 (122-163)	172 (167-175)	169 (161-179)	169 (164-172)	170 (160-173)	170 (163-174)	171 (162-175)	167 (159-173)
Alkalinity (mg/L CaCO ₃) [<50% variable]	40 (40-40)	72 (72-72)	73 (68-80)	73 (72-76)	77 (76-80)	77 (72-80)	76 (68-80)	77 (68-84)
Hardness (mg/L CaCO ₃) [<50% variable]	65 (65-68)	89 (88-92)	105 (104-108)	85 (76-90)	87 (84-88)	95 (92-96)	97 (92-100)	85 (84-88)
Total Overlying NH ₃ (mg/L) [<50% variable]	1.0 ^a (<1.0- <1.0)	1.0 ^a (1.1- <1.0)	1.67 ^a (<1.0-2.0)	1.07 ^a (<1.0-1.2)	1.17 ^a (<1.0-1.5)	1.0 ^a (<1.0- <1.0)	1.0 ^a (<1.0- <1.0)	1.0 ^a (<1.0- <1.0)
Total Overlying Sulfides (mg/L) [<50% variable]	0.010 ^a (<0.010- 0.010)	0.018 ^a (<0.010- 0.035)	0.024 ^a (<0.010- 0.053)	0.029 ^a (<0.010- 0.068)	0.025 ^a (<0.010- 0.056)	0.010 ^a (<0.010- <0.010)	0.010 ^a (<0.010- 0.013)	0.010 ^a (<0.010- <0.010)

^aestimated value

4.4 Discussion

Mortality in the samples ranged from 0 to 8.8 percent, compared with 3.8 percent in the control. No samples were significantly different from the controls; therefore, none of them meet the one- or two- hit criteria for survival.

5.0 MICROTOX® TEST

5.1 Methods

The luminescent marine bacterium *Vibrio fischeri* was used as the test organism for the Microtox test. The bacteria were exposed to porewater extracted from sediment samples and light readings were measured after 5 and 15 minutes of exposure. Test equipment included the Microtox Model 500 Analyzer, which measures light output and is equipped with a 15°C chamber to maintain test temperature in the samples and a 4°C chamber to keep the rehydrated bacteria chilled.

Vials of freeze-dried bacteria (Microtox® Acute Reagent Lot #s 10K1032, expiration dates 10/2012) were obtained from Strategic Diagnostics, Inc. and stored at -20°C until use. On the day of the test, a vial was rehydrated with 1.0 ml of Microtox Reconstitution Solution, mixed thoroughly, and allowed to equilibrate for 30 minutes at 4°C. The bacteria were used within 2 hours of rehydration.

The tests were conducted in accordance with Ecology (2008) test protocol; these methods are summarized in Table 10. Approximately 50 ml of porewater was extracted from each sample by centrifuging for 30 minutes at 4500 G. Each porewater extract was adjusted to a salinity of 20 parts per thousand (ppt) with Crystal Sea Marine Mix artificial seasalt. The DO ranged from 7.7 to 7.9 mg/L in the adjusted samples. Since the DO in each sample was between 50 and 100 percent saturation (5.0 to 10.2 mg/L), the samples did not require aeration. The pH was adjusted to 7.8 to 8.2 using NaOH or HCl. None of the porewater samples were diluted below 90 percent. The control was deionized water adjusted to 20 ppt with artificial seasalt. Each porewater was tested within 3 hours of extraction.

Tests were conducted using five replicates. Disposable glass cuvettes were placed in the Microtox test wells and 1 ml of salinity-adjusted porewater was added. The rehydrated bacteria (reagent) were thoroughly mixed and 10 µl was added to each test cuvette, with mixing after each addition. After an initial incubation period of 5 minutes, the control cuvette was placed in the read chamber of the Microtox Analyzer to set the instrument. Initial light readings (I_0) were then taken by placing each cuvette in the read chamber of the Microtox Analyzer and measurements were recorded on a data sheet. Light output was measured at 5 minutes (I_5) and 15 minutes (I_{15}) of exposure after the initial light reading (I_0).

Test acceptability criteria were final mean control light output greater than or equal to 72 percent of initial control mean output, and test mean output not greater than 110 percent of control mean output. The data were evaluated statistically by conducting one-tailed t-tests or Mann-Whitney U-tests on the change in output over time for test sediment porewaters compared to the control porewater (where light output was lower than the control). Sediment performance was evaluated against sediment acceptability criteria outlined by the Northwest Regional Sediment Evaluation Framework (RSET 2009), as presented in Table 1.

A reference toxicant test using phenol was conducted in conjunction with the sediment tests to ensure that the sensitivity of the test was within the acceptable range of historical values determined in this laboratory.

Table 10 Summary of methods for the Microtox test.

Test dates	March 31, 2011
Test organism source	Strategic Diagnostics
Batch number and expiration date	Lot#10K1032, Expiration 10/2012
Control	Saltwater (20 ppt) prepared with Crystal Sea artificial seasalt
Sample preparation	Centrifugation at 4500 G for 30 minutes; salinity adjustment to 20 ppt using Crystal Sea salt; pH adjustment to 7.8-8.2 ppt; DO 5.0 to 10.2 mg/L
Test chamber	Glass cuvette
Test volume	1 mL
Volume of inoculum/replicate	10 µL
Number of replicates/sample	5
Test temperature	15 ± 1°C
Aeration	None
Reference toxicant	Phenol
Acceptability criteria	Final control light output ≥72% initial; test output ≤110% control

5.2 Results

The results of toxicity tests conducted using Microtox are provided in Table 11. Statistics were conducted using Biostat software, which follows the flowchart recommended by RSET. Comparisons are shown to the control. A detailed summary of results is provided in Appendix A. Summary and detailed statistical analyses for endpoint measurements are provided in Appendix B. Summaries of water quality data are provided in Appendix C. Benchsheets are provided in Appendix D.

Table 11 Results of Microtox tests.

Sample	5 minute reading		15 minute reading	
	Mean % of initial light output	Significantly different relative to the control	Mean % of initial light output	Significantly different relative to the control
<u>Test 1: LL SED</u>				
Control	93 ± 2	--	83 ± 3	--
LL-SED1	92 ± 3	No	83 ± 4	No
LL-SED2	94 ± 1	No	88 ± 2	No
LL-SED3	94 ± 2	No	82 ± 3	No
LL_SED4	95 ± 3	No	83 ± 4	No
<u>Test 2: MC SED</u>				
Control	94 ± 2	--	89 ± 5	--
MC-SED1	94 ± 3	No	87 ± 4	No
MC-SED2	98 ± 1	No	90 ± 2	No
MC-SED3	96 ± 3	No	88 ± 2	No

5.3 QA/QC

A summary of the water quality parameters for the Microtox tests is provided in Table 12. The Microtox tests met control acceptance criteria and there were no deviations from protocol.

Table 12 Summary of sites water quality parameters for Microtox analyses

Analyte	Mean (st.dev)	Minimum	Maximum	Number of Readings	Met Requirements
Initial Salinity (ppt)	0.01 (0.04)	0.0	0.1	7	N/A
Final Salinity (ppt)	20.0 (0.7)	19.2	20.8	7	Y
Initial DO (mg/L)	7.8 (0.1)	7.7	7.9	7	N/A
Final DO (mg/L)	7.8 (0.1)	7.7	7.9	7	Y
Initial pH	7.9 (0.3)	7.4	8.3	7	N/A
Final pH	8.0 (0.1)	7.9	8.2	7	Y
Final Concentration (%)	99.9 (0.0)	99.8	100	7	Y
Total NH3 (mg/L)	5.1 (4.7) ¹	<1.0	11.9	7	N/A
Total Sulfides (mg/L)	0.24 (0.22)	0.016	0.561	7	N/A
Turbidity (NTU)	44.7 (34.3)	5.5	95.9	7	N/A

¹estimated value

Results of the reference toxicant test conducted in conjunction with this testing program are provided in Table 13. Bench sheets and control charts are provided in Appendix E. The test was run with the same batch of organisms used in the testing program. The results of this test fell within the range of mean ± two standard deviations of historical results, indicating that the sensitivity of the test organisms was appropriate.

Table 13 Microtox reference toxicant test results.

Species	Test date	Toxicant	EC50	Acceptable Range (mean \pm 2 S.D.)	CV (%)
Microtox	March 31, 2011	Phenol	5 min: 40.8 mg/L 15 min: 82.6 mg/L	5 min: 25.7 – 55.2 15 min: 31.3 – 93.4	18.2 24.9

5.4 Discussion

Change in light output in the samples at 15 minutes ranged from 82 to 90 percent, compared with 83 and 89 percent in the controls. No samples were significantly different from the controls; therefore, none of them meet the one-or two- hit criteria for luminescence.

6.0 CONCLUSIONS

Only sample LL-SED2 failed the one-hit criterion for *C. dilutus* survival (RSET 2009). The mortality in LL-SED2 is currently being confirmed, as it may have been caused by the *Chaoborus* in the sample and not by the chemistry of the sample. All samples, except LL-SED1 and MC-SED2, failed the two-hit criterion for *C. dilutus* survival (RSET 2009); as these samples did not have a second hit in *C. dilutus* growth, the *H. azteca* or Microtox tests, these samples are considered unlikely to cause adverse impacts to ecological receptors. LL-SED2 failed the one-hit criterion for *C. dilutus* survival, but that test is currently being repeated due to concerns over native organisms present in the sample which may have affected the outcome.

Table 14 One-hit/Two-hit criteria summary results table

Site	<i>C. dilutus</i> Survival	<i>C. dilutus</i> Growth	<i>H. azteca</i> Survival	Microtox Luminescence
LL-SED1	None	None	None	None
LL-SED2	One-hit	None	None	None
LL-SED3	Two-hit	None	None	None
LL-SED4	Two-hit	None	None	None
MC-SED1	Two-hit	None	None	None
MC-SED2	None	None	None	None
MC-SED3	Two-hit	None	None	None

7.0 REFERENCES

- American Society of Testing and Materials (ASTM). 2000. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Designation E 1706-00.
- Floyd Snider. 2011. Port of Seattle, Lora Lake Parcel, Remedial Investigation/Feasibility Study Work Plan
- Nautilus Environmental. 2008. Evaluation of Candidate Freshwater Sediment Reference Sites-Toxicological Results. Final Report.
- Regional Sediment Evaluation Team (RSET). 2009. Sediment Evaluation Framework for the Pacific Northwest. May 2009.
- U.S. Environmental Protection Agency (USEPA). 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.
- Washington Department of Ecology. 2008. Sediment Sampling and Analysis Plan Appendix: Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards Publication No. 03-09-043. Revised February 2008.
- Washington Department of Ecology. 2009. Baseline Characterization of Nine Proposed Freshwater Sediment Reference Sites, 2008. Publication Number 09-03-032.

APPENDIX A - Results Summaries

**Appendix A-1. 20-Day Solid Phase *Chironomus dilutus* Survival & Growth
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: April 13, 2011

^aNumber of pupae and flies

^bAFDW = Ash-Free Dry Weight. Weights are for larvae only, not pupated animals

^cOne-tailed t-test. Survival data arcsine square-root transformed prior to analysis. Growth data either square root or log transformed prior to analysis Alpha = 0.05

Shaded values fail RSET one-hit criteria (Test sediment mortality - Control sediment mortality >25% and significantly different; Test sediment Growth/Control sediment Growth <0.7 and significantly different)

Replicates colored blue had *Chaoborus* in the samples

Site	Replicate	Rnd. No.	# Alive	# Pupated ^a	% Mortality	Mean % Mortality	St Dev	Total org AFDW (mg) ^b	AFDW per Org (mg)	Mean AFDW per Org (mg)	St Dev	Significant Decrease Compared to Control ^c	
												Survival	Growth
Control	1	153	11	0	8.3			3.68	0.33				
	2	130	12	0	0.0			4.67	0.39				
	3	150	11	0	8.3			5.55	0.50				
	4	144	12	0	0.0	7.3	5.3	4.72	0.39	0.41	0.06	--	--
	5	138	11	0	8.3			3.81	0.35				
	6	148	11	0	8.3			4.45	0.40				
	7	163	11	0	8.3			5.16	0.47				
	8	116	10	0	16.7			4.65	0.47				
LL- SED 1	1	139	5	0	58.3			4.25	0.85				
	2	122	2	0	83.3			2.94	1.47				
	3	158	9	0	25.0			8.20	0.91				
	4	107	4	0	66.7	31.3	33.6	6.62	1.66	1.02	0.35	No	No
	5	108	12	0	0.0			11.88	0.99				
	6	119	12	0	0.0			9.57	0.80				
	7	140	12	0	0.0			8.68	0.72				
	8	136	10	0	16.7			7.56	0.76				
LL- SED 2	1	101	2	0	83.3			1.32	0.66				
	2	141	1	0	91.7			0.39	0.39				
	3	128	1	0	91.7			0.23	0.23				
	4	154	7	0	41.7	77.1	18.2	3.87	0.55	0.85	0.46	Yes	No
	5	161	5	0	58.3			5.37	1.07				
	6	155	3	0	75.0			3.08	1.03				
	7	146	1	0	91.7			1.39	1.39				
	8	131	2	0	83.3			2.97	1.49				
LL- SED 3	1	112	8	0	33.3			13.30	1.66				
	2	117	4	0	66.7			7.47	1.87				
	3	115	11	0	8.3			15.27	1.39				
	4	113	11	0	8.3	30.2	27.8	13.13	1.19	1.41	0.29	Yes	No
	5	156	4	0	66.7			5.86	1.47				
	6	124	11	0	8.3			12.62	1.15				
	7	157	12	0	0.0			11.74	0.98				
	8	111	6	0	50.0			9.49	1.58				

**Appendix A-1. 20-Day Solid Phase *Chironomus dilutus* Survival & Growth
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: April 13, 2011

^aNumber of pupae and flies

^bAFDW = Ash-Free Dry Weight. Weights are for larvae only, not pupated animals

^cOne-tailed t-test. Survival data arcsine square-root transformed prior to analysis. Growth data either square root or log transformed prior to analysis Alpha = 0.05

Shaded values fail RSET one-hit criteria (Test sediment mortality - Control sediment mortality >25% and significantly different; Test sediment Growth/Control sediment Growth <0.7 and significantly different)

Replicates colored blue had Chaoborus in the samples

Site	Replicate	Rnd. No.	# Alive	# Pupated ^a	% Mortality	Mean % Mortality	St Dev	Total org AFDW (mg) ^b	AFDW per Org (mg)	Mean AFDW per Org (mg)	St Dev	Significant Decrease Compared to Control ^c	
												Survival	Growth
LL- SED 4	1	162	9	0	25.0			4.22	0.47				
	2	135	8	0	33.3			3.46	0.43				
	3	126	7	0	41.7			7.78	1.11				
	4	102	5	0	58.3	31.3	19.3	10.59	2.12	1.01	0.53	Yes	No
	5	118	12	0	0.0			10.27	0.86				
	6	132	7	0	41.7			8.42	1.20				
	7	110	11	0	8.3			10.59	0.96				
	8	123	7	0	41.7			6.53	0.93				
MC- SED 1	1	147	7	0	41.7			8.96	1.28				
	2	125	8	0	33.3			12.38	1.55				
	3	160	8	0	33.3			7.84	0.98				
	4	137	9	0	25.0	25.0	12.6	12.75	1.42	1.19	0.36	Yes	No
	5	145	11	0	8.3			10.41	0.95				
	6	159	10	0	16.7			10.13	1.01				
	7	152	11	0	8.3			6.71	0.61				
	8	104	8	0	33.3			13.59	1.70				
MC- SED 2	1	121	9	0	25.0			12.33	1.37				
	2	164	9	0	25.0			9.19	1.02				
	3	151	8	0	33.3			8.87	1.11				
	4	103	8	0	33.3	20.8	10.9	11.14	1.39	1.22	0.22	Yes	No
	5	114	10	0	16.7			15.86	1.59				
	6	127	10	0	16.7			10.84	1.08				
	7	129	10	0	16.7			9.44	0.94				
	8	109	12	0	0.0			14.74	1.23				
MC- SED 3	9	120	8	0	33.3			10.60	1.33				
	10	149	10	0	16.7			10.75	1.08				
	11	143	9	0	25.0			8.98	1.00				
	12	142	9	0	25.0	30.2	10.9	10.95	1.22	1.28	0.21	Yes	No
	13	133	6	0	50.0			9.83	1.64				
	14	134	7	0	41.7			10.39	1.48				
	15	105	9	0	25.0			12.04	1.34				
	16	106	9	0	25.0			10.69	1.19				

**Appendix Table A-2. *Hyalella azteca* 10-day Survival
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: April 5, 2011

Site	Rep	# Alive	% Mortality	Mean % Mortality	St. Dev.	Significant Decrease Compared to Control ^a
Control	1	10	0	3.8	5.2	--
	2	9	10			
	3	10	0			
	4	10	0			
	5	10	0			
	6	9	10			
	7	10	0			
	8	9	10			
LL-SED 1	1	9	10	5.0	7.6	
	2	10	0			
	3	10	0			
	4	10	0			
	5	9	10			
	6	10	0			
	7	10	0			
	8	8	20			
LL-SED 2	1	10	0	3.8	5.2	
	2	10	0			
	3	10	0			
	4	9	10			
	5	9	10			
	6	9	10			
	7	10	0			
	8	10	0			
LL-SED 3	1	10	0	3.8	5.2	
	2	9	10			
	3	10	0			
	4	10	0			
	5	10	0			
	6	9	10			
	7	10	0			
	8	9	10			
LL-SED 4	1	10	0	0.0	0.0	
	2	10	0			
	3	10	0			
	4	10	0			
	5	10	0			
	6	10	0			
	7	10	0			
	8	10	0			
MC-SED 1	1	10	0	6.3	7.4	
	2	10	0			
	3	9	10			
	4	9	10			
	5	10	0			
	6	10	0			
	7	9	10			
	8	8	20			
MC-SED 2	1	10	0	3.8	5.2	
	2	10	0			
	3	9	10			
	4	9	10			
	5	10	0			
	6	10	0			
	7	10	0			
	8	9	10			
MC-SED 3	1	9	10	8.8	6.4	
	2	9	10			
	3	10	0			
	4	9	10			
	5	8	20			
	6	9	10			
	7	10	0			
	8	9	10			

**Appendix Table A-3. Microtox 100 Percent Sediment Porewater Test
Port of Seattle Lora Lake RIFS Sediment Characterization
Client Floyd-Snider
Test Date: 3/31/2011**

Site	Light Reading								T _(mean) / C _(mean)	Quality Control Steps	
	Reading	Replicate					Mean	St.Dev.		F _{c(mean)} /I _{c(mean)}	Evaluation of initial light output in site sediments (0)T _(mean) /I _{(0)C_(mean)}
		1	2	3	4	5					
CON	I ₍₀₎	99	105	106	112	110	106				
	I ₍₅₎	93	99	97	106	100	99		0.93		
	I ₍₁₅₎	82	91	87	94	87	88		0.83		
	C ₍₅₎	0.94	0.94	0.92	0.95	0.91	0.93	0.02			
	C ₍₁₅₎	0.83	0.87	0.82	0.84	0.79	0.83	0.03			
LL Sed 1	I ₍₀₎	91	83	85	86	70	83				0.78
	I ₍₅₎	83	78	81	79	62	77				
	I ₍₁₅₎	73	69	75	68	58	69				
	T ₍₅₎	0.91	0.94	0.95	0.92	0.89	0.92	0.03	0.99		
	T ₍₁₅₎	0.80	0.83	0.88	0.79	0.83	0.83	0.04	1.00		
LL Sed 2	I ₍₀₎	66	61	62	70	65	65				0.61
	I ₍₅₎	63	57	59	65	62	61				
	I ₍₁₅₎	59	54	55	60	56	57				
	T ₍₅₎	0.95	0.93	0.95	0.93	0.95	0.94	0.01	1.02		
	T ₍₁₅₎	0.89	0.89	0.89	0.86	0.86	0.88	0.02	1.06		
LL Sed 3	I ₍₀₎	80	77	76	79	77	78				0.73
	I ₍₅₎	75	75	69	73	72	73				
	I ₍₁₅₎	68	60	61	66	65	64				
	T ₍₅₎	0.94	0.97	0.91	0.92	0.94	0.94	0.02	1.01		
	T ₍₁₅₎	0.85	0.78	0.80	0.84	0.84	0.82	0.03	0.99		
LL Sed 4	I ₍₀₎	67	76	70	68	67	70				0.65
	I ₍₅₎	65	70	65	68	63	66				
	I ₍₁₅₎	59	60	56	58	56	58				
	T ₍₅₎	0.97	0.92	0.93	1.00	0.94	0.95	0.03	1.02		
	T ₍₁₅₎	0.88	0.79	0.80	0.85	0.84	0.83	0.04	1.00		

I₍₀₎ is the light reading after the initial five minute incubation period

I₍₅₎ is the light reading five minutes after I₍₀₎

I₍₁₅₎ is the light reading fifteen minutes after I₍₀₎

C_(t), R_(t), and T_(t) are the changes in light readings from the initial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

I₍₅₎:F_{c(mean)}/I_{c(mean)}: **93% YES**

I₍₁₅₎:F_{c(mean)}/I_{c(mean)}: **83% YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable (use reference sediment for statistical analysis if available).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

LL Sed 1 I_{T(mean)}/I_{C(mean)}: **78% NO**

LL Sed 2 I_{T(mean)}/I_{C(mean)}: **61% NO**

LL Sed 3 I_{T(mean)}/I_{C(mean)}: **73% NO**

LL Sed 4 I_{T(mean)}/I_{C(mean)}: **65% NO**

INVALID: If the test sediment is greater than 110%, the results in uninterpretable

YES: If test sediment is reference, reference is acceptable

**Appendix Table A-3. Microtox 100 Percent Sediment Porewater Test
Port of Seattle Lora Lake RIFS Sediment Characterization
Client Floyd-Snider
Test Date: 3/31/2011**

Site	Light Reading								T _(mean) / C _(mean)	Quality Control Steps	
	Reading	Replicate					Mean	St.Dev.		F _{c(mean)} /I _{c(mean)}	Evaluation of initial light output in site sediments (0)T _(mean) /I _{(0)C_(mean)}
		1	2	3	4	5					
CON	I ₍₀₎	94	98	96	99	94	96				
	I ₍₅₎	90	91	89	90	91	90			0.94	
	I ₍₁₅₎	91	89	84	84	82	86			0.89	
	C ₍₅₎	0.96	0.93	0.93	0.91	0.97	0.94	0.02			
	C ₍₁₅₎	0.97	0.91	0.88	0.85	0.87	0.89	0.05			
MC Sed 1	I ₍₀₎	100	94	89	97	94	95				0.99
	I ₍₅₎	89	91	85	90	91	89				
	I ₍₁₅₎	82	86	79	83	81	82				
	T ₍₅₎	0.89	0.97	0.96	0.93	0.97	0.94	0.03	1.00		
	T ₍₁₅₎	0.82	0.91	0.89	0.86	0.86	0.87	0.04	0.97		
MC Sed 2	I ₍₀₎	88	85	86	85	86	86				0.89
	I ₍₅₎	86	83	83	82	86	84				
	I ₍₁₅₎	79	76	77	76	81	78				
	T ₍₅₎	0.98	0.98	0.97	0.96	1.00	0.98	0.01	1.04		
	T ₍₁₅₎	0.90	0.89	0.90	0.89	0.94	0.90	0.02	1.01		
MC Sed 3	I ₍₀₎	89	90	90	90	85	89				0.92
	I ₍₅₎	84	85	87	90	79	85				
	I ₍₁₅₎	77	80	77	79	76	78				
	T ₍₅₎	0.94	0.94	0.97	1.00	0.93	0.96	0.03	1.02		
	T ₍₁₅₎	0.87	0.89	0.86	0.88	0.89	0.88	0.02	0.98		
	I ₍₀₎						#DIV/0!				#DIV/0!
	I ₍₅₎						#DIV/0!				
	I ₍₁₅₎						#DIV/0!				
	T ₍₅₎	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
	T ₍₁₅₎	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

I₍₀₎ is the light reading after the initial five minute incubation period

I₍₅₎ is the light reading five minutes after I₍₀₎

I₍₁₅₎ is the light reading fifteen minutes after I₍₀₎

C_(t), R_(t), and T_(t) are the changes in light readings from the initial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

I₍₅₎:F_{c(mean)}/I_{c(mean)}: **94% YES**

I₍₁₅₎:F_{c(mean)}/I_{c(mean)}: **89% YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable (use reference sediment for statistical analysis if available).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

MC Sed 1 I_{T(mean)}/I_{C(mean)}: **99% YES**

MC Sed 2 I_{T(mean)}/I_{C(mean)}: **89% YES**

MC Sed 3 I_{T(mean)}/I_{C(mean)}: **92% YES**

0 I_{T(mean)}/I_{C(mean)}: **#DIV/0! #DIV/0!**

INVALID: If the test sediment is greater than 110%, the results in uninterpretable

YES: If test sediment is reference, reference is acceptable

APPENDIX B - Statistical Analyses

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: LL-Sed2
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 77.088
 SD: 18.234
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 9.073 SS: 1563.927 K: 8 b: 36.139 Alpha Level: 0.05 Calculated Value: 0.8351 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 9.518 Test Residual SD: 6.647 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.9531 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 64 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	83.3	12.5	8.3	5	3.189	3.264	1.5		-22.468
2	91.7	15	0	1.5	10.565	13.48	1.5		-13.48
3	91.7	15	8.3	5	10.565	3.264	5		-13.48
4	41.7	9	0	1.5	22.468	13.48	5		-12.913
5	58.3	10	8.3	5	12.913	3.264	5		-2.691
6	75	11	8.3	5	2.691	3.264	5		3.189
7	91.7	15	8.3	5	10.565	3.264	5		3.189
8	83.3	12.5	16.7	8	3.189	10.64	8		3.264
9							9		3.264
10							10		3.264
11							11		3.264
12							12.5		3.264
13							12.5		10.565
14							15		10.565
15							15		10.565
16							15		10.64

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: LL-Sed4
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 31.25
 SD: 19.294
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 11.046 SS: 2318.443 K: 8 b: 44.941 Alpha Level: 0.05 Calculated Value: 0.8711 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 11.98 Test Residual SD: 9.565 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 1.3803 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 53.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	25	11	8.3	6.5	1.554	3.264	2		-31.554
2	33.3	12	0	2	3.69	13.48	2		-14.81
3	41.7	14	8.3	6.5	8.668	3.264	2		-13.48
4	58.3	16	0	2	18.224	13.48	6.5		-13.48
5	0	2	8.3	6.5	31.554	3.264	6.5		-1.554
6	41.7	14	8.3	6.5	8.668	3.264	6.5		3.264
7	8.3	6.5	8.3	6.5	14.81	3.264	6.5		3.264
8	41.7	14	16.7	10	8.668	10.64	6.5		3.264
9							6.5		3.264
10							10		3.264
11							11		3.69
12							12		8.668
13							14		8.668
14							14		8.668
15							14		10.64
16							16		18.224

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: MC-Sed1
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 24.988
 SD: 12.605
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 7.601 SS: 1097.734 K: 8 b: 30.434 Alpha Level: 0.05 Calculated Value: 0.8438 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 7.494 Test Residual SD: 4.114 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.3344 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 56.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	41.7	16	8.3	6	11.027	3.264	1.5		-13.48
2	33.3	14	0	1.5	6.049	13.48	1.5		-13.48
3	33.3	14	8.3	6	6.049	3.264	6		-12.451
4	25	12	0	1.5	0.805	13.48	6		-12.451
5	8.3	6	8.3	6	12.451	3.264	6		-5.075
6	16.7	10.5	8.3	6	5.075	3.264	6		0.805
7	8.3	6	8.3	6	12.451	3.264	6		3.264
8	33.3	14	16.7	10.5	6.049	10.64	6		3.264
9							6		3.264
10							10.5		3.264
11							10.5		3.264
12							12		6.049
13							14		6.049
14							14		6.049
15							14		10.64
16							16		11.027

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: MC-Sed2
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 20.838
 SD: 10.895
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 8.633 SS: 1416.094 K: 8 b: 34.222 Alpha Level: 0.05 Calculated Value: 0.827 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 7.266 Test Residual SD: 8.14 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.1567 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 55.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	25	13.5	8.3	6	4.644	3.264	2		-25.356
2	25	13.5	0	2	4.644	13.48	2		-13.48
3	33.3	15.5	8.3	6	9.888	3.264	2		-13.48
4	33.3	15.5	0	2	9.888	13.48	6		-1.236
5	16.7	10.5	8.3	6	1.236	3.264	6		-1.236
6	16.7	10.5	8.3	6	1.236	3.264	6		-1.236
7	16.7	10.5	8.3	6	1.236	3.264	6		3.264
8	0	2	16.7	10.5	25.356	10.64	6		3.264
9							10.5		3.264
10							10.5		3.264
11							10.5		3.264
12							10.5		4.644
13							13.5		4.644
14							13.5		9.888
15							15.5		9.888
16							15.5		10.64

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: LL-Sed-1
 Alias: Hyalella Mortality
 Replicates: 8
 Mean: 5
 SD: 7.559
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Hyalella Mortality
 Replicates: 8
 Mean: 3.75
 SD: 5.175
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 8.943 SS: 1519.604 K: 8 b: 32.924 Alpha Level: 0.05 Calculated Value: 0.7133 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 9.912 Test Residual SD: 3.712 Ref. Residual Mean: 8.641 Ref. Residual SD: 2.385 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.8143 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \geq x2$ Alternate: $x1 < x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 30.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: Yes Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	10	13	0	5.5	10.506	6.913	5.5		-7.929
2	0	5.5	10	13	7.929	11.522	5.5		-7.929
3	0	5.5	0	5.5	7.929	6.913	5.5		-7.929
4	0	5.5	0	5.5	7.929	6.913	5.5		-7.929
5	10	13	0	5.5	10.506	6.913	5.5		-7.929
6	0	5.5	10	13	7.929	11.522	5.5		-6.913
7	0	5.5	0	5.5	7.929	6.913	5.5		-6.913
8	20	16	10	13	18.636	11.522	5.5		-6.913
9							5.5		-6.913
10							5.5		-6.913
11							13		10.506
12							13		10.506
13							13		11.522
14							13		11.522
15							13		11.522
16							16		18.636

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: MC-Sed1
 Alias: Amphipod Mortality
 Replicates: 8
 Mean: 6.25
 SD: 7.44
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Amphipod Mortality
 Replicates: 8
 Mean: 3.75
 SD: 5.175
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 8.958 SS: 1524.616 K: 8 b: 34.894 Alpha Level: 0.05 Calculated Value: 0.7986 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 10.234 Test Residual SD: 2.661 Ref. Residual Mean: 8.641 Ref. Residual SD: 2.385 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 1.2603 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 37.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: Yes Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0	5	0	5	10.234	6.913	5		-10.234
2	0	5	10	12.5	10.234	11.522	5		-10.234
3	10	12.5	0	5	8.201	6.913	5		-10.234
4	10	12.5	0	5	8.201	6.913	5		-10.234
5	0	5	0	5	10.234	6.913	5		-6.913
6	0	5	10	12.5	10.234	11.522	5		-6.913
7	10	12.5	0	5	8.201	6.913	5		-6.913
8	20	16	10	12.5	16.331	11.522	5		-6.913
9							5		-6.913
10							12.5		8.201
11							12.5		8.201
12							12.5		8.201
13							12.5		11.522
14							12.5		11.522
15							12.5		11.522
16							16		16.331

APPENDIX C - Water Quality Summaries

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

Control								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃ (mg/l)	Total Sulfides (mg/l)
0	19.6	8.1	6.75	131	52	68	<1.0	0.015
1	19.9	7.0	6.84	127	---	---	---	---
2	19.7	6.8	7.09	145	---	---	---	---
3	19.6	6.5	7.12	137	---	---	---	---
4	19.5	6.4	7.11	139	---	---	---	---
5	19.6	6.3	7.11	140	64	92	<1.0	<0.010
6	19.7	7.2	7.38	165	---	---	---	---
7	19.8	5.7	7.24	173	---	---	---	---
8	19.8	5.3	7.30	175	---	---	---	---
9	19.6	5.4	7.10	178	---	---	---	---
10	19.7	5.9	7.28	174	72	88	1.2	<0.010
11	19.4	6.0	7.48	171	---	---	---	---
12	19.7	6.7	7.44	170	---	---	---	---
13	19.8	5.7	7.10	175	---	---	---	---
14	19.9	4.8	7.09	171	---	---	---	---
15	19.8	4.6	7.07	165	80	96	<1.0	<0.010
16	19.7	4.3	7.06	166	---	---	---	---
17	19.8	4.3	7.10	166	---	---	---	---
18	19.7	4.4	7.07	168	---	---	---	---
19	19.8	4.0	6.88	221	---	---	---	---
20	19.9	4.0	6.93	176	80	88	3.2	<0.010
Mean	19.7	5.7	7.12	163	70	86	nc	nc
Min	19.4	4.0	6.75	127	52	68	<1.0	<0.010
Max	19.9	8.1	7.48	221	80	96	3.2	0.015

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃ (mg/l)	Total Sulfides (mg/l)
0	19.5	7.0	7.27	169	76	96	<1.0	0.011
1	19.7	5.7	7.05	171	---	---	---	---
2	19.6	5.7	7.08	173	---	---	---	---
3	19.6	5.8	7.10	173	---	---	---	---
4	19.5	5.7	7.12	177	---	---	---	---
5	19.6	5.8	7.11	174	76	84	<1.0	<0.010
6	19.7	5.8	7.16	166	---	---	---	---
7	19.8	3.9	7.03	171	---	---	---	---
8	19.7	5.0	7.15	172	---	---	---	---
9	19.6	5.0	7.00	173	---	---	---	---
10	19.6	5.0	7.21	169	72	88	<1.0	<0.010
11	19.5	5.4	7.34	169	---	---	---	---
12	19.7	5.4	7.40	169	---	---	---	---
13	19.7	5.6	7.07	175	---	---	---	---
14	19.7	4.6	7.30	172	---	---	---	---
15	19.7	5.0	7.06	172	76	96	<1.0	<0.010
16	19.6	4.5	7.10	171	---	---	---	---
17	19.8	4.3	7.08	172	---	---	---	---
18	19.7	4.2	7.10	172	---	---	---	---
19	19.6	4.2	6.99	188	---	---	---	---
20	19.6	4.0	6.90	173	88	100	3.0	<0.010
Mean	19.6	5.1	7.12	172	78	93	nc	nc
Min	19.5	3.9	6.90	166	72	84	<1.0	<0.010
Max	19.8	7.0	7.40	188	88	100	3.0	0.011

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃ (mg/l)	Total Sulfides (mg/l)
0	19.7	6.1	7.12	174	84	104	6.1	0.036
1	19.9	4.6	6.89	179	---	---	---	---
2	19.7	4.9	6.96	173	---	---	---	---
3	19.6	4.8	7.01	174	---	---	---	---
4	19.5	4.9	7.02	175	---	---	---	---
5	19.6	4.9	6.96	174	72	88	9.5	<0.010
6	19.7	5.6	7.05	166	---	---	---	---
7	19.9	5.1	7.09	168	---	---	---	---
8	19.7	5.2	7.09	167	---	---	---	---
9	19.5	5.6	7.02	166	---	---	---	---
10	19.6	5.3	7.12	161	64	76	2.1	<0.010
11	19.4	5.9	7.24	161	---	---	---	---
12	19.8	5.8	7.23	159	---	---	---	---
13	19.6	6.3	7.05	160	---	---	---	---
14	19.6	5.8	7.11	155	---	---	---	---
15	19.7	5.6	7.06	150	76	76	<1.0	0.010
16	19.6	5.0	6.95	148	---	---	---	---
17	19.8	4.8	6.99	149	---	---	---	---
18	19.7	4.6	7.00	150	---	---	---	---
19	19.7	4.4	6.97	158	---	---	---	---
20	19.7	4.1	6.90	156	76	92	2.7	<0.010
Mean	19.7	5.2	7.04	163	74	87	nc	nc
Min	19.4	4.1	6.89	148	64	76	<1.0	<0.010
Max	19.9	6.3	7.24	179	84	104	9.5	0.036

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Sulfides (mg/l)
0	19.6	6.8	7.29	165	72	100	<1.0	0.020
1	19.9	6.3	7.10	166	---	---	---	---
2	19.7	6.3	7.12	166	---	---	---	---
3	19.6	6.2	7.11	167	---	---	---	---
4	19.6	6.3	7.12	167	---	---	---	---
5	19.6	6.2	7.09	166	72	96	<1.0	<0.010
6	19.8	6.3	7.20	166	---	---	---	---
7	19.8	5.8	7.21	169	---	---	---	---
8	19.8	6.0	7.20	171	---	---	---	---
9	19.7	5.6	7.12	172	---	---	---	---
10	19.5	6.1	7.29	166	68	88	<1.0	<0.010
11	19.4	6.0	7.35	165	---	---	---	---
12	19.6	6.3	7.31	164	---	---	---	---
13	19.6	6.6	7.09	166	---	---	---	---
14	19.7	6.0	7.22	163	---	---	---	---
15	19.6	6.1	7.13	158	68	100	<1.0	0.033
16	19.6	4.7	6.97	156	---	---	---	---
17	19.7	4.8	7.06	159	---	---	---	---
18	19.8	4.8	7.00	156	---	---	---	---
19	19.6	4.2	6.91	166	---	---	---	---
20	19.6	4.1	6.95	161	80	96	3.1	<0.010
Mean	19.7	5.8	7.14	165	72	96	nc	nc
Min	19.4	4.1	6.91	156	68	88	<1.0	<0.010
Max	19.9	6.8	7.35	172	80	100	3.1	0.033

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-4								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.5	6.6	7.35	165	76	96	<1.0	0.029
1	19.8	5.3	7.08	162	---	---	---	---
2	19.7	5.7	7.12	169	---	---	---	---
3	19.6	5.4	7.14	168	---	---	---	---
4	19.7	5.5	7.13	169	---	---	---	---
5	19.6	5.2	7.11	170	80	100	<1.0	<0.010
6	19.7	5.8	7.19	169	---	---	---	---
7	19.6	5.0	7.19	171	---	---	---	---
8	19.7	5.2	7.23	171	---	---	---	---
9	19.6	4.9	7.10	151	---	---	---	---
10	19.6	5.2	7.30	171	76	88	<1.0	0.013
11	19.4	5.4	7.53	174	---	---	---	---
12	19.7	6.2	7.28	168	---	---	---	---
13	19.7	5.3	7.23	179	---	---	---	---
14	19.6	5.0	7.27	174	---	---	---	---
15	19.5	4.6	7.10	169	88	88	<1.0	0.023
16	19.5	4.7	7.07	164	---	---	---	---
17	19.6	4.6	7.16	170	---	---	---	---
18	19.7	4.7	7.09	166	---	---	---	---
19	19.6	4.2	6.84	176	---	---	---	---
20	19.6	4.0	6.84	171	88	100	3.4	<0.010
Mean	19.6	5.2	7.16	169	82	94	nc	nc
Min	19.4	4.0	6.84	151	76	88	<1.0	<0.010
Max	19.8	6.6	7.53	179	88	100	3.4	0.029

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

MC-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.6	6.9	7.35	160	72	96	<1.0	<0.010
1	19.6	6.5	7.20	160	---	---	---	---
2	19.6	6.6	7.18	164	---	---	---	---
3	19.6	6.4	7.17	165	---	---	---	---
4	19.6	6.5	7.19	163	---	---	---	---
5	19.7	6.4	7.22	166	76	100	<1.0	<0.010
6	19.7	6.5	7.23	165	---	---	---	---
7	19.7	5.9	7.23	171	---	---	---	---
8	19.7	6.0	7.23	172	---	---	---	---
9	19.6	5.9	7.13	176	---	---	---	---
10	19.6	6.1	7.25	164	80	88	<1.0	<0.010
11	19.3	6.3	7.21	169	---	---	---	---
12	19.7	6.1	7.23	168	---	---	---	---
13	19.6	6.1	7.10	169	---	---	---	---
14	19.7	5.3	7.19	164	---	---	---	---
15	19.6	4.9	7.13	162	80	120	<1.0	<0.010
16	19.7	4.4	7.05	162	---	---	---	---
17	19.7	4.5	7.05	165	---	---	---	---
18	19.8	4.4	7.00	166	---	---	---	---
19	19.7	4.0	6.93	173	---	---	---	---
20	19.6	4.1	6.93	167	80	104	2.9	<0.010
Mean	19.6	5.7	7.15	166	78	102	nc	nc
Min	19.3	4.0	6.93	160	72	88	<1.0	<0.010
Max	19.8	6.9	7.35	176	80	120	2.9	0.000

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

MC-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.7	7.3	7.40	134	80	88	<1.0	<0.010
1	19.6	6.8	7.26	163	---	---	---	---
2	19.6	7.1	7.26	166	---	---	---	---
3	19.5	7.0	7.27	167	---	---	---	---
4	19.4	7.0	7.27	165	---	---	---	---
5	19.7	6.8	7.26	166	96	104	<1.0	<0.010
6	19.7	7.2	7.29	164	---	---	---	---
7	19.8	6.4	7.26	169	---	---	---	---
8	19.7	6.0	7.23	171	---	---	---	---
9	19.6	6.0	7.13	175	---	---	---	---
10	19.5	6.2	7.30	170	76	92	<1.0	<0.010
11	19.3	6.1	7.31	168	---	---	---	---
12	19.7	6.0	7.33	168	---	---	---	---
13	19.5	5.5	7.12	170	---	---	---	---
14	19.7	5.2	7.22	165	---	---	---	---
15	19.6	4.7	7.13	160	88	100	<1.0	<0.010
16	19.6	4.5	7.09	158	---	---	---	---
17	19.6	4.5	7.12	160	---	---	---	---
18	19.7	4.6	7.09	159	---	---	---	---
19	19.6	4.0	6.90	174	---	---	---	---
20	19.6	4.0	6.94	167	84	100	2.6	<0.010
Mean	19.6	5.9	7.20	165	85	97	nc	nc
Min	19.3	4.0	6.90	134	76	88	<1.0	<0.010
Max	19.8	7.3	7.40	175	96	104	2.6	<0.010

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

MC-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.8	7.8	7.43	155	80	88	<1.0	0.015
1	19.9	7.2	7.33	157	---	---	---	---
2	19.7	7.4	7.33	163	---	---	---	---
3	19.5	7.1	7.27	162	---	---	---	---
4	19.4	7.0	7.29	161	---	---	---	---
5	19.7	6.8	7.33	163	76	96	<1.0	<0.010
6	19.8	7.4	7.48	169	---	---	---	---
7	19.8	6.3	7.34	173	---	---	---	---
8	19.8	5.8	7.28	175	---	---	---	---
9	19.6	5.1	7.15	179	---	---	---	---
10	19.5	5.4	7.28	174	88	88	<1.0	<0.010
11	19.4	6.0	7.45	169	---	---	---	---
12	19.7	6.4	7.41	170	---	---	---	---
13	19.7	6.1	7.16	170	---	---	---	---
14	19.7	5.9	7.27	164	---	---	---	---
15	19.7	5.5	7.19	160	100	80	<1.0	<0.010
16	19.6	4.7	7.12	159	---	---	---	---
17	19.7	4.8	7.16	162	---	---	---	---
18	19.8	4.6	7.11	166	---	---	---	---
19	19.7	4.2	6.97	175	---	---	---	---
20	19.6	4.2	6.96	170	84	100	3.3	<0.010
Mean	19.7	6.0	7.25	166	86	90	nc	nc
Min	19.4	4.2	6.96	155	76	80	<1.0	<0.010
Max	19.9	7.8	7.48	179	100	100	3.3	0.015

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data
Initiated April 5, 2011**

Control								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Overlying NH ₃ (mg/l)	Overlying Sulfides (mg/l)
0	21.2	8.4	6.54	122	40	68	<1.0	<0.010
1	21.0	7.7	6.90	133	---	---	---	---
2	23.1	5.8	6.55	131	---	---	---	---
3	22.8	6.3	6.86	150	---	---	---	---
4	22.7	6.5	6.77	147	---	---	---	---
5	22.8	6.4	6.84	149	40	64	<1.0	<0.010
6	22.9	6.1	6.98	161	---	---	---	---
7	22.8	6.7	7.06	152	---	---	---	---
8	22.9	6.7	7.05	158	---	---	---	---
9	22.9	6.4	7.02	163	---	---	---	---
10	22.8	6.5	7.03	161	40	64	<1.0	0.010
Mean	22.5	6.7	6.87	148	40	65	nc	nc
Min	21.0	5.8	6.54	122	40	64	<1.0	<0.010
Max	23.1	8.4	7.06	163	40	68	<1.0	0.010

NC = Not Calculable

LL-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃ (mg/l)	Overlying Sulfides (mg/l)
0	21.2	7.2	7.33	167	72	88	1.1	0.035
1	21.2	7.0	7.33	167	---	---	---	---
2	23.0	5.3	7.04	175	---	---	---	---
3	22.9	4.7	7.07	173	---	---	---	---
4	22.8	5.3	7.02	172	---	---	---	---
5	22.9	5.2	7.05	174	72	92	<1.0	<0.010
6	22.9	5.2	7.19	171	---	---	---	---
7	22.9	5.6	7.19	167	---	---	---	---
8	22.9	5.5	7.20	173	---	---	---	---
9	22.9	5.4	7.16	174	---	---	---	---
10	22.8	5.6	7.21	175	72	88	<1.0	<0.010
Mean	22.6	5.6	7.16	172	72	89	nc	nc
Min	21.2	4.7	7.02	167	72	88	<1.0	<0.010
Max	23.0	7.2	7.33	175	72	92	1.1	0.035

NC = Not Calculable

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated April 5, 2011

LL-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.2	6.6	7.15	172	80	104	2.0	0.053
1	21.2	6.6	7.19	172	---	---	---	---
2	23.0	4.8	6.91	179	---	---	---	---
3	23.0	4.8	6.99	174	---	---	---	---
4	22.8	4.8	6.90	172	---	---	---	---
5	22.9	4.8	6.92	172	68	108	2.0	<0.010
6	22.9	4.9	7.02	164	---	---	---	---
7	23.0	4.9	6.93	162	---	---	---	---
8	22.9	5.3	6.94	166	---	---	---	---
9	23.0	5.4	6.99	163	---	---	---	---
10	22.8	5.3	7.02	161	72	104	<1.0	<0.010
Mean	22.6	5.3	7.00	169	73	105	nc	nc
Min	21.2	4.8	6.90	161	68	104	<1.0	<0.010
Max	23.0	6.6	7.19	179	80	108	2.0	0.053

NC = Not Calculable

LL-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.2	6.4	7.20	164	76	76	1.2	0.068
1	21.2	6.8	7.32	165	---	---	---	---
2	23.1	5.0	7.09	170	---	---	---	---
3	22.9	5.3	7.12	171	---	---	---	---
4	22.7	5.5	7.06	170	---	---	---	---
5	22.8	5.4	7.10	172	72	90	<1.0	<0.010
6	22.9	5.0	7.19	171	---	---	---	---
7	22.8	4.8	7.15	169	---	---	---	---
8	22.7	5.2	7.15	171	---	---	---	---
9	23.0	5.2	7.05	170	---	---	---	---
10	22.8	5.1	7.04	167	72	90	<1.0	<0.010
Mean	22.6	5.4	7.13	169	73	85	nc	nc
Min	21.2	4.8	7.04	164	72	76	<1.0	<0.010
Max	23.1	6.8	7.32	172	76	90	1.2	0.068

NC = Not Calculable

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data
Initiated April 5, 2011**

LL-SED-4								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.4	6.0	7.26	160	76	88	1.5	0.056
1	21.2	6.8	7.37	166	---	---	---	---
2	23.0	5.7	7.16	173	---	---	---	---
3	22.9	5.3	7.17	173	---	---	---	---
4	22.7	5.5	7.07	173	---	---	---	---
5	22.7	5.3	7.11	172	80	88	<1.0	<0.010
6	22.8	5.2	7.17	171	---	---	---	---
7	22.9	4.9	7.15	168	---	---	---	---
8	22.9	4.9	7.19	170	---	---	---	---
9	22.7	5.0	7.09	170	---	---	---	---
10	22.8	4.8	7.10	171	76	84	<1.0	<0.010
Mean	22.5	5.4	7.17	170	77	87	nc	nc
Min	21.2	4.8	7.07	160	76	84	<1.0	<0.010
Max	23.0	6.8	7.37	173	80	88	1.5	0.056

NC = Not Calculable

MC-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.4	6.9	7.35	164	72	92	<1.0	<0.010
1	21.3	7.2	7.37	163	---	---	---	---
2	23.1	5.9	7.11	169	---	---	---	---
3	22.9	6.0	7.23	170	---	---	---	---
4	22.6	6.1	7.11	173	---	---	---	---
5	22.8	6.0	7.18	174	80	96	<1.0	<0.010
6	22.9	5.8	7.22	173	---	---	---	---
7	22.8	5.8	7.16	172	---	---	---	---
8	22.9	5.5	7.23	173	---	---	---	---
9	22.7	5.5	7.14	170	---	---	---	---
10	22.8	5.3	7.13	173	80	96	<1.0	<0.010
Mean	22.6	6.0	7.20	170	77	95	nc	nc
Min	21.3	5.3	7.11	163	72	92	<1.0	<0.010
Max	23.1	7.2	7.37	174	80	96	<1.0	<0.010

NC = Not Calculable

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated April 5, 2011

MC-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.3	7.8	7.44	163	68	92	<1.0	<0.010
1	21.2	7.5	7.47	162	---	---	---	---
2	23.1	6.2	7.25	170	---	---	---	---
3	22.8	6.0	7.28	171	---	---	---	---
4	22.7	6.4	7.16	171	---	---	---	---
5	22.7	6.2	7.21	173	80	100	<1.0	<0.010
6	22.9	6.2	7.29	171	---	---	---	---
7	23.0	5.9	7.27	171	---	---	---	---
8	23.0	5.8	7.30	175	---	---	---	---
9	23.0	5.9	7.22	175	---	---	---	---
10	22.8	6.0	7.24	175	80	100	<1.0	0.013
Mean	22.6	6.4	7.28	171	76	97	nc	nc
Min	21.2	5.8	7.16	162	68	92	<1.0	<0.010
Max	23.1	7.8	7.47	175	80	100	<1.0	0.013

NC = Not Calculable

MC-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.3	7.8	7.39	159	68	84	<1.0	<0.010
1	21.2	7.5	7.46	161	---	---	---	---
2	23.2	6.4	7.27	166	---	---	---	---
3	22.9	6.1	7.28	167	---	---	---	---
4	22.7	6.5	7.19	167	---	---	---	---
5	22.7	6.4	7.21	166	84	88	<1.0	<0.010
6	22.9	6.4	7.33	169	---	---	---	---
7	23.0	6.2	7.32	168	---	---	---	---
8	22.9	6.4	7.39	171	---	---	---	---
9	23.1	6.1	7.30	173	---	---	---	---
10	22.9	5.9	7.30	172	80	84	<1.0	<0.010
Mean	22.6	6.5	7.31	167	77	85	nc	nc
Min	21.2	5.9	7.19	159	68	84	<1.0	<0.010
Max	23.2	7.8	7.46	173	84	88	<1.0	<0.010

NC = Not Calculable

APPENDIX D - Laboratory Bench Sheets

20 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 20 day Survival

Client: Flood Snider
 Test #: 1104-TD18 thru 1104-TD24

Start Date & Time: 4/13/11 1330
 End Date & Time: 5/3/11 1330
 Test Organism: Chironomus dilutus

Site	Rep #	Cont #	Day 0	Survival Day 20				Initials/Comments
				total	#larvae	#pupae	#flies	
CON	1	153	12	11	11	0	0	X
	2	130	12	12	12	0	0	(M)
	3	150	12	11	11	0	0	CC
	4	144	12	12	12	0	0	BP
	5	138	12	11	11	0	0	X
	6	148	12	11	11	0	0	(M)
	7	163	12	11	11	0	0	CC
	8	116	12	10	10	0	0	X
LL-SED 1	1	139	12	5	5	0	0	X
	2	122	12	2	2	0	0	CC *
	3	158	12	9*	9	0	0	BP
	4	107	12	4	4	0	0	(M)
	5	108	12	12*	12	0	0	X
	6	119	12	12	12	0	0	CC
	7	140	12	12	12	0	0	BP
	8	136	12	10*	10	0	0	(M)
LL-SED 2	1	101	12	2	2	0	0	(M)
	2	141	12	1	1	0	0	BP #1
	3	128	12	8	8	0	0	X
	4	154	12	7	7	0	0	X
	5	161	12	5	5	0	0	BP
	6	155	12	3	3	0	0	CC
	7	146	12	1	1	0	0	(M)
	8	131	12	2	2	0	0	X
LL-SED 3	1	112	12	8	8	0	0	BP
	2	117	12	4	4	0	0	CC
	3	115	12	11	11	0	0	X
	4	113	12	11	11	0	0	BP
	5	150	12	4	4	0	0	(M)
	6	124	12	11	11	0	0	X
	7	157	12	12	12	0	0	BP
	8	111	12	6	6	0	0	CC
LL-SED 4	1	162	12	9	9	0	0	X *
	2	135	12	8	8	0	0	(M) *
	3	126	12	7	7	0	0	BP
	4	102	12	5	5	0	0	CC
	5	118	12	12	12	0	0	X
	6	132	12	7	7	0	0	BP
	7	110	12	11	11	0	0	(M)
	8	123	12	7	7	0	0	X
MC-SED 1	1	147	12	7	7	0	0	CC
	2	125	12	8	8	0	0	BP
	3	160	12	8	8	0	0	(M)
	4	137	12	9	9	0	0	X
	5	145	12	11	11	0	0	BP
	6	159	12	10	10	0	0	CC
	7	152	12	11	11	0	0	(M)
	8	104	12	8	8	0	0	BP

* Nematodes present
 ① invisible midge larvae present

QA Check: (M)

20 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 20 day Survival

Client: Floyd Snider
 Test #: 1104-1018 thru 1104-1024

Start Date & Time: 4/13/11 1330
 End Date & Time: 5/3/11 1330
 Test Organism: Chironomus dilutus

Site	Rep #	Cont #	Day 0	Survival Day 20				Initials/Comments
				total	#larvae	#pupae	#flies	
MC SED 2	1	121	12	9	9	0	0	CS
	2	164	12	9	9			CC
	3	151	12	8	8			CS
	4	103	12	8	8			CS
	5	114	12	10	10			CS
	6	127	12	10	10			CC
	7	129	12	10	10			CS
	8	109	12	12	12			CS
MC SED 3	1	120	12	8	8			CS
	2	149	12	10	10			CS
	3	143	12	9	9			CS
	4	142	12	9	9			CS
	5	133	12	6	6			CS
	6	134	12	7	7			CS
	7	105	12	9	9			CS
	8	106	12	9	9			CS
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					

QA Check: (M)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy., E. Suite 2
 Tacoma, WA 98424

Client: Floyd Snider Test 2
 Organism: Chironomus tentans
 Test no.: 1104-1008 thru 1104-1024

Site	Rep #	Cont #	Pan wt. (gm)	Dry wt. (gm)	Ash wt. (gm)	Ash free dry wt. (gm)	No. organisms	Avg. per site (mg)
CON	1	153	0.05970	0.06371	0.068003		11	
	2	130	0.07691	0.08229	0.07762		12	
	3	150	0.09019	0.08822	0.08267		11	
	4	144	0.07368	0.07950	0.07478		12	
	5	138	0.06826	0.07250	0.06869		11	
	6	148	0.06940	0.07592	0.07147		11	
	7	163	0.07678	0.08304	0.07788		11	
	8	116	0.06442	0.06968	0.06503		10	
LLSED-1	1	137	0.07868	0.08385	0.078960		5	
	2	122	0.05783	0.06133	0.05839		2	
	3	158	0.06495	0.07585	0.06765		9	
	4	107	0.07197	0.08000	0.07338		4	
	5	108	0.06563	0.08027	0.06839		12	
	6	119	0.06542	0.07702	0.06745		12	
	7	140	0.07892	0.08914	0.08646		12	
	8	136	0.06620	0.07510	0.06754		10	
LLSED-2	1	101	0.06993	0.07143	0.07011		2	
	2	141	0.06629	0.06682	0.06643		1	
	3	128	0.07639	0.07666	0.07643		1	
	4	154	0.06495	0.06949	0.06562		7	
	5	161	0.07069	0.07699	0.07162		5	
	6	155	0.07146	0.07526	0.07218		3	
	7	146	0.08130	0.08290	0.08151		1	
	8	131	0.06563	0.06901	0.06604		2	
LLSED-3	1	112	0.06650	0.08339	0.07009		8	
	2	117	0.06055	0.06973	0.06226		4	
	3	115	0.06598	0.08410	0.06883		11	
	4	113	0.07066	0.08781	0.07458		11	
	5	156	0.05927	0.06628	0.06042		4	
	6	124	0.06220	0.07750	0.06488		11	
	7	157	0.06675	0.08158	0.06984		12	
	8	111	0.06134	0.07320	0.06371		6	
LLSED-4	1	162	0.07398	0.07958	0.07536		9	
	2	135	0.08148	0.08564	0.08218		8	
	3	126	0.06876	0.07844	0.07066		7	
	4	102	0.07088	0.08454	0.07395		5	
	5	118	0.06613	0.08072	0.07045		12	
	6	132	0.06874	0.07961	0.07119		7	
	7	110	0.06744	0.08097	0.07038		11	
	8	123	0.06864	0.07749	0.07096		7	
Tech Initials			ut	cc	cc		cc	

1) Dry wt. Date/time in: 5/3/11 1830 T° 61
 Dry wt. Date/time out: 5-5-11 1300 T° 64
 Dry wt. Tech: cc

2) Furnace date/time in: 5-6-11 0900 T° 550
 Furnace date/time out: 5-6-11 1100 T° 550
 Furnace tech: ut

QA Check: (M)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy., E. Suite 2
 Tacoma, WA 98424

Client: Floyd Snider Test 2
 Organism: Chironomus tentans
 Test no.: 1104-T008 thru H04-T024

Site	Rep #	Cont #	Pan wt. (gm)	Dry wt. (gm)	Ash wt. (gm)	Ash free dry wt. (gm)	No. organisms	Avg. per site (mg)
MC-SED-1	1	147	0.07078	0.08209	0.07313		7	
	2	125	0.06568	0.08866	0.07628		8	
	3	160	0.07016	0.08107	0.07323		8	
	4	137	0.07449	0.09665	0.08390		9	
	5	145	0.07571	0.08853	0.07812		11	
	6	159	0.07240	0.08654	0.07641		10	
	7	153	0.06049	0.06900	0.06229		11	
	8	104	0.07776	0.09475	0.08116		8	
MC-SED-2	1	121	0.07167	0.09529	0.08296		9	
	2	164	0.07250	0.08480	0.07561		9	
	3	151	0.07287	0.08398	0.07511		8	
	4	103	0.06223	0.07668	0.06554		8	
	5	114	0.06723	0.11395	0.09809		10	
	6	127	0.05970	0.07451	0.06367		10	
	7	129	0.07153	0.08297	0.07353		10	
	8	109	0.07407	0.09586	0.08296		12	
MC-SED-3	1	120	0.06555	0.07955	0.06895		8	
	2	149	0.07413	0.08947	0.07872		10	
	3	143	0.05881	0.07054	0.06156		9	
	4	143	0.06911	0.08594	0.07499		9	
	5	133	0.07295	0.10676	0.09693		6	
	6	134	0.06165	0.12446	0.11407		7	
	7	105	0.07799	0.09267	0.08063		9	
	8	106	0.07264	0.08511	0.07442		9	
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
Tech Initials			et	ce	cc		(V)	

1) Dry wt. Date/time in: 5-3-11 1330
 Dry wt. Date/time out: 5-5-11 1300
 Dry wt. Tech: ce

2) Furnace date/time in: 5-5-11 5:41 T° 550
 Furnace date/time out: 5-6-11 4:00 T° 550
 Furnace tech: et

① 0.08112

QA Check: (M)

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #:

Start Date & Time: 4/13/11 1330 Test 2

Site: 60N

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Test 2

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	0.015	52	68	6.75	131	8.1	19.6	✓	✓	✓	JS
1					6.84	127	7.0	19.9	✓	✓	✓	JS
2					7.09	145	6.8	19.7	✓	✓	✓	JS
3					7.12	137	6.5	19.6	✓	✓	✓	JS
4					7.11	139	6.4	19.5	✓	✓	✓	JS
5	<1.0	<0.010	64	92	7.11	140	6.3	19.6	✓	✓	✓	(M)
6					7.38	165	7.2	19.7	✓	✓	✓	JS
7					7.24	173	5.7	19.8	✓	✓	✓	BP
8					7.30	175	5.3	19.8	✓	✓	✓	(M)
9					7.10	178	5.4	19.6	✓	✓	✓	MF
10	1.2	<0.010	72	88	7.28	174	5.9	19.7	✓	✓	✓	MF
11					7.48	171	6.0	19.4	✓	✓	✓	MF
12					7.44	170	6.7	19.7	✓	✓	✓	BP
13					7.10	175	5.7	19.8	✓	✓	✓	JS
14					7.09	171	4.8	19.9	✓	✓	✓	JS
15	<1.0	<0.010	80	96	7.07	165	4.6	19.8	✓	✓	✓	JS
16					7.06	166	4.3	19.7	✓	✓	✓	BP
17					7.10	166	4.3	19.8	✓	✓	✓	(M)
18					7.07	168	4.4	19.7	✓	✓	✓	(M)
19					6.88	221	4.0	19.8	✓	✓	✓	BP
20	3.2	<0.010	80	88	6.93	176	4.0	19.9	✓	✓	✓	BP

QA Check: (M)

Test Chamber: PM-V

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T018

Start Date & Time: 4/13/11 1330

Test 2

Site: LL-SED1

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	0.011	76	96	7.27	169	7.0	19.5	✓	✓	✓	JS
1					7.05	171	5.7	19.7	✓	✓	✓	JS
2					7.08	173	5.7	19.6	✓	✓	✓	JS
3					7.10	173	5.8	19.6	✓	✓	✓	JS
4					7.12	177	5.7	19.5	✓	✓	✓	JS
5	<1.0	<0.010	76	84	7.11	174	5.8	19.6	✓	✓	✓	(M)
6					7.16	166	5.8	19.7	✓	✓	✓	JS
7					7.03	171	3.9	19.8	✓	✓	✓	BP
8					7.15	172	5.0	19.7	✓	✓	✓	(M)
9					7.00	173	5.0	19.6	✓	✓	✓	JS
10	<1.0	<0.010	72	88	7.21	169	5.0	19.6	✓	✓	✓	JS
11					7.34	169	5.4	19.5	✓	✓	✓	JS
12					7.40	169	5.4	19.7	✓	✓	✓	BP
13					7.07	175	5.6	19.7	✓	✓	✓	JS
14					7.30	172	4.6	19.7	✓	✓	✓	JS
15	<1.0	<0.010	76	96	7.00	172	5.0	19.7	✓	✓	✓	JS
16					7.10	171	4.5	19.6	✓	✓	✓	BP
17					7.08	172	4.3	19.8	✓	✓	✓	(M)
18					7.10	172	4.2	19.7	✓	✓	✓	(M)
19					6.99	188	4.2	19.6	✓	✓	✓	BP
20	3.0	<0.010	88	100	6.90	173	4.0	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: RMU

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

 Client: Floyd Snider

 Test #: 1104-T019

 Start Date & Time: 4/13/11 1330 Test 2

 Site: LL-SED 2

 Test Organism: Chironomus tentans

 End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk		pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	6.1	0.036	84	104	7.12	174	6.1	19.7	✓	✓	✓	JS
1					6.89	179	4.6	19.9	✓	✓	✓	JS
2					6.96	173	4.9	19.7	✓	✓	✓	JS
3					7.01	174	4.8	19.5	✓	✓	✓	JS
4					7.02	175	4.9	19.5	✓	✓	✓	JS
5	9.5	<0.010	72	88	6.96	174	4.9	19.6	✓	✓	✓	(M)
6					7.05	166	5.6	19.7	✓	✓	✓	JS
7					7.09	168	5.1	19.9	✓	✓	✓	BP
8					7.09	167	5.2	19.7	✓	✓	✓	(M)
9					7.02	166	5.6	19.5	✓	✓	✓	MF
10	2.1	<0.010	64	76	7.12	161	5.3	19.6	✓	✓	✓	MF
11					7.24	161	5.9	19.4	✓	✓	✓	MF
12					7.23	159	5.8	19.8	✓	✓	✓	BP
13					7.05	160	6.3	19.6	✓	✓	✓	JS
14					7.11	155	5.8	19.6	✓	✓	✓	JS
15	<1.0	0.010	76	76	7.06	150	5.6	19.7	✓	✓	✓	JS
16					6.95	148	5.0	19.6	✓	✓	✓	BP
17					6.99	149	4.8	19.8	✓	✓	✓	(M)
18					7.00	150	4.6	19.7	✓	✓	✓	(M)
19					6.97	158	4.4	19.7	✓	✓	✓	BP
20	2.7	<0.010	76	92	6.90	156	4.1	19.7	✓	✓	✓	BP

 QA Check: (M)

 Test Chamber: RMC

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Smidley

Test #: 1104-T020

Start Date & Time: 4/13/11 1330

Test 2

Site: LL-SED3

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	<1.0	0.020	72	100	7.29	165	6.8	19.6	✓	✓	✓	JS
1					7.10	166	6.3	19.9	✓	✓	✓	JS
2					7.12	166	6.3	19.7	✓	✓	✓	JS
3					7.11	167	6.2	19.6	✓	✓	✓	JS
4					7.12	167	6.3	19.6	✓	✓	✓	JS
5	<1.0	<0.010	72	96	7.09	166	6.2	19.6	✓	✓	✓	(M)
6					7.20	166	6.3	19.8	✓	✓	✓	JS
7					7.21	169	5.8	19.8	✓	✓	✓	BP
8					7.20	171	6.0	19.8	✓	✓	✓	(M)
9					7.12	172	5.6	19.7	✓	✓	✓	MF
10	<1.0	<0.010	68	88	7.29	166	6.1	19.5	✓	✓	✓	MF
11					7.35	165	6.0	19.4	✓	✓	✓	MF
12					7.31	164	6.3	19.6	✓	✓	✓	BP
13					7.09	166	6.6	19.6	✓	✓	✓	JS
14					7.22	163	6.0	19.7	✓	✓	✓	JS
15	<1.0	0.033	68	100	7.13	158	6.1	19.6	✓	✓	✓	JS
16					6.97	156	4.7	19.6	✓	✓	✓	BP
17					7.06	159	4.8	19.7	✓	✓	✓	(M)
18					7.00	156	4.8	19.8	✓	✓	✓	(M)
19					6.91	166	4.2	19.6	✓	✓	✓	BP
20	3.1	<0.010	80	96	6.95	161	4.1	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: Rm

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T021

Start Date & Time: 4/13/11 1330 Test 4

Site: LL-SED4

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk (mg/L as CaCO ₃)	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
									am	pm		
0	<1.0	0.029	76	96	7.35	165	6.6	19.5	✓	✓	✓	JS
1					7.08	162	5.3	19.8	✓	✓	✓	JS
2					7.12	169	5.7	19.7	✓	✓	✓	JS
3					7.14	168	5.4	19.6	✓	✓	✓	JS
4					7.13	169	5.5	19.7	✓	✓	✓	JS
5	<1.0	<0.010	80	100	7.11	170	5.2	19.6	✓	✓	✓	(M)
6					7.19	169	5.8	19.7	✓	✓	✓	JS
7					7.19	171	5.0	19.6	✓	✓	✓	BP
8					7.23	171	5.2	19.7	✓	✓	✓	(M)
9					7.10	151	4.9	19.6	✓	✓	✓	MF
10	5.0 <1.0	0.013	76	88	7.30	171	5.2	19.6	✓	✓	✓	MF
11					7.53	174	5.4	19.4	✓	✓	✓	MF
12					7.28	168	6.2	19.7	✓	✓	✓	BP
13					7.23	179	5.3	19.7	✓	✓	✓	JS
14					7.27	174	5.0	19.6	✓	✓	✓	JS
15	<1.0	0.023	88	88	7.10	169	4.6	19.5	✓	✓	✓	JS
16					7.07	164	4.7	19.5	✓	✓	✓	BP
17					7.16	170	4.6	19.6	✓	✓	✓	(M)
18					7.09	166	4.7	19.7	✓	✓	✓	(M)
19					6.84	176	4.2	19.6	✓	✓	✓	BP
20	3.4	<0.010	88	100	6.84	171	4.0	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: RMC

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T022

Start Date & Time: 4/13/11 1330

Test 2

Site: MC-8ED1

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	<0.01	729	96	7.35	160	6.9	19.6	✓	✓	✓	JS
1					7.20	160	6.5	19.6	✓	✓	✓	JS
2					7.18	164	6.6	19.4	✓	✓	✓	JS
3					7.17	165	6.4	19.6	✓	✓	✓	JS
4					7.19	163	6.5	19.6	✓	✓	✓	JS
5	<1.0	<0.010	76	100	7.22	166	6.4	19.7	✓	✓	✓	(M)
6					7.23	165	6.5	19.7	✓	✓	✓	JS
7					7.23	171	5.9	19.7	✓	✓	✓	BP
8					7.23	172	6.0	19.7	✓	✓	✓	(M)
9					7.13	176	5.9	19.6	✓	✓	✓	MF
10	<1.0	<0.010	80	88	7.29	164	6.1	19.6	✓	✓	✓	MF
11					7.21	169	6.3	19.3	✓	✓	✓	MF
12					7.23	168	6.1	19.7	✓	✓	✓	BP
13					7.10	169	6.1	19.6	✓	✓	✓	JS
14					7.19	164	5.3	19.7	✓	✓	✓	JS
15	80 <1.0	<0.010	80	120	7.13	162	4.9	19.6	✓	✓	✓	JS
16					7.05	162	4.4	19.7	✓	✓	✓	BP
17					7.05	165	4.5	19.7	✓	✓	✓	(M)
18					7.00	166	4.4	19.8	✓	✓	✓	(M)
19					6.93	173	4.0	19.7	✓	✓	✓	BP
20	2.9	<0.010	80	104	6.93	167	4.1	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: RM-C

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T023

Start Date & Time: 4/13/11 1330 Test 2

Site: MC-SED2

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	<1.0	<0.010	80	88	7.40	134	7.3	19.7	✓	✓	✓	JS
1					7.26	163	6.8	19.6	✓	✓	✓	JS
2					7.26	166	7.1	19.6	✓	✓	✓	JS
3					7.27	167	7.0	19.5	✓	✓	✓	JS
4					7.27	165	7.0	19.4	✓	✓	✓	JS
5	<1.0	<0.010	96	104	7.26	166	6.8	19.7	✓	✓	✓	(M)
6					7.29	164	7.2	19.7	✓	✓	✓	JS
7					7.26	169	^{SP} 7.64	19.8	✓	✓	✓	BP
8					7.23	171	6.0	19.7	✓	✓	✓	(M)
9					7.13	175	6.0	19.6	✓	✓	✓	MF
10	<1.0	<0.010	76	92	7.30	170	6.2	19.9	✓	✓	✓	MF
11					7.31	168	6.1	19.3	✓	✓	✓	MF
12					7.33	168	6.0	19.7	✓	✓	✓	BP
13					7.12	170	5.5	19.5	✓	✓	✓	JS
14					7.22	165	5.2	19.7	✓	✓	✓	JS
15	<1.0	<0.010	88	100	7.13	1604 160	4.7	19.6	✓	✓	✓	JS
16					7.09	158	4.5	19.6	✓	✓	✓	BP
17					7.12	160	4.5	19.6	✓	✓	✓	(M)
18					7.09	159	4.6	19.7	✓	✓	✓	(M)
19					6.90	174	4.0	19.6	✓	✓	✓	BP
20	2.6	<0.010	84	100	6.94	167	4.0	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: Rm. C

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Smidew Test #: 1104-T024

Start Date & Time: 4/13/11 1330 Test 2

Site: MC-8003 Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	0.015	80	88	7.43	155	7.8	19.8	✓	✓	✓	JS
1					7.33	157	7.2	19.9	✓	✓	✓	JS
2					7.33	163	7.4	19.7	✓	✓	✓	JS
3					7.27	162	7.1	19.5	✓	✓	✓	JS
4					7.29	161	7.0	19.4	✓	✓	✓	JS
5	<1.0	<0.010	76	96	7.33	163	6.8	19.7	✓	✓	✓	(M)
6					7.48	169	7.4	19.8	✓	✓	✓	JS
7					7.34	173	6.3	19.8	✓	✓	✓	BP
8					7.28	175	5.8	19.8	✓	✓	✓	(M)
9					7.19	179	5.1	19.6	✓	✓	✓	MF
10	<1.0	<0.010	88	88	7.28	174	5.4	19.5	✓	✓	✓	MF
11					7.49	169	6.0	19.4	✓	✓	✓	MF
12					7.41	170	6.4	19.7	✓	✓	✓	BP
13					7.16	170	6.1	19.7	✓	✓	✓	JS
14					7.27	164	5.9	19.7	✓	✓	✓	JS
15	<1.0	<0.010	88 100	80	7.19	160	5.5	19.7	✓	✓	✓	JS
16					7.12	159	4.7	19.6	✓	✓	✓	BP
17					7.16	162	4.8	19.7	✓	✓	✓	(M)
18					7.11	166	4.6	19.8	✓	✓	✓	(M)
19					6.97	175	4.2	19.7	✓	✓	✓	BP
20	3.3	<0.010	84	100	6.96	170	4.2	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: Rm. C

Overlying Ammonia

Client: Floyd Snider

Species: Chironomus tentans

Test Date: ~~4/6/2011~~ 4/13/11

Test #s: ~~1104-TD18 thru 1104-TD24~~

TEST #2 (1104-TD18 thru 1104-TD24)

Site	Day 0		Day 5		Day 10		Day 15		Day 20	
	NH ₃ (mg/L)	S ⁻ (mg/L)	NH ₃ (mg/L)	S ⁻ (mg/L)	NH ₃ (mg/L)	S ⁻ (mg/L)	NH ₃ (mg/L)	S ⁻ (mg/L)	NH ₃ (mg/L)	S ⁻ (mg/L)
CON	<1.0	0.015	<1.0	<0.010	1.2	<0.010	<1.0	<0.010	3.2	<0.010
LL-SED1	<1.0	0.011	<1.0	<0.010	<1.0	<0.010	<1.0	<0.010	3.0	<0.010
LL-SED2	6.1	0.036	9.5	<0.010	2.1	<0.010	<1.0	0.010	2.7	<0.010
LL-SED3	<1.0	0.020	<1.0	<0.010	<1.0	<0.010	<1.0	0.033	3.1	<0.010
LL-SED4	<1.0	0.029	<1.0	<0.010	<1.0	0.013	<1.0	0.023	3.4	<0.010
MC-SED1	<1.0	<0.01	<1.0	<0.010	<1.0	<0.010	<1.0	<0.010	2.9	<0.010
MC-SED2	<1.0	<0.01	<1.0	<0.010	<1.0	<0.010	<1.0	<0.010	2.6	<0.010
MC-SED3	<1.0	0.015	<1.0	<0.010	<1.0	<0.010	<1.0	<0.010	3.3	<0.010
Analysis Date:	5/11/11	4/14/11	5/11/11	4/19/11	5/11/11	4/28/11	5/11/11	4/29/11	5/11/11	5/4/11
Tech:	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)	MF

Sample I.D.	NH ₃ (mg/L)	Sample Dup	Spike (mg/L)	RPD	% Recovery
Day 0 LL-SED3	Blank	NA	11.0	NA	90.2
	—	0.0	0.0	0	97.5
Day 15 LL-SED3	Blank	NA	12.2	NA	100
	—	0.4	0.6	40	105.7

Comments: _____

QA Check: (M)

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Survival

Client: Floud Snidly Start Date & Time: 4/5/11 1445
 Test #: 1104-1008 thru 1104-1014 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Conc. or site	Cont. #	Survival	
		Day 0	Day 10
(N)	29	10	10
	64	10	9
	14	10	10
	39	10	10
	43	10	10
	31	10	9
	37	10	10
	54	10	9
LL-SED 1	63	10	9
	49	10	10
	27	10	10
	16	10	10
	4	10	9
	51	10	10
	55	10	10
	17	10	8
LL-SED 2	52	10	10
	18	10	10
	44	10	10
	22	10	9
	46	10	9
	10	10	9
	13	10	10
	41	10	10
LL-SED 3	33	10	10
	50	10	9
	56	10	10
	19	10	10
	6	10	10
	35	10	9
	12	10	10
	40	10	9
LL-SED 4	11	10	10
	58	10	10
	28	10	10
	25	10	10
	34	10	10
	21	10	10
	2	10	10
	5	10	10
		10	
		10	
	Tech Initials	<u>AS/N</u>	<u>9+</u>

Animal Source: APB Aquatic
 Date Received: 4/1/11
 Age at test initiation: 9 days

QA Check: (N)

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floud Snider
 Conc. or Site: CAH
 Test #: _____

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃										
0	40	68	<1.0	<0.01	6.54	122	8.4	21.2	CC		DS
1					6.90	133	7.7	21.0 ⁰	(M)		DS
2					6.55	131	5.8	23.1	BP		DS
3					6.86	150	6.3	22.8	(M)		BP
4					6.77	147	6.5	22.7	BP		BP
5	40	64	<1.0	<0.01	6.84	149	6.4	22.8	BP		BP
6					6.98	161	6.1	22.9	(M)		(M)
7					7.06	152	6.7	22.8	DS		DS
8					7.05	158	6.7	22.9	DS		DS
9					7.02	163	6.4	22.9	MA		DS
10	40	64	<1.0	0.010	7.03	161	6.5	22.8	ST		ST

Test Chamber: RM. B QA Check: (M)

① Temp. increased in chamber

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. of Site: LL - SED 1
 Test #: 1104-TD08

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	(mg/L as CaCO ₃)	(mg/L)										
0	72	88		1.1	0.035	7.33	147	7.2	21.2	✓		SS
1						7.33	107	7.0	21.2	Ⓜ		SS
2						7.04	175	5.3	23.0	BP		SS
3						7.07	173	4.7	22.9	Ⓜ		BP
4						7.02	172	5.3	22.8	BP		BP
5	72	92		<1.0	<0.01	7.05	174	5.2	22.9	BP		BP
6						7.19	171	5.2	22.9	Ⓜ		Ⓜ
7						7.19	167	5.6	22.9	SS		SS
8						7.20	173	5.5	22.9	SS		SS
9						7.16	174	5.4	22.9	MA		SS
10	72	88		<1.0	<0.01	7.21	175	5.6	22.8	ST		ST

Test Chamber: RM. B QA Check: Ⓜ

① Test chamber temperature turned up

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL SED 2
 Test #: 1104-TD09

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	(mg/L as CaCO ₃)	(mg/L)										
0	80	104		2.0	0.053	7.15	172	6.6	21.2	✓		SS
1						7.19	172	6.6	21.2	(M)		SS
2						6.91	179	4.8	23.0	SP		SS
3						6.99	174	4.8	23.0	(M)		SP
4						6.90	172	4.8	22.8	SP		SP
5	68	108		2.0	50.01	6.92	172	4.8	22.9	SP		SP
6						7.02	164	4.9	22.9	(M)		(M)
7						6.93	162	4.9	23.0	SP		SS
8						6.94	166	5.3	22.9	SP		SS
9						6.99	163	5.4	23.0	SH		SS
10	72	104		<1.0	<0.01	7.02	161	5.3	22.8	GT		GT

Test Chamber: R.M.B QA Check: (M)

① Test chamber temperature up

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snyder
 Conc. or Site: LL5FD3
 Test #: 1104-T01D
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	mg/L	as CaCO ₃										
0	76	76		1.2	0.068	7.20	164	6.4	21.2	CR		SS
1						7.32	165	6.8	21.2	(M)		SS
2						7.09	170	5.0	23.1	SA		SS
3						7.12	171	5.3	22.9	(M)		BP
4						7.06	170	5.5	22.7	BP		BP
5	72	90		<1.0	<0.01	7.10	172	5.4	22.8	BP		BP
6						7.19	171	5.0	22.9	(M)		(M)
7						7.15	169	4.8	22.8	SS		SS
8						7.15	171	5.2	22.7	SS		SS
9						7.05	170	5.2	23.0	MA		SS
10	72	90		<1.0	<0.01	7.04	167	5.1	22.8	SA		SA

Test Chamber: RM. B QA Check: (M)

① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL SED 4
 Test #: 1104-TO11

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	mg/L	as CaCO ₃										
0	710	86		1.5	0.056	7.26	160	6.0	21.4	CE		SS
1						7.37	166	6.8	21.2	M		SS
2						7.16	173	5.7	23.0	BP		SS
3						7.17	173	5.3	22.9	M		BP
4						7.07	173	5.5	22.7	BP		BP
5	80	88		<1.0	<0.01	7.11	172	5.3	22.7	BP		BP
6						7.17	171	6.2	22.8	M		M
7						7.15	168	4.9	22.9	SS		SS
8						7.19	170	4.9	22.9	SS		SS
9						7.09	170	5.0	22.7	MH		SS
10	76	84		<1.0	<0.01	7.10	171	4.8	22.8	BT		BT

Test Chamber: RM. B QA Check: M

*@Test chamber turned
Temperature
UP*

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SEDI
 Test #: 1104-T012
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	(mg/L)	as CaCO ₃										
0	72	92		<1.0	<0.01	7.35	164	6.9	21.4	ce		DS
1						7.37	163	7.2	21.3	(M)		DS
2						7.11	169	5.9	23.1	BP		DS
3						7.23	170	6.0	22.9	(M)		BP
4						7.11	173	6.1	22.6	BP		BP
5	80	96		<1.0	<0.01	7.18	174	6.0	22.8	BP		BP
6						7.22	173	5.8	22.9	(M)		(M)
7						7.16	172	5.8	22.8	DS		DS
8						7.23	173	5.5	22.9	DS		DS
9						7.14	170	5.5	22.7	NA		DS
10	80	96		<1.0	<0.01	7.13	173	5.3	22.8	gt		gt

Test Chamber: FM. B QA Check: (M)
 Test Chamber Temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SEED
 Test #: 1104-TO13
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk (mg/L as CaCO ₃)	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
0	08	92	<1.0	<0.01	7.44	163	7.8	21.3			SS
1					7.47	162	7.5	21.2	(M)		SS
2					7.25	170	170	23.1	BP		SS
3					7.28	171	6.0	22.8	(M)		BP
4					7.16	171	6.4	22.7	BP		BP
5	80	100	<1.0	<0.01	7.21	173	6.2	22.7	BP		BP
6					7.29	171	6.2	22.9	(M)		(M)
7					7.27	171	5.9	23.0	SS		SS
8					7.30	175	5.8	23.0	SS		SS
9					7.22	175	5.9	23.0	SH		SS
10	80	100	<1.0	0.013	7.24	175	6.0	22.8	BT		BT

Test Chamber: RM.B QA Check: (M)

① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SED3
 Test #: 1104-T014

Start Date & Time: 4/5/11 1445
 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	(mg/L as CaCO ₃)										
0	608	84	<1.0	<0.01	7.39	159	7.8	21.3	CL		SS
1					7.40	161	7.5	21.2	MP		SS
2					7.27	166	6.4	23.2	SP		SS
3					7.28	167	6.1	22.9	MP		SP
4					7.19	167	6.5	22.7	SP		SP
5	84	88	<1.0	<0.01	7.21	166	6.4	22.7	SP		SP
6					7.33	169	6.4	22.9	MP		MP
7					7.32	168	6.2	23.0	SS		SS
8					7.39	171	6.4	22.9	SS		SS
9					7.30	173	6.1	23.1	SH		SS
10	80	84	<1.0	<0.010	7.30	172	5.9	22.9	GT		GT

Test Chamber: RM. B QA Check: MP
 ① Test chamber temperature increased

Overlying Ammonia

Client: Floyd Snider

Species: Hyallolella azteca

Test Date: 4/8/2011

Test #s: ~~1104-7012 thru 1104-7024~~ 1104-7008 thru 1104-7014

Site	Day 0		Day 5		Day 10	
	Ammonia (mg/L)	Sulfide (mg/L)	Ammonia (mg/L)	Sulfide (mg/L)	Ammonia (mg/L)	Sulfide (mg/L)
CON	<1.0	<0.01	<1.0	<0.010	<1.0	0.010
LL-SED1	1.1	0.035	<1.0	<0.010	<1.0	<0.010
LL-SED2	2.0	0.053	2.0	<0.010	<1.0	<0.010
LL-SED3	1.2	0.068	<1.0	<0.010	<1.0	<0.010
LL-SED4	1.5	0.0510	<1.0	<0.010	<1.0	<0.010
MC-SED1	<1.0	<0.01	<1.0	<0.010	<1.0	<0.010
MC-SED2	<1.0	<0.01	<1.0	<0.010	<1.0	0.013
MC-SED3	<1.0	<0.01	<1.0	<0.010	<1.0	<0.010
Analysis Date:	4/14/11	4/8/11	4/14/11	4/12/11	4/28/11	4/15/11
Tech:	(M)	(M)	(M)	(M)	(M)	(M)

Sample ID	Sample ID	NH3 (mg/L)	Sample Dup	Spike (mg/L)	RPD	% Recovery
LL-SED3	Blank	0.0	NA	12.0	NA	98.4
DAY 0	(M) 1.2	1.2	1.2	12.8	0.0	95.1
LL-SED3	Blank	0.0	NA	11.9	NA	97.5
D10		0.0	0.0	11.7	0.0	95.1

Comments: _____

QA Check: (M)

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Survival

Client: Floud Snidly Start Date & Time: 4/5/11 1445
 Test #: 1104-1008 thru 1104-1014 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Conc. or site	Cont. #	Survival	
		Day 0	Day 10
(N)	29	10	10
	64	10	9
	14	10	10
	39	10	10
	43	10	10
	31	10	9
	37	10	10
	54	10	9
LL-SED 1	63	10	9
	49	10	10
	27	10	10
	16	10	10
	4	10	9
	51	10	10
	55	10	10
	17	10	8
LL-SED 2	52	10	10
	18	10	10
	44	10	10
	22	10	9
	46	10	9
	10	10	9
	13	10	10
	41	10	10
LL-SED 3	33	10	10
	50	10	9
	56	10	10
	19	10	10
	6	10	10
	35	10	9
	12	10	10
	40	10	9
LL-SED 4	11	10	10
	58	10	10
	28	10	10
	25	10	10
	34	10	10
	21	10	10
	2	10	10
	5	10	10
		10	
		10	
	Tech Initials	<u>AS/N</u>	<u>9+</u>

Animal Source: APB Aquatic
 Date Received: 4/1/11
 Age at test initiation: 9 days

QA Check: (N)

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: CON
 Test #: _____

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃										
0	40	68	<1.0	<0.01	6.54	122	8.4	21.2	CC		JS
1					6.90	133	7.7	21.0 ^①	(M)		JS
2					6.55	131	5.8	23.1	BP		JS
3					6.86	150	6.3	22.8	(M)		BP
4					6.77	147	6.5	22.7	BP		BP
5	40	64	<1.0	<0.01	6.84	149	6.4	22.8	BP		BP
6					6.98	161	6.1	22.9	(M)		(M)
7					7.06	152	6.7	22.8	JS		JS
8					7.05	158	6.7	22.9	JS		JS
9					7.02	163	6.4	22.9	NH		JS
10	40	64	<1.0	0.010	7.03	161	6.5	22.8	BT		BT

Test Chamber: Rm. B

QA Check: (M)

① Temp. increased in chamber

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Smider
 Conc. or Site: LL-SED 1
 Test #: 1104-TD08

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	72	88	1.1	0.035	7.33	147	7.2	21.2	CC		JS
1					7.33	167	7.0	21.2	(M)		JS
2					7.04	175	5.3	23.0	BP		JS
3					7.07	173	4.7	22.9	(M)		BP
4					7.02	172	5.3	22.8	BP		BP
5	72	92	<1.0	<0.01	7.05	174	5.2	22.9	BP		BP
6					7.19	171	5.2	22.9	(M)		(M)
7					7.19	167	5.6	22.9	JS		JS
8					7.20	173	5.5	22.9	JS		JS
9					7.16	174	5.4	22.9	MA		JS
10	72	88	<1.0	<0.01	7.21	175	5.6	22.8	ET		ET

Test Chamber: RM. B

QA Check: (M)

① Test chamber temperature turned up

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL-SED2
 Test #: 1104-T009

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃										
0	80	104	2.0	0.053	7.15	172	6.6	21.2	CP		JS
1					7.19	172	6.6	21.2	(M)		JS
2					6.91	179	4.8	23.0	BP		JS
3					6.99	174	4.8	23.0	(M)		BP
4					6.90	172	4.8	22.8	BP		BP
5	68	108	2.0	0.01	6.92	172	4.8	22.9	BP		BP
6					7.02	164	4.9	22.9	(M)		(M)
7					6.93	162	4.9	23.0	JS		JS
8					6.94	166	5.3	22.9	JS		JS
9					6.99	163	5.4	23.0	NH		JS
10	72	104	2.0 <1.0	<0.01	7.02	161	5.3	22.8	ET		ET

Test Chamber: Rm. B

QA Check: (M)

① Test chamber temperature turned up

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Flouyd Snider
 Conc. or Site: LL-SED 3
 Test #: 1104-T010

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	mg/L as CaCO ₃										Initials
0	76	76	1.2	0.068	7.20	164	6.4	21.2	CP		JS
1					7.32	165	6.8	21.2	(M)		JS
2					7.09	170	5.0	23.1	JS		JS
3					7.12	171	5.3	22.9	(M)		BP
4					7.06	170	5.5	22.7	BP		BP
5	72	90	<1.0	<0.01	7.10	172	5.4	22.8	BP		BP
6					7.19	171	5.0	22.9	(M)		(M)
7					7.15	169	4.8	22.8	JS		JS
8					7.15	171	5.2	22.7	JS		JS
9					7.05	170	5.2	23.0	MA		JS
10	72	90	<1.0	<0.01	7.04	167	5.1	22.8	JS		JS

Test Chamber: Rm. B

QA Check: (M)

① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snidler
 Conc. or Site: LL-SED4
 Test #: 1104-T011

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	76	86	1.5	0.056	7.26	160	6.0	21.4	CP		JS
1					7.37	166	6.8	21.2	(M)		JS
2					7.16	173	5.7	23.0	BP		JS
3					7.17	173	5.3	22.9	(M)		BP
4					7.07	173	5.5	22.7	BP		BP
5	80	88	<1.0	<0.01	7.11	172	5.3	22.7	BP		BP
6					7.17	171	5.2	22.8	(M)		(M)
7					7.15	168	4.9	22.9	JS		JS
8					7.19	170	4.9	22.9	JS		JS
9					7.09	170	5.0	22.7	SH		JS
10	76	84	<1.0	<0.01	7.10	171	4.8	22.8	Et		Et

Test Chamber: Rm. B

@ Test chamber
 Temperature turned
 up

QA Check: (M)

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SEDI
 Test #: 1104-TO12

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	mg/L as CaCO ₃										Initials
0	72	92	<1.0	<0.01	7.35	164	6.9	21.4	ce		JS
1					7.37	163	7.2	21.3	(m)		JS
2					7.11	169	5.9	23.1	BP		JS
3					7.23	170	6.0	22.9	(m)		BP
4					7.11	173	6.1	22.6	BP		BP
5	80	96	<1.0	<0.01	7.18	174	6.0	22.8	BP		BP
6					7.22	173	5.8	22.9	(m)		(m)
7					7.16	172	5.8	22.8	JS		JS
8					7.23	173	5.5	22.9	JS		JS
9					7.14	170	5.5	22.7	SH		JS
10	80	96 96	<1.0	<0.01	7.13	173	5.3	22.8	Et		Et

Test Chamber: Rm. B

① Test chamber temperature increased

QA Check: (m)

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-BED2
 Test #: 1104-T013

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	098	92	<1.0	<0.01	7.44	163	7.8	21.3	BP		JS
1					7.47	162	7.5	21.2	BP		JS
2					7.25	170	6.2	23.1	BP		JS
3					7.28	171	6.0	22.8	BP		BP
4					7.16	171	6.4	22.7	BP		BP
5	80	100	<1.0	<0.01	7.21	173	6.2	22.7	BP		BP
6					7.29	171	6.2	22.9	BP		BP
7					7.27	171	5.9	23.0	BP		JS
8					7.30	175	5.8	23.0	BP		JS
9					7.22	175	5.9	23.0	SH		JS
10	80	100	<1.0	0.013	7.24	175	6.0	22.8	BP		BP

Test Chamber: RM. B

① Test chamber temperature increased

QA Check: BP

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SED3
 Test #: 1104-T014

Start Date & Time: 4/5/11 1445
 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	68	84	<1.0	<0.01	7.39	159	7.8	21.3	CE		JS
1					7.46	161	7.5	21.2	(M)		JS
2					7.27	166	6.4	23.2	BP		JS
3					7.28	167	6.1	22.9	(M)		BP
4					7.19	167	6.5	22.7	BP		BP
5	84	88	<1.0	<0.01	7.21	166	6.4	22.7	BP		BP
6					7.33	169	6.4	22.9	(M)		(M)
7					7.32	168	6.2	23.0	JS		JS
8					7.39	171	6.4	22.9	JS		JS
9					7.30	173	6.1	23.1	SA		JS
10	80	84	<1.0	<0.010	7.30	172	5.9	22.9	ET		ET

Test Chamber: RM. B

① Test chamber temperature increased

QA Check: (M)

Nautilus Environmental
 5009 Pacific Hwy E Suite 2
 Tacoma, WA 98424

Physical and Chemical
 Measurements of Overlying Water
 Sediment Bioassay

Overlying Ammonia

Client: Floyd Snider

Species: Hyallolela azteca

Test Date: 4/8/2011

Test #s: ~~1104-TD08 thru 1104-TD14~~ 1104-TD08 thru 1104-TD14

Site	Day 0		Day 5		Day 10	
	Ammonia (mg/L)	Sulfide (mg/L)	Ammonia (mg/L)	Sulfide (mg/L)	Ammonia (mg/L)	Sulfide (mg/L)
CON	<1.0	<0.01	<1.0	<0.010	<1.0	0.010
LL-SED1	1.1	0.035	<1.0	<0.010	<1.0	<0.010
LL-SED2	2.0	0.053	2.0	<0.010	<1.0	<0.010
LL-SED3	1.2	0.068	<1.0	<0.010	<1.0	<0.010
LL-SED4	1.5	0.0510	<1.0	<0.010	<1.0	<0.010
MC-SED1	<1.0	<0.01	<1.0	<0.010	<1.0	<0.010
MC-SED2	<1.0	<0.01	<1.0	<0.010	<1.0	0.013
MC-SED3	<1.0	<0.01	<1.0	<0.010	<1.0	<0.010
Analysis Date:	4/14/11	4/8/11	4/14/11	4/12/11	4/28/11	4/15/11
Tech:	(M)	(M)	(M)	(M)	(M)	(M)

Sample ID	Sample ID	NH3 (mg/L)	Sample Dup	Spike (mg/L)	RPD	% Recovery
LL-SED3 DAY 0	Blank	0.0	NA	12.0	NA	98.4
	(M) 1.2	1.2	1.2	12.8	0.0	95.1
LL-SED3 DAY 10	Blank	0.0	NA	11.9	NA	97.5
	////	0.0	0.0	11.7	0.0	95.1

Comments: _____

QA Check: (M)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Raw Data Sheet
 Microtox
 100% Sediment Porewater Toxicity

Client Name: Floyd Smider Test Date: 3/31/11

Sample ID: LLSED1, LLSED2
LLSED3, LLSED4 Test No.: 1103-T061, 1103-T062
1103-T063, 1103-T064

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	I ₍₀₎	5 min	99	105	106	112	110
	I ₍₅₎	10min	93	99	97	106	100
	I ₍₁₅₎	20 min	82	91	87	94	87
LLSED 1	I ₍₀₎	5 min	91	83	85	86	70
	I ₍₅₎	10min	83	78	81	79	62
	I ₍₁₅₎	20 min	73	69	75	68	58
LLSED 2	I ₍₀₎	5 min	66	61	62	70	65
	I ₍₅₎	10min	63	57	59	65	62
	I ₍₁₅₎	20 min	59	54	55	60	56
LLSED 3	I ₍₀₎	5 min	80	77	76	79	77
	I ₍₅₎	10min	75	75	69	73	72
	I ₍₁₅₎	20 min	68	60	61	66	65
LLSED 4	I ₍₀₎	5 min	67	76	70	68	67
	I ₍₅₎	10min	65	70	65	68	63
	I ₍₁₅₎	20 min	59	60	56	58	56
	I ₍₀₎	5 min					
	I ₍₅₎	10min					
	I ₍₁₅₎	20 min					

Comments: QC check - (m)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Raw Data Sheet
 Microtox
 100% Sediment Porewater Toxicity

Client Name: Floyd Snider Test Date: 3/31/11

Sample ID: MCSED1, MCSED2, MCSED3 Test No.: 1103-T065, 1103-T066
1103-T067

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	I ₍₀₎	5 min	94	98	96	99	94
	I ₍₅₎	10min	90	91	89	90	91
	I ₍₁₅₎	20 min	91	89	84	84	82
MCSED 1	I ₍₀₎	5 min	100	94	89	97	94
	I ₍₅₎	10min	89	91	85	90	91
	I ₍₁₅₎	20 min	82	86	79	83	81
MC SED 2	I ₍₀₎	5 min	88	85	86	85	86
	I ₍₅₎	10min	86	83	83	82	86
	I ₍₁₅₎	20 min	79	76	77	76	81
MC SED 3	I ₍₀₎	5 min	89	90	90	90	85
	I ₍₅₎	10min	84	85	87	90	79
	I ₍₁₅₎	20 min	77	80	77	79	76
	I ₍₀₎	5 min					
	I ₍₅₎	10min					
	I ₍₁₅₎	20 min					
	I ₍₀₎	5 min					
	I ₍₅₎	10min					
	I ₍₁₅₎	20 min					

Comments: QC check - @

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Physical and Chemical
 Measurements of Porewaters
 Sediment Bioassays

Analyst: Ut

Client: Floyd Snider

Test Date: 3/31/11

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 1103-T061, -T067

Test Species: Vibrio fischeri

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O. (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
CON	19.4	19.4	7.9	7.9	8.17	-	-	-	(1)
MCSED1	0.0	20.6	7.7	7.7	8.19	-	-	-	
MCSED2	0.0	20.8	7.8	7.8	8.03	-	-	-	
MCSED3	0.0	19.2	7.8	7.8	8.29	8.16	20µL 0.1 N HCl	99.9%	
LLSED1	0.0	19.4	7.7	7.7	7.92	-	-	-	
LLSED2	0.0	20.5	7.9	7.9	7.37	7.93	50µL 0.1 N NaOH	99.8%	
LLSED3	0.1	19.2	7.9	7.9	7.66	8.00	30µL 0.1 N NaOH	99.8%	

Sample Description: _____

Comments: _____

QA Check: (M)

See sample
 check in

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Physical and Chemical
 Measurements of Porewaters
 Sediment Bioassays

Analyst: gt

Client: Floyd Snider

Test Date: 3/31/11

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 1103-T061,-T067

Test Species: Vibrio fischeri

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O. (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
LLSED4	0.0	20.2	7.9	7.9	7.85	8.01	10 mL 0.1N NaOH	99.9%	Sample checked in

Sample Description: _____

Comments: _____

QA Check: (m)

APPENDIX E - Reference Toxicant Tests

Chironomus 96-h Acute Survival Test

Nautilus Environmental WA

Test Type: Survival (96h)

Organism: Chironomus tentans (Midge)

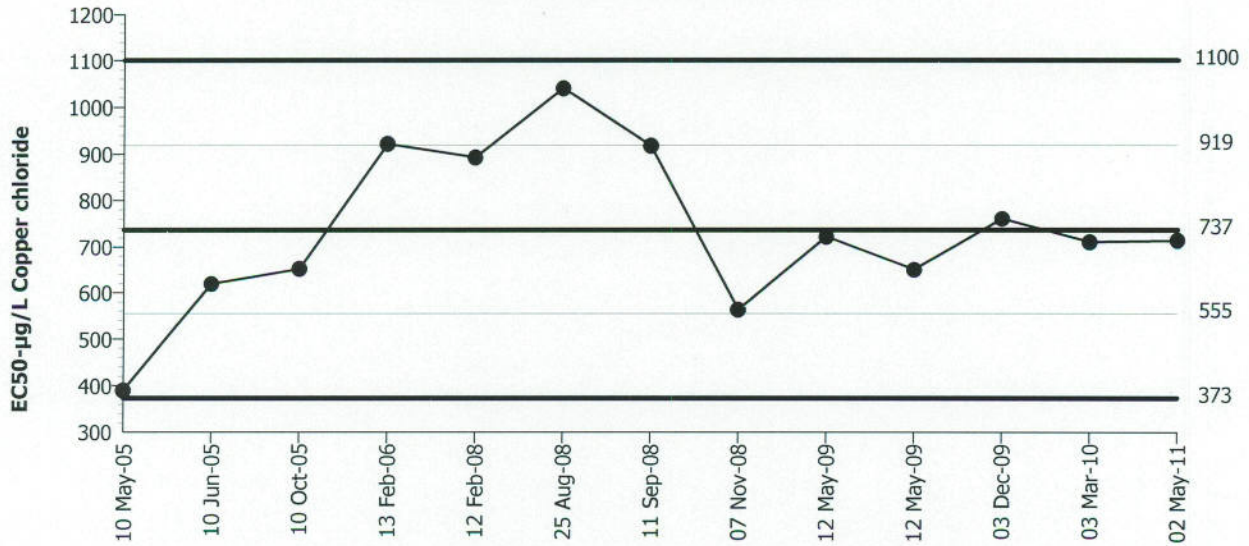
Material: Copper chloride

Protocol: EPA/600/R-99/064 (2000)

Endpoint: 96h Survival Rate

Source: Reference Toxicant-REF

Chironomus 96-h Acute Survival Test



Mean: 736.6 Count: 12 -1s Warning Limit: 554.7 -2s Action Limit: 372.8
 Sigma: 181.9 CV: 24.70% +1s Warning Limit: 918.5 +2s Action Limit: 1100

Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2005	May	10	389.8	-346.8	-1.907	(-)		03-9785-3768	06-1599-1620
2		Jun	10	619.3	-117.3	-0.6446			08-3314-6775	08-1540-4607
3		Oct	10	651.6	-84.96	-0.4671			08-1025-4680	04-9254-8883
4	2006	Feb	13	921.9	185.3	1.019	(+)		08-9851-1226	07-3219-0331
5	2008		12	892.6	156	0.8574			15-6976-5200	18-3934-0764
6		Aug	25	1040	303.3	1.667	(+)		06-6119-9769	09-7546-4295
7		Sep	11	917.7	181.1	0.9959			12-5480-0473	10-6515-6515
8		Nov	7	563	-173.6	-0.9545			11-4948-7713	17-3277-7072
9	2009	May	12	721.9	-14.71	-0.08084			07-7016-2012	11-9025-1031
10			12	650.3	-86.31	-0.4745			10-1811-8659	15-1190-7362
11		Dec	3	760.9	24.26	0.1334			06-1499-1772	06-0264-7224
12	2010	Mar	3	710.4	-26.21	-0.1441			17-7743-6517	09-5758-4695
13	2011	May	2	713.8	-22.83	-0.1255			05-0735-0656	07-1751-6097

CETIS Summary Report

Report Date: 06 May-11 14:51 (p 1 of 1)
 Test Code: RA050211CT | 05-0735-0656

Chironomus 96-h Acute Survival Test **Nautilus Environmental WA**

Batch ID: 10-9064-4993	Test Type: Survival (96h)	Analyst: Cat Curran
Start Date: 02 May-11 14:00	Protocol: EPA/600/R-99/064 (2000)	Diluent: Diluted Mineral Water (8:2)
Ending Date: 06 May-11 14:00	Species: Chironomus tentans	Brine:
Duration: 96h	Source: Aquatic Biosystems, CO	Age: 23in

Sample ID: 08-4898-7155	Code: RA020511CT	Client: Reference Toxicant Test
Sample Date: 02 May-11	Material: Copper chloride	Project:
Receive Date: 02 May-11	Source: Reference Toxicant	
Sample Age: 14h	Station:	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
05-9024-2029	96h Survival Rate	375	750	530.3	22.7%		Steel Many-One Rank Test

Point Estimate Summary

Analysis ID	Endpoint	Level	µg/L	95% LCL	95% UCL	TU	Method
07-1751-6097	96h Survival Rate	EC50	713.8	557.5	913.8		Trimmed Spearman-Kärber

96h Survival Rate Summary

Conc-µg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
187.5		4	0.85	0.7785	0.9215	0.6	1	0.09574	0.1915	22.53%	15.0%
375		4	0.85	0.7785	0.9215	0.6	1	0.09574	0.1915	22.53%	15.0%
750		4	0.45	0.3785	0.5215	0.2	0.6	0.09574	0.1915	42.55%	55.0%
1500		4	0.15	0.1127	0.1873	0	0.2	0.05	0.1	66.67%	85.0%
3000		4	0	0	0	0	0	0	0		100.0%

96h Survival Rate Detail

Conc-µg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
187.5		0.8	1	0.6	1
375		0.8	1	1	0.6
750		0.4	0.2	0.6	0.6
1500		0.2	0	0.2	0.2
3000		0	0	0	0

96 Hour Reference Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 96-hr Chronic

Client: Reference Toxicant
Sample ID: CuCl₂
Test #: RA020511CT

Start Date & Time: 5/2/11 1400
End Date & Time: 5/6/11 1400
Test Organism: Chironomus tentans

Conc. CuCl ₂	Cont. #	Survival		Dissolved O ₂ (mg/L)					pH (units)					Cond. µS/cm					Temperature (°C)				
		0	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
0 ug/L	22	5	5	7.2	8.1	7.3	8.1	7.9	7.62	7.34	7.43	7.63	7.63	162	172	177	168	172	23.0	22.6	23.5	20.0	20.1
	20	5	5																				
	2	5	5																				
	18	5	5																				
187.5 ug/L	8	5	4	8.5	8.3	7.2	8.0	7.7	7.75	7.42	7.41	7.64	7.66	161	169	174	163	168	22.2	22.8	23.8	19.9	20.2
	14	5	5																				
	21	5	3																				
	11	5	5																				
375 ug/L	23	5	4	8.4	8.6	8.0	8.2	8.0	7.79	7.46	7.43	7.68	7.69	162	169	174	162	166	22.1	22.7	23.8	20.0	20.4
	3	5	5																				
	13	5	5																				
	16	5	3																				
750 ug/L	9	5	2	8.4	8.7	7.6	8.1	7.8	7.77	7.46	7.53	7.66	7.69	158	170	175	163	166	22.2	22.7	23.6	20.2	20.4
	5	5	1																				
	12	5	3																				
	24	5	3																				
1500 ug/L	19	5	1	8.2	8.7	8.0	8.3	7.8	7.65	7.40	7.64	7.70	7.66	163	170	174	163	166	22.2	22.7	23.8	20.3	20.4
	17	5	0																				
	6	5	1																				
	10	5	1																				
3000 ug/L	7	5	0	8.7	8.7	8.0	8.4	8.1	7.43	7.38	7.67	7.76	7.69	163	171	175	163	166	22.2	22.8	23.9	20.2	20.2
	1	5	0																				
	4	5	0																				
	15	5	0																				

Tech. Initials: ET BP ET NF ET

Test Chamber: Room A

QA Check: (M)

Animal Source: ABS Date Received: 4/12/11

Age at test initiation: 2nd-3rd instar

Comments: _____

CETIS Summary Report

Report Date: 02 Jun-11 08:46 (p 1 of 1)
 Test Code: RA040511HA | 12-7538-8678

Acute Amphipod Survival Test **Nautilus Environmental WA**

Batch ID: 15-8530-2608	Test Type: Survival	Analyst: Meghan Feuk
Start Date: 05 Apr-11 14:45	Protocol: ASTM E1706-00 (2000)	Diluent: Diluted Mineral Water (8:2)
Ending Date: 09 Apr-11 14:15	Species: Hyalella azteca	Brine:
Duration: 95h	Source: Aquatic Indicators	Age:

Sample ID: 18-2228-7009	Code: RA040511HA	Client: Reference Toxicant Test
Sample Date: 05 Apr-11 14:45	Material: Copper chloride	Project:
Receive Date: 05 Apr-11 14:45	Source: Reference Toxicant	
Sample Age: N/A	Station:	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
12-7655-6547	Survival Rate	<187.5	187.5	N/A	14.3%		Steel Many-One Rank Test

Point Estimate Summary

Analysis ID	Endpoint	Level	µg/L	95% LCL	95% UCL	TU	Method
19-5580-0324	Survival Rate	EC25	0	N/A	0		Linear Interpolation (ICPIN)
		EC50	0	N/A	0		

Survival Rate Summary

Conc-µg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.825	0.7892	0.8608	0.7	0.9	0.04787	0.09574	11.61%	0.0%
187.5		4	0.1	0.05688	0.1431	0	0.2	0.05774	0.1155	115.5%	87.88%
375		4	0	0	0	0	0	0	0		100.0%
750		4	0	0	0	0	0	0	0		100.0%
1500		4	0	0	0	0	0	0	0		100.0%
3000		4	0	0	0	0	0	0	0		100.0%

Survival Rate Detail

Conc-µg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.9	0.8	0.7	0.9
187.5		0.2	0	0	0.2
375		0	0	0	0
750		0	0	0	0
1500		0	0	0	0
3000		0	0	0	0

96 Hour Reference Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 96-hr Chronic

Client: Reference Toxicant
Sample ID: 3000 ug/L CuCl₂
Test #: RA040511 Ha

Start Date & Time: 4/5/11 1445
End Date & Time: 4/9/11 1415
Test Organism: H. azteca

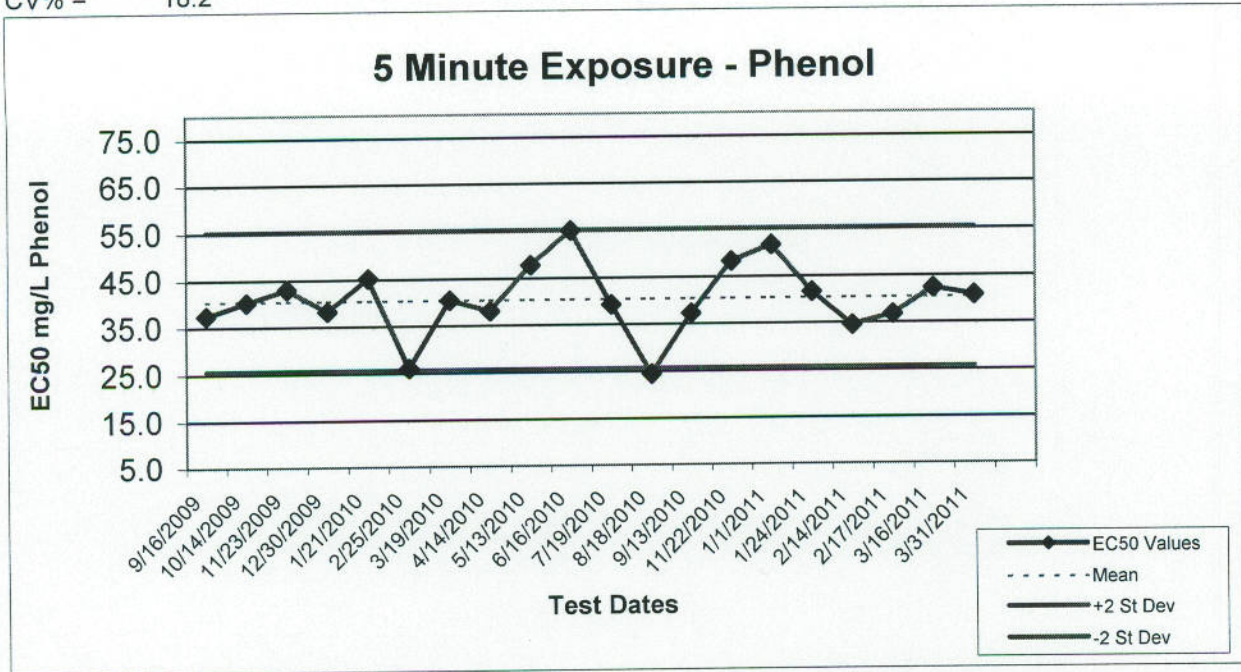
Conc. CuCl ₂	Cont. #	Survival		Dissolved O ₂ (mg/L)					pH (units)					Cond. μS/cm					Temperature (°C)				
		0	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
0 ug/L	2	10	9	8.8	8.5	7.9	7.5	7.6	7.77	7.89	7.89	7.79	7.59	165	170	182	196	207	21.3	20.9	22.8	22.7	22.7
	24	10	8																				
	23	10	7																				
	21	10	9																				
187.5	6	10	2	8.6	8.5	7.8	7.6	7.5	7.74	7.91	7.90	7.84	7.60	165	170	182	188	191	21.4	21.0	22.8	22.8	22.7
	16	10	0																				
	1	10	0																				
	11	10	2																				
375	14	10	0	8.6	8.4	7.9	7.6	7.2	7.71	7.89	7.90	7.85	7.55	165	169	181	187	189	21.4	21.1	22.9	22.9	22.8
	7	10	0																				
	5	10	0																				
	3	10	0																				
750	12	10	0	8.7	8.5	7.8	7.7	7.7	7.65	7.87	7.87	7.84	7.57	165	170	183	190	192	21.3	21.2	22.8	22.8	22.7
	18	10	0																				
	15	10	0																				
	22	10	0																				
1500	13	10	0	8.7	8.4	7.8	7.7	7.7	7.48	7.77	7.80	7.77	7.51	165	169	181	187	190	21.2	21.1	22.8	22.9	22.7
	8	10	0																				
	10	10	0																				
	20	10	0																				
3000	17	10	0	8.7	8.3	8.0	7.9	7.5	7.25	7.82	7.83	7.80	7.57	166	172	185	193	195	21.1	21.0	22.8	22.8	22.6
	4	10	0																				
	19	10	0																				
	9	10	0																				

Tech Initials: BP BP BP BP BP BP BP BP

Animal Source: Aquatic Comments: _____
Date Received: 4/1/11 Dilution Water: 8:2,017
Age at test initiation: 9 days Test Chamber: Rm. B QA Check: BP

Reference Toxicant Control Chart Microtox 5-Minute Exposure

CV% = 18.2

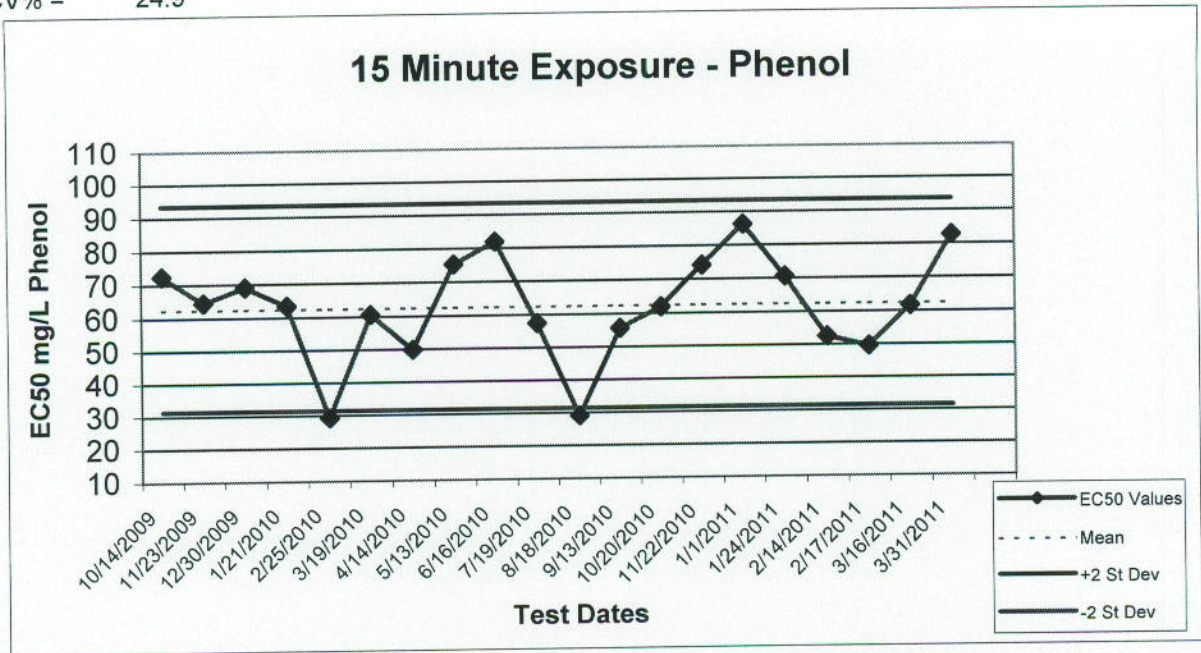


Date	Time	EC50 %	EC50 mg/L Phenol ^a	Mean	StDev	-2 SD	+2 SD
9/16/2009	1229	22.0	37.4	40.4	7.4	25.7	55.2
10/14/2009	926	23.7	40.2	40.4	7.4	25.7	55.2
11/23/2009	1011	25.3	43.0	40.4	7.4	25.7	55.2
12/30/2009	911	22.5	38.3	40.4	7.4	25.7	55.2
1/21/2010	1015	26.6	45.2	40.4	7.4	25.7	55.2
2/25/2010	1223	15.3	26.0	40.4	7.4	25.7	55.2
3/19/2010	833	23.8	40.5	40.4	7.4	25.7	55.2
4/14/2010	934	23.8	38.1	40.4	7.4	25.7	55.2
5/13/2010	939	29.9	47.8	40.4	7.4	25.7	55.2
6/16/2010	912	34.4	55.0	40.4	7.4	25.7	55.2
7/19/2010	830	24.5	39.2	40.4	7.4	25.7	55.2
8/18/2010	1018	15.3	24.4	40.4	7.4	25.7	55.2
9/13/2010	1214	23.3	37.3	40.4	7.4	25.7	55.2
11/22/2010	1100	30.2	48.3	40.4	7.4	25.7	55.2
1/1/2011	1436	32.3	51.7	40.4	7.4	25.7	55.2
1/24/2011	829	26.0	41.7	40.4	7.4	25.7	55.2
2/14/2011	1339	21.6	34.5	40.4	7.4	25.7	55.2
2/17/2011	1010	23.0	36.8	40.4	7.4	25.7	55.2
3/16/2011	812	26.5	42.3	40.4	7.4	25.7	55.2
3/31/2011	1154	25.5	40.8	40.4	7.4	25.7	55.2

a - Highest concentration of Phenol is 160 mg/L

Reference Toxicant Control Chart Microtox 15-Minute Exposure

CV% = 24.9



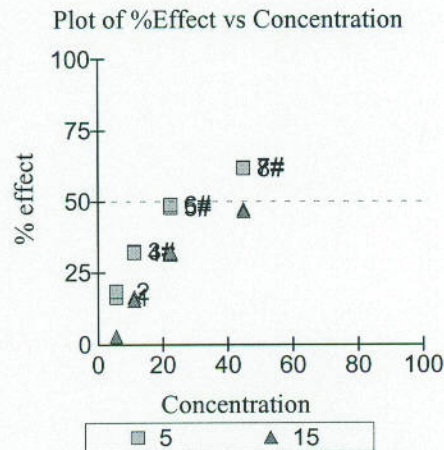
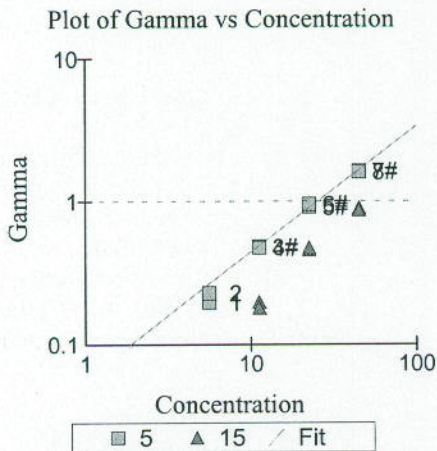
Date	Time	EC50 %	EC50 mg/L Phenol ^a	Mean	StDev	-2 SD	+2 SD
10/14/2009	926	42.6	72.4	62.4	15.5	31.3	93.4
11/23/2009	1011	37.9	64.4	62.4	15.5	31.3	93.4
12/30/2009	911	40.6	69.0	62.4	15.5	31.3	93.4
1/21/2010	1015	37.3	63.3	62.4	15.5	31.3	93.4
2/25/2010	1223	17.2	29.2	62.4	15.5	31.3	93.4
3/19/2010	833	35.6	60.5	62.4	15.5	31.3	93.4
4/14/2010	934	31.2	49.9	62.4	15.5	31.3	93.4
5/13/2010	939	47.0	75.2	62.4	15.5	31.3	93.4
6/16/2010	912	51.2	81.9	62.4	15.5	31.3	93.4
7/19/2010	830	35.9	57.4	62.4	15.5	31.3	93.4
8/18/2010	1018	18.2	29.1	62.4	15.5	31.3	93.4
9/13/2010	1214	34.8	55.7	62.4	15.5	31.3	93.4
10/20/2010	904	38.7	61.9	62.4	15.5	31.3	93.4
11/22/2010	1100	46.4	74.2	62.4	15.5	31.3	93.4
1/1/2011	1436	53.9	86.2	62.4	15.5	31.3	93.4
1/24/2011	829	44.1	70.5	62.4	15.5	31.3	93.4
2/14/2011	1339	32.9	52.6	62.4	15.5	31.3	93.4
2/17/2011	1010	31.0	49.6	62.4	15.5	31.3	93.4
3/16/2011	812	38.5	61.6	62.4	15.5	31.3	93.4
3/31/2011	1154	51.6	82.6	62.4	15.5	31.3	93.4

a - Highest concentration of Phenol is 160 mg/L

MicrotoxOmni Test Report

Date: 03/31/2011 11:54 AM

Test Protocol: Basic Test
 Sample: 160mg/L Phenol
 Toxicant: 160mg/L Phenol
 Reagent Lot no.: 10K1032
 Test description: Reference Toxicant
 Test name: RT033111VF
 Database file: C:\Program Files\MicrotoxOmni\Edge Analytical.mdb



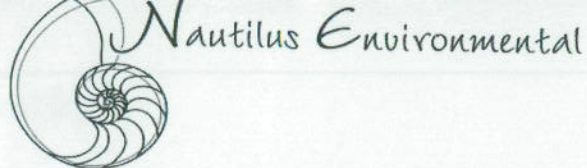
Sample	Conc	5 Mins Data:				15 Mins Data:		
		Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	95.21	91.27	0.9586 #		62.45	0.6559 #	
Control	0.000	95.78	90.90	0.9490 #		62.23	0.6497 #	
1	5.625	95.01	75.83	0.1951	16.32%	61.24	0.0128 *	1.264%
2	5.625	99.24	77.17	0.2266	18.48%	62.94	0.0293 *	2.849%
3	11.25	97.10	62.66	0.4781 #	32.35%	52.98	0.1965	16.42%
4	11.25	97.94	63.59	0.4691 #	31.93%	54.22	0.1792	15.20%
5	22.50	100.26	50.05	0.9107 #	47.66%	44.96	0.4558 #	31.31%
6	22.50	101.02	49.36	0.9521 #	48.77%	44.90	0.4688 #	31.92%
7	45.00	99.27	36.02	1.629 #	61.96%	34.25	0.8921 #	47.15%
8	45.00	100.13	36.63	1.607 #	61.65%	35.00	0.8676 #	46.46%

- used in calculation; * - invalid data; D - deleted from calcs.
 Autocalc has been used.

Calculations on 5 Mins data:
 EC50 Concentration: 25.53% (95% confidence range: 24.24 to 26.90)
 95% Confidence Factor: 1.054
 Estimating Equation: $\text{LOG C} = 1.124 \times \text{LOG G} + 1.407$
 Coeff. of Determination (R^2): 0.9958
 Slope: 0.8863
 Correction Factor: 0.9538

Calculations on 15 Mins data:
 EC50 Concentration: 51.61% (95% confidence range: 47.70 to 55.83)
 95% Confidence Factor: 1.082
 EC50 value was calculated from extrapolated data.
 Estimating Equation: $\text{LOG C} = 1.075 \times \text{LOG G} + 1.713$
 Coeff. of Determination (R^2): 0.9981
 Slope: 0.9286

APPENDIX F - Chain-of-Custody Forms



TESTING LOCATION (Please Check Box)

California

5550 Morehouse Drive, Suite 150
San Diego, CA 92121
Phone 858.587.7333
Fax 858.587.3961

Washington

5009 Pacific Highway East, Suite 2
Tacoma, WA 98424
Phone 253.922.4296
Fax 253.922.5814

British Columbia

8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773
Fax 604.357.1361

Chain of Custody

Date 3/30/11 Page 1 of 1

Sample Collection By: Floyd Snider

Report to: Enn Breckel
Company: Floyd Snider
Address: Two Union Square, 601 Union St, Suite 600
City/State/Zip: Seattle, WA 98101
Contact: Enn Breckel
Phone: 206-292-2078
Email: enn.breckel@floyd.snider.com

Invoice To:
Company: same
Address: _____
City/State/Zip: _____
Contact: _____
Phone: _____
Email: _____

ANALYSES REQUIRED			Receipt Temperature (°C)
10-day acute amphipod (Hyalella caelestis)	20-day chronic midge (Chironomus dubius)	15-min 100% porewater Miretox Backlog	
X	X	X	S11-039 8.1 ^(M) 7.5
X	X	X	S11-040 5.5
X	X	X	S11-041 7.5
X	X	X	S11-042 6.2
X	X	X	S11-043 8.2
X	X	X	S11-044 9.0
X	X	X	S11-045 5.5 8.2

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS
1 LL-SED1-0-15-032911	3/29/11	14:05	Sediment	Plastic Jar	3	Extra volume collected
2 LL-SED2-0-15-032911		12:00			3	↓
3 LL-SED3-0-15-032911		11:10			3	↓
4 LL-SED4-0-15-032911		13:10			3	↓
5 MC-SED1-0-10-032911		16:50			1	
6 MC-SED2-0-10-032911		16:35			1	
7 MC-SED3-0-10-032911		16:15			1	

PROJECT INFORMATION		SAMPLE RECEIPT		RELINQUISHED BY (CLIENT)		RELINQUISHED BY (COURIER)	
Client:		Total No. of Containers	15	(Signature)	<u>Enn Breckel</u>	(Signature)	
PO No.:		Received Good Condition?	✓	(Time)	10:40	(Time)	
Shipped Via:		Matches Test Schedule?	✓	(Printed Name)	Enn Breckel	(Printed Name)	
SPECIAL INSTRUCTIONS/COMMENTS:				(Date)	3/30/11	(Date)	
				(Company)	Floyd Snider	(Company)	
				RECEIVED BY (COURIER)		RECEIVED BY (LABORATORY)	
(Signature)		(Signature)	<u>Maria Brayfield</u>				
(Time)		(Time)	1040				
(Printed Name)		(Printed Name)	Maria Brayfield				
(Date)		(Date)	3/30/11				
(Company)		(Company)	Nautilus Log-in's above				

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

APPENDIX A - Results Summaries

**Appendix A-1. 20-Day Solid Phase *Chironomus dilutus* Survival & Growth
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: April 13, 2011

^aNumber of pupae and flies

^bAFDW = Ash-Free Dry Weight. Weights are for larvae only, not pupated animals

^cOne-tailed t-test. Survival data arcsine square-root transformed prior to analysis. Growth data either square root or log transformed prior to analysis Alpha = 0.05

Shaded values fail RSET one-hit criteria (Test sediment mortality - Control sediment mortality >25% and significantly different; Test sediment Growth/Control sediment Growth <0.7 and significantly different)

Replicates colored blue had *Chaoborus* in the samples

Site	Replicate	Rnd. No.	# Alive	# Pupated ^a	% Mortality	Mean % Mortality	St Dev	Total org AFDW (mg) ^b	AFDW per Org (mg)	Mean AFDW per Org (mg)	St Dev	Significant Decrease Compared to Control ^c	
												Survival	Growth
Control	1	153	11	0	8.3			3.68	0.33				
	2	130	12	0	0.0			4.67	0.39				
	3	150	11	0	8.3			5.55	0.50				
	4	144	12	0	0.0	7.3	5.3	4.72	0.39	0.41	0.06	--	--
	5	138	11	0	8.3			3.81	0.35				
	6	148	11	0	8.3			4.45	0.40				
	7	163	11	0	8.3			5.16	0.47				
	8	116	10	0	16.7			4.65	0.47				
LL- SED 1	1	139	5	0	58.3			4.25	0.85				
	2	122	2	0	83.3			2.94	1.47				
	3	158	9	0	25.0			8.20	0.91				
	4	107	4	0	66.7	31.3	33.6	6.62	1.66	1.02	0.35	No	No
	5	108	12	0	0.0			11.88	0.99				
	6	119	12	0	0.0			9.57	0.80				
	7	140	12	0	0.0			8.68	0.72				
	8	136	10	0	16.7			7.56	0.76				
LL- SED 2	1	101	2	0	83.3			1.32	0.66				
	2	141	1	0	91.7			0.39	0.39				
	3	128	1	0	91.7			0.23	0.23				
	4	154	7	0	41.7	77.1	18.2	3.87	0.55	0.85	0.46	Yes	No
	5	161	5	0	58.3			5.37	1.07				
	6	155	3	0	75.0			3.08	1.03				
	7	146	1	0	91.7			1.39	1.39				
	8	131	2	0	83.3			2.97	1.49				
LL- SED 3	1	112	8	0	33.3			13.30	1.66				
	2	117	4	0	66.7			7.47	1.87				
	3	115	11	0	8.3			15.27	1.39				
	4	113	11	0	8.3	30.2	27.8	13.13	1.19	1.41	0.29	Yes	No
	5	156	4	0	66.7			5.86	1.47				
	6	124	11	0	8.3			12.62	1.15				
	7	157	12	0	0.0			11.74	0.98				
	8	111	6	0	50.0			9.49	1.58				

**Appendix A-1. 20-Day Solid Phase *Chironomus dilutus* Survival & Growth
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: April 13, 2011

^aNumber of pupae and flies

^bAFDW = Ash-Free Dry Weight. Weights are for larvae only, not pupated animals

^cOne-tailed t-test. Survival data arcsine square-root transformed prior to analysis. Growth data either square root or log transformed prior to analysis Alpha = 0.05

Shaded values fail RSET one-hit criteria (Test sediment mortality - Control sediment mortality >25% and significantly different; Test sediment Growth/Control sediment Growth <0.7 and significantly different)

Replicates colored blue had Chaoborus in the samples

Site	Replicate	Rnd. No.	# Alive	# Pupated ^a	% Mortality	Mean % Mortality	St Dev	Total org AFDW (mg) ^b	AFDW per Org (mg)	Mean AFDW per Org (mg)	St Dev	Significant Decrease Compared to Control ^c	
												Survival	Growth
LL- SED 4	1	162	9	0	25.0			4.22	0.47				
	2	135	8	0	33.3			3.46	0.43				
	3	126	7	0	41.7			7.78	1.11				
	4	102	5	0	58.3	31.3	19.3	10.59	2.12	1.01	0.53	Yes	No
	5	118	12	0	0.0			10.27	0.86				
	6	132	7	0	41.7			8.42	1.20				
	7	110	11	0	8.3			10.59	0.96				
	8	123	7	0	41.7			6.53	0.93				
MC- SED 1	1	147	7	0	41.7			8.96	1.28				
	2	125	8	0	33.3			12.38	1.55				
	3	160	8	0	33.3			7.84	0.98				
	4	137	9	0	25.0	25.0	12.6	12.75	1.42	1.19	0.36	Yes	No
	5	145	11	0	8.3			10.41	0.95				
	6	159	10	0	16.7			10.13	1.01				
	7	152	11	0	8.3			6.71	0.61				
	8	104	8	0	33.3			13.59	1.70				
MC- SED 2	1	121	9	0	25.0			12.33	1.37				
	2	164	9	0	25.0			9.19	1.02				
	3	151	8	0	33.3			8.87	1.11				
	4	103	8	0	33.3	20.8	10.9	11.14	1.39	1.22	0.22	Yes	No
	5	114	10	0	16.7			15.86	1.59				
	6	127	10	0	16.7			10.84	1.08				
	7	129	10	0	16.7			9.44	0.94				
	8	109	12	0	0.0			14.74	1.23				
MC- SED 3	9	120	8	0	33.3			10.60	1.33				
	10	149	10	0	16.7			10.75	1.08				
	11	143	9	0	25.0			8.98	1.00				
	12	142	9	0	25.0	30.2	10.9	10.95	1.22	1.28	0.21	Yes	No
	13	133	6	0	50.0			9.83	1.64				
	14	134	7	0	41.7			10.39	1.48				
	15	105	9	0	25.0			12.04	1.34				
	16	106	9	0	25.0			10.69	1.19				

**Appendix Table A-2. *Hyalella azteca* 10-day Survival
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: April 5, 2011

Site	Rep	# Alive	% Mortality	Mean % Mortality	St. Dev.	Significant Decrease Compared to Control ^a
Control	1	10	0	3.8	5.2	--
	2	9	10			
	3	10	0			
	4	10	0			
	5	10	0			
	6	9	10			
	7	10	0			
	8	9	10			
LL-SED 1	1	9	10	5.0	7.6	
	2	10	0			
	3	10	0			
	4	10	0			
	5	9	10			
	6	10	0			
	7	10	0			
	8	8	20			
LL-SED 2	1	10	0	3.8	5.2	
	2	10	0			
	3	10	0			
	4	9	10			
	5	9	10			
	6	9	10			
	7	10	0			
	8	10	0			
LL-SED 3	1	10	0	3.8	5.2	
	2	9	10			
	3	10	0			
	4	10	0			
	5	10	0			
	6	9	10			
	7	10	0			
	8	9	10			
LL-SED 4	1	10	0	0.0	0.0	
	2	10	0			
	3	10	0			
	4	10	0			
	5	10	0			
	6	10	0			
	7	10	0			
	8	10	0			
MC-SED 1	1	10	0	6.3	7.4	
	2	10	0			
	3	9	10			
	4	9	10			
	5	10	0			
	6	10	0			
	7	9	10			
	8	8	20			
MC-SED 2	1	10	0	3.8	5.2	
	2	10	0			
	3	9	10			
	4	9	10			
	5	10	0			
	6	10	0			
	7	10	0			
	8	9	10			
MC-SED 3	1	9	10	8.8	6.4	
	2	9	10			
	3	10	0			
	4	9	10			
	5	8	20			
	6	9	10			
	7	10	0			
	8	9	10			

**Appendix Table A-3. Microtox 100 Percent Sediment Porewater Test
Port of Seattle Lora Lake RIFS Sediment Characterization
Client Floyd-Snider
Test Date: 3/31/2011**

Site	Light Reading								T _(mean) / C _(mean)	Quality Control Steps	
	Reading	Replicate					Mean	St.Dev.		F _{c(mean)} /I _{c(mean)}	Evaluation of initial light output in site sediments (0)T _(mean) /I _{(0)C_(mean)}
		1	2	3	4	5					
CON	I ₍₀₎	99	105	106	112	110	106				
	I ₍₅₎	93	99	97	106	100	99		0.93		
	I ₍₁₅₎	82	91	87	94	87	88		0.83		
	C ₍₅₎	0.94	0.94	0.92	0.95	0.91	0.93	0.02			
	C ₍₁₅₎	0.83	0.87	0.82	0.84	0.79	0.83	0.03			
LL Sed 1	I ₍₀₎	91	83	85	86	70	83				0.78
	I ₍₅₎	83	78	81	79	62	77				
	I ₍₁₅₎	73	69	75	68	58	69				
	T ₍₅₎	0.91	0.94	0.95	0.92	0.89	0.92	0.03	0.99		
	T ₍₁₅₎	0.80	0.83	0.88	0.79	0.83	0.83	0.04	1.00		
LL Sed 2	I ₍₀₎	66	61	62	70	65	65				0.61
	I ₍₅₎	63	57	59	65	62	61				
	I ₍₁₅₎	59	54	55	60	56	57				
	T ₍₅₎	0.95	0.93	0.95	0.93	0.95	0.94	0.01	1.02		
	T ₍₁₅₎	0.89	0.89	0.89	0.86	0.86	0.88	0.02	1.06		
LL Sed 3	I ₍₀₎	80	77	76	79	77	78				0.73
	I ₍₅₎	75	75	69	73	72	73				
	I ₍₁₅₎	68	60	61	66	65	64				
	T ₍₅₎	0.94	0.97	0.91	0.92	0.94	0.94	0.02	1.01		
	T ₍₁₅₎	0.85	0.78	0.80	0.84	0.84	0.82	0.03	0.99		
LL Sed 4	I ₍₀₎	67	76	70	68	67	70				0.65
	I ₍₅₎	65	70	65	68	63	66				
	I ₍₁₅₎	59	60	56	58	56	58				
	T ₍₅₎	0.97	0.92	0.93	1.00	0.94	0.95	0.03	1.02		
	T ₍₁₅₎	0.88	0.79	0.80	0.85	0.84	0.83	0.04	1.00		

I₍₀₎ is the light reading after the initial five minute incubation period

I₍₅₎ is the light reading five minutes after I₍₀₎

I₍₁₅₎ is the light reading fifteen minutes after I₍₀₎

C_(t), R_(t), and T_(t) are the changes in light readings from the initial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

I₍₅₎:F_{c(mean)}/I_{c(mean)}: **93% YES**

I₍₁₅₎:F_{c(mean)}/I_{c(mean)}: **83% YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable (use reference sediment for statistical analysis if available).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

LL Sed 1 I_{T(mean)}/I_{C(mean)}: **78% NO**

LL Sed 2 I_{T(mean)}/I_{C(mean)}: **61% NO**

LL Sed 3 I_{T(mean)}/I_{C(mean)}: **73% NO**

LL Sed 4 I_{T(mean)}/I_{C(mean)}: **65% NO**

INVALID: If the test sediment is greater than 110%, the results in uninterpretable

YES: If test sediment is reference, reference is acceptable

**Appendix Table A-3. Microtox 100 Percent Sediment Porewater Test
Port of Seattle Lora Lake RIFS Sediment Characterization
Client Floyd-Snider
Test Date: 3/31/2011**

Site	Light Reading								T _(mean) / C _(mean)	Quality Control Steps	
	Reading	Replicate					Mean	St.Dev.		F _{c(mean)} /I _{c(mean)}	Evaluation of initial light output in site sediments (0)T _(mean) /I _{(0)C_(mean)}
		1	2	3	4	5					
CON	I ₍₀₎	94	98	96	99	94	96				
	I ₍₅₎	90	91	89	90	91	90			0.94	
	I ₍₁₅₎	91	89	84	84	82	86			0.89	
	C ₍₅₎	0.96	0.93	0.93	0.91	0.97	0.94	0.02			
	C ₍₁₅₎	0.97	0.91	0.88	0.85	0.87	0.89	0.05			
MC Sed 1	I ₍₀₎	100	94	89	97	94	95				0.99
	I ₍₅₎	89	91	85	90	91	89				
	I ₍₁₅₎	82	86	79	83	81	82				
	T ₍₅₎	0.89	0.97	0.96	0.93	0.97	0.94	0.03	1.00		
	T ₍₁₅₎	0.82	0.91	0.89	0.86	0.86	0.87	0.04	0.97		
MC Sed 2	I ₍₀₎	88	85	86	85	86	86				0.89
	I ₍₅₎	86	83	83	82	86	84				
	I ₍₁₅₎	79	76	77	76	81	78				
	T ₍₅₎	0.98	0.98	0.97	0.96	1.00	0.98	0.01	1.04		
	T ₍₁₅₎	0.90	0.89	0.90	0.89	0.94	0.90	0.02	1.01		
MC Sed 3	I ₍₀₎	89	90	90	90	85	89				0.92
	I ₍₅₎	84	85	87	90	79	85				
	I ₍₁₅₎	77	80	77	79	76	78				
	T ₍₅₎	0.94	0.94	0.97	1.00	0.93	0.96	0.03	1.02		
	T ₍₁₅₎	0.87	0.89	0.86	0.88	0.89	0.88	0.02	0.98		
	I ₍₀₎						#DIV/0!				#DIV/0!
	I ₍₅₎						#DIV/0!				
	I ₍₁₅₎						#DIV/0!				
	T ₍₅₎	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		
	T ₍₁₅₎	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		

I₍₀₎ is the light reading after the initial five minute incubation period

I₍₅₎ is the light reading five minutes after I₍₀₎

I₍₁₅₎ is the light reading fifteen minutes after I₍₀₎

C_(t), R_(t), and T_(t) are the changes in light readings from the initial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 72% control initial mean output?

I₍₅₎:F_{c(mean)}/I_{c(mean)}: **94% YES**

I₍₁₅₎:F_{c(mean)}/I_{c(mean)}: **89% YES**

YES: Control results are acceptable and can be used for statistical analyses.

NO: Control results are unacceptable (use reference sediment for statistical analysis if available).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

MC Sed 1 I_{T(mean)}/I_{C(mean)}: **99% YES**

MC Sed 2 I_{T(mean)}/I_{C(mean)}: **89% YES**

MC Sed 3 I_{T(mean)}/I_{C(mean)}: **92% YES**

0 I_{T(mean)}/I_{C(mean)}: **#DIV/0! #DIV/0!**

INVALID: If the test sediment is greater than 110%, the results in uninterpretable

YES: If test sediment is reference, reference is acceptable

APPENDIX B - Statistical Analyses

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: LL-Sed2
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 77.088
 SD: 18.234
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 9.073 SS: 1563.927 K: 8 b: 36.139 Alpha Level: 0.05 Calculated Value: 0.8351 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 9.518 Test Residual SD: 6.647 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.9531 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 64 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	83.3	12.5	8.3	5	3.189	3.264	1.5		-22.468
2	91.7	15	0	1.5	10.565	13.48	1.5		-13.48
3	91.7	15	8.3	5	10.565	3.264	5		-13.48
4	41.7	9	0	1.5	22.468	13.48	5		-12.913
5	58.3	10	8.3	5	12.913	3.264	5		-2.691
6	75	11	8.3	5	2.691	3.264	5		3.189
7	91.7	15	8.3	5	10.565	3.264	5		3.189
8	83.3	12.5	16.7	8	3.189	10.64	8		3.264
9							9		3.264
10							10		3.264
11							11		3.264
12							12.5		3.264
13							12.5		10.565
14							15		10.565
15							15		10.565
16							15		10.64

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: LL-Sed4
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 31.25
 SD: 19.294
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 11.046 SS: 2318.443 K: 8 b: 44.941 Alpha Level: 0.05 Calculated Value: 0.8711 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 11.98 Test Residual SD: 9.565 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 1.3803 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 53.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	25	11	8.3	6.5	1.554	3.264	2		-31.554
2	33.3	12	0	2	3.69	13.48	2		-14.81
3	41.7	14	8.3	6.5	8.668	3.264	2		-13.48
4	58.3	16	0	2	18.224	13.48	6.5		-13.48
5	0	2	8.3	6.5	31.554	3.264	6.5		-1.554
6	41.7	14	8.3	6.5	8.668	3.264	6.5		3.264
7	8.3	6.5	8.3	6.5	14.81	3.264	6.5		3.264
8	41.7	14	16.7	10	8.668	10.64	6.5		3.264
9							6.5		3.264
10							10		3.264
11							11		3.69
12							12		8.668
13							14		8.668
14							14		8.668
15							14		10.64
16							16		18.224

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: MC-Sed1
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 24.988
 SD: 12.605
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 7.601 SS: 1097.734 K: 8 b: 30.434 Alpha Level: 0.05 Calculated Value: 0.8438 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 7.494 Test Residual SD: 4.114 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.3344 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 56.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	41.7	16	8.3	6	11.027	3.264	1.5		-13.48
2	33.3	14	0	1.5	6.049	13.48	1.5		-13.48
3	33.3	14	8.3	6	6.049	3.264	6		-12.451
4	25	12	0	1.5	0.805	13.48	6		-12.451
5	8.3	6	8.3	6	12.451	3.264	6		-5.075
6	16.7	10.5	8.3	6	5.075	3.264	6		0.805
7	8.3	6	8.3	6	12.451	3.264	6		3.264
8	33.3	14	16.7	10.5	6.049	10.64	6		3.264
9							6		3.264
10							10.5		3.264
11							10.5		3.264
12							12		6.049
13							14		6.049
14							14		6.049
15							14		10.64
16							16		11.027

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: MC-Sed2
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 20.838
 SD: 10.895
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Chironomid Mortality
 Replicates: 8
 Mean: 7.275
 SD: 5.344
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 8.633 SS: 1416.094 K: 8 b: 34.222 Alpha Level: 0.05 Calculated Value: 0.827 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 7.266 Test Residual SD: 8.14 Ref. Residual Mean: 6.74 Ref. Residual SD: 4.877 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.1567 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 55.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: No Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	25	13.5	8.3	6	4.644	3.264	2		-25.356
2	25	13.5	0	2	4.644	13.48	2		-13.48
3	33.3	15.5	8.3	6	9.888	3.264	2		-13.48
4	33.3	15.5	0	2	9.888	13.48	6		-1.236
5	16.7	10.5	8.3	6	1.236	3.264	6		-1.236
6	16.7	10.5	8.3	6	1.236	3.264	6		-1.236
7	16.7	10.5	8.3	6	1.236	3.264	6		3.264
8	0	2	16.7	10.5	25.356	10.64	6		3.264
9							10.5		3.264
10							10.5		3.264
11							10.5		3.264
12							10.5		4.644
13							13.5		4.644
14							13.5		9.888
15							15.5		9.888
16							15.5		10.64

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: LL-Sed-1
 Alias: Hyalella Mortality
 Replicates: 8
 Mean: 5
 SD: 7.559
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Hyalella Mortality
 Replicates: 8
 Mean: 3.75
 SD: 5.175
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 8.943 SS: 1519.604 K: 8 b: 32.924 Alpha Level: 0.05 Calculated Value: 0.7133 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 9.912 Test Residual SD: 3.712 Ref. Residual Mean: 8.641 Ref. Residual SD: 2.385 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 0.8143 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \geq x2$ Alternate: $x1 < x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 30.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: Yes Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	10	13	0	5.5	10.506	6.913	5.5		-7.929
2	0	5.5	10	13	7.929	11.522	5.5		-7.929
3	0	5.5	0	5.5	7.929	6.913	5.5		-7.929
4	0	5.5	0	5.5	7.929	6.913	5.5		-7.929
5	10	13	0	5.5	10.506	6.913	5.5		-7.929
6	0	5.5	10	13	7.929	11.522	5.5		-6.913
7	0	5.5	0	5.5	7.929	6.913	5.5		-6.913
8	20	16	10	13	18.636	11.522	5.5		-6.913
9							5.5		-6.913
10							5.5		-6.913
11							13		10.506
12							13		10.506
13							13		11.522
14							13		11.522
15							13		11.522
16							16		18.636

Project Name: Port of Seattle Lora Lake RIFS Sediment Characterization

Sample: x1
 Samp ID: MC-Sed1
 Alias: Amphipod Mortality
 Replicates: 8
 Mean: 6.25
 SD: 7.44
 Tr Mean: N/A
 Trans SD: N/A

Ref Samp: x2
 Ref ID: Control
 Alias: Amphipod Mortality
 Replicates: 8
 Mean: 3.75
 SD: 5.175
 Tr Mean: N/A
 Trans SD: N/A

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 8.958 SS: 1524.616 K: 8 b: 34.894 Alpha Level: 0.05 Calculated Value: 0.7986 Critical Value: ≤ 0.887 Normally Distributed: No Override Option: Not Invoked	Test Residual Mean: 10.234 Test Residual SD: 2.661 Ref. Residual Mean: 8.641 Ref. Residual SD: 2.385 Deg. of Freedom: 14 Alpha Level: 0.1 Calculated Value: 1.2603 Critical Value: ≥ 1.761 Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$ Mann-Whitney N1: 8 Mann-Whitney N2: 8 Degrees of Freedom: Experimental Alpha Level: 0.05 Calculated Value: 37.5 Critical Value: ≥ 49.000 Accept Null Hypothesis: Yes Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0	5	0	5	10.234	6.913	5		-10.234
2	0	5	10	12.5	10.234	11.522	5		-10.234
3	10	12.5	0	5	8.201	6.913	5		-10.234
4	10	12.5	0	5	8.201	6.913	5		-10.234
5	0	5	0	5	10.234	6.913	5		-6.913
6	0	5	10	12.5	10.234	11.522	5		-6.913
7	10	12.5	0	5	8.201	6.913	5		-6.913
8	20	16	10	12.5	16.331	11.522	5		-6.913
9							5		-6.913
10							12.5		8.201
11							12.5		8.201
12							12.5		8.201
13							12.5		11.522
14							12.5		11.522
15							12.5		11.522
16							16		16.331

APPENDIX C - Water Quality Summaries

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
 Port of Seattle Lora Lake RIFS Sediment Characterization
 Water Quality Data**

Initiated 13 April 2011

Control								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃ (mg/l)	Total Sulfides (mg/l)
0	19.6	8.1	6.75	131	52	68	<1.0	0.015
1	19.9	7.0	6.84	127	---	---	---	---
2	19.7	6.8	7.09	145	---	---	---	---
3	19.6	6.5	7.12	137	---	---	---	---
4	19.5	6.4	7.11	139	---	---	---	---
5	19.6	6.3	7.11	140	64	92	<1.0	<0.010
6	19.7	7.2	7.38	165	---	---	---	---
7	19.8	5.7	7.24	173	---	---	---	---
8	19.8	5.3	7.30	175	---	---	---	---
9	19.6	5.4	7.10	178	---	---	---	---
10	19.7	5.9	7.28	174	72	88	1.2	<0.010
11	19.4	6.0	7.48	171	---	---	---	---
12	19.7	6.7	7.44	170	---	---	---	---
13	19.8	5.7	7.10	175	---	---	---	---
14	19.9	4.8	7.09	171	---	---	---	---
15	19.8	4.6	7.07	165	80	96	<1.0	<0.010
16	19.7	4.3	7.06	166	---	---	---	---
17	19.8	4.3	7.10	166	---	---	---	---
18	19.7	4.4	7.07	168	---	---	---	---
19	19.8	4.0	6.88	221	---	---	---	---
20	19.9	4.0	6.93	176	80	88	3.2	<0.010
Mean	19.7	5.7	7.12	163	70	86	nc	nc
Min	19.4	4.0	6.75	127	52	68	<1.0	<0.010
Max	19.9	8.1	7.48	221	80	96	3.2	0.015

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Sulfides (mg/l)
0	19.5	7.0	7.27	169	76	96	<1.0	0.011
1	19.7	5.7	7.05	171	---	---	---	---
2	19.6	5.7	7.08	173	---	---	---	---
3	19.6	5.8	7.10	173	---	---	---	---
4	19.5	5.7	7.12	177	---	---	---	---
5	19.6	5.8	7.11	174	76	84	<1.0	<0.010
6	19.7	5.8	7.16	166	---	---	---	---
7	19.8	3.9	7.03	171	---	---	---	---
8	19.7	5.0	7.15	172	---	---	---	---
9	19.6	5.0	7.00	173	---	---	---	---
10	19.6	5.0	7.21	169	72	88	<1.0	<0.010
11	19.5	5.4	7.34	169	---	---	---	---
12	19.7	5.4	7.40	169	---	---	---	---
13	19.7	5.6	7.07	175	---	---	---	---
14	19.7	4.6	7.30	172	---	---	---	---
15	19.7	5.0	7.06	172	76	96	<1.0	<0.010
16	19.6	4.5	7.10	171	---	---	---	---
17	19.8	4.3	7.08	172	---	---	---	---
18	19.7	4.2	7.10	172	---	---	---	---
19	19.6	4.2	6.99	188	---	---	---	---
20	19.6	4.0	6.90	173	88	100	3.0	<0.010
Mean	19.6	5.1	7.12	172	78	93	nc	nc
Min	19.5	3.9	6.90	166	72	84	<1.0	<0.010
Max	19.8	7.0	7.40	188	88	100	3.0	0.011

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Sulfides (mg/l)
0	19.7	6.1	7.12	174	84	104	6.1	0.036
1	19.9	4.6	6.89	179	---	---	---	---
2	19.7	4.9	6.96	173	---	---	---	---
3	19.6	4.8	7.01	174	---	---	---	---
4	19.5	4.9	7.02	175	---	---	---	---
5	19.6	4.9	6.96	174	72	88	9.5	<0.010
6	19.7	5.6	7.05	166	---	---	---	---
7	19.9	5.1	7.09	168	---	---	---	---
8	19.7	5.2	7.09	167	---	---	---	---
9	19.5	5.6	7.02	166	---	---	---	---
10	19.6	5.3	7.12	161	64	76	2.1	<0.010
11	19.4	5.9	7.24	161	---	---	---	---
12	19.8	5.8	7.23	159	---	---	---	---
13	19.6	6.3	7.05	160	---	---	---	---
14	19.6	5.8	7.11	155	---	---	---	---
15	19.7	5.6	7.06	150	76	76	<1.0	0.010
16	19.6	5.0	6.95	148	---	---	---	---
17	19.8	4.8	6.99	149	---	---	---	---
18	19.7	4.6	7.00	150	---	---	---	---
19	19.7	4.4	6.97	158	---	---	---	---
20	19.7	4.1	6.90	156	76	92	2.7	<0.010
Mean	19.7	5.2	7.04	163	74	87	nc	nc
Min	19.4	4.1	6.89	148	64	76	<1.0	<0.010
Max	19.9	6.3	7.24	179	84	104	9.5	0.036

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
 Port of Seattle Lora Lake RIFS Sediment Characterization
 Water Quality Data**

Initiated 13 April 2011

LL-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Sulfides (mg/l)
0	19.6	6.8	7.29	165	72	100	<1.0	0.020
1	19.9	6.3	7.10	166	---	---	---	---
2	19.7	6.3	7.12	166	---	---	---	---
3	19.6	6.2	7.11	167	---	---	---	---
4	19.6	6.3	7.12	167	---	---	---	---
5	19.6	6.2	7.09	166	72	96	<1.0	<0.010
6	19.8	6.3	7.20	166	---	---	---	---
7	19.8	5.8	7.21	169	---	---	---	---
8	19.8	6.0	7.20	171	---	---	---	---
9	19.7	5.6	7.12	172	---	---	---	---
10	19.5	6.1	7.29	166	68	88	<1.0	<0.010
11	19.4	6.0	7.35	165	---	---	---	---
12	19.6	6.3	7.31	164	---	---	---	---
13	19.6	6.6	7.09	166	---	---	---	---
14	19.7	6.0	7.22	163	---	---	---	---
15	19.6	6.1	7.13	158	68	100	<1.0	0.033
16	19.6	4.7	6.97	156	---	---	---	---
17	19.7	4.8	7.06	159	---	---	---	---
18	19.8	4.8	7.00	156	---	---	---	---
19	19.6	4.2	6.91	166	---	---	---	---
20	19.6	4.1	6.95	161	80	96	3.1	<0.010
Mean	19.7	5.8	7.14	165	72	96	nc	nc
Min	19.4	4.1	6.91	156	68	88	<1.0	<0.010
Max	19.9	6.8	7.35	172	80	100	3.1	0.033

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

LL-SED-4								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.5	6.6	7.35	165	76	96	<1.0	0.029
1	19.8	5.3	7.08	162	---	---	---	---
2	19.7	5.7	7.12	169	---	---	---	---
3	19.6	5.4	7.14	168	---	---	---	---
4	19.7	5.5	7.13	169	---	---	---	---
5	19.6	5.2	7.11	170	80	100	<1.0	<0.010
6	19.7	5.8	7.19	169	---	---	---	---
7	19.6	5.0	7.19	171	---	---	---	---
8	19.7	5.2	7.23	171	---	---	---	---
9	19.6	4.9	7.10	151	---	---	---	---
10	19.6	5.2	7.30	171	76	88	<1.0	0.013
11	19.4	5.4	7.53	174	---	---	---	---
12	19.7	6.2	7.28	168	---	---	---	---
13	19.7	5.3	7.23	179	---	---	---	---
14	19.6	5.0	7.27	174	---	---	---	---
15	19.5	4.6	7.10	169	88	88	<1.0	0.023
16	19.5	4.7	7.07	164	---	---	---	---
17	19.6	4.6	7.16	170	---	---	---	---
18	19.7	4.7	7.09	166	---	---	---	---
19	19.6	4.2	6.84	176	---	---	---	---
20	19.6	4.0	6.84	171	88	100	3.4	<0.010
Mean	19.6	5.2	7.16	169	82	94	nc	nc
Min	19.4	4.0	6.84	151	76	88	<1.0	<0.010
Max	19.8	6.6	7.53	179	88	100	3.4	0.029

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

MC-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.6	6.9	7.35	160	72	96	<1.0	<0.010
1	19.6	6.5	7.20	160	---	---	---	---
2	19.6	6.6	7.18	164	---	---	---	---
3	19.6	6.4	7.17	165	---	---	---	---
4	19.6	6.5	7.19	163	---	---	---	---
5	19.7	6.4	7.22	166	76	100	<1.0	<0.010
6	19.7	6.5	7.23	165	---	---	---	---
7	19.7	5.9	7.23	171	---	---	---	---
8	19.7	6.0	7.23	172	---	---	---	---
9	19.6	5.9	7.13	176	---	---	---	---
10	19.6	6.1	7.25	164	80	88	<1.0	<0.010
11	19.3	6.3	7.21	169	---	---	---	---
12	19.7	6.1	7.23	168	---	---	---	---
13	19.6	6.1	7.10	169	---	---	---	---
14	19.7	5.3	7.19	164	---	---	---	---
15	19.6	4.9	7.13	162	80	120	<1.0	<0.010
16	19.7	4.4	7.05	162	---	---	---	---
17	19.7	4.5	7.05	165	---	---	---	---
18	19.8	4.4	7.00	166	---	---	---	---
19	19.7	4.0	6.93	173	---	---	---	---
20	19.6	4.1	6.93	167	80	104	2.9	<0.010
Mean	19.6	5.7	7.15	166	78	102	nc	nc
Min	19.3	4.0	6.93	160	72	88	<1.0	<0.010
Max	19.8	6.9	7.35	176	80	120	2.9	0.000

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

MC-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.7	7.3	7.40	134	80	88	<1.0	<0.010
1	19.6	6.8	7.26	163	---	---	---	---
2	19.6	7.1	7.26	166	---	---	---	---
3	19.5	7.0	7.27	167	---	---	---	---
4	19.4	7.0	7.27	165	---	---	---	---
5	19.7	6.8	7.26	166	96	104	<1.0	<0.010
6	19.7	7.2	7.29	164	---	---	---	---
7	19.8	6.4	7.26	169	---	---	---	---
8	19.7	6.0	7.23	171	---	---	---	---
9	19.6	6.0	7.13	175	---	---	---	---
10	19.5	6.2	7.30	170	76	92	<1.0	<0.010
11	19.3	6.1	7.31	168	---	---	---	---
12	19.7	6.0	7.33	168	---	---	---	---
13	19.5	5.5	7.12	170	---	---	---	---
14	19.7	5.2	7.22	165	---	---	---	---
15	19.6	4.7	7.13	160	88	100	<1.0	<0.010
16	19.6	4.5	7.09	158	---	---	---	---
17	19.6	4.5	7.12	160	---	---	---	---
18	19.7	4.6	7.09	159	---	---	---	---
19	19.6	4.0	6.90	174	---	---	---	---
20	19.6	4.0	6.94	167	84	100	2.6	<0.010
Mean	19.6	5.9	7.20	165	85	97	nc	nc
Min	19.3	4.0	6.90	134	76	88	<1.0	<0.010
Max	19.8	7.3	7.40	175	96	104	2.6	<0.010

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 13 April 2011

MC-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Overlying Sulfides (mg/l)
0	19.8	7.8	7.43	155	80	88	<1.0	0.015
1	19.9	7.2	7.33	157	---	---	---	---
2	19.7	7.4	7.33	163	---	---	---	---
3	19.5	7.1	7.27	162	---	---	---	---
4	19.4	7.0	7.29	161	---	---	---	---
5	19.7	6.8	7.33	163	76	96	<1.0	<0.010
6	19.8	7.4	7.48	169	---	---	---	---
7	19.8	6.3	7.34	173	---	---	---	---
8	19.8	5.8	7.28	175	---	---	---	---
9	19.6	5.1	7.15	179	---	---	---	---
10	19.5	5.4	7.28	174	88	88	<1.0	<0.010
11	19.4	6.0	7.45	169	---	---	---	---
12	19.7	6.4	7.41	170	---	---	---	---
13	19.7	6.1	7.16	170	---	---	---	---
14	19.7	5.9	7.27	164	---	---	---	---
15	19.7	5.5	7.19	160	100	80	<1.0	<0.010
16	19.6	4.7	7.12	159	---	---	---	---
17	19.7	4.8	7.16	162	---	---	---	---
18	19.8	4.6	7.11	166	---	---	---	---
19	19.7	4.2	6.97	175	---	---	---	---
20	19.6	4.2	6.96	170	84	100	3.3	<0.010
Mean	19.7	6.0	7.25	166	86	90	nc	nc
Min	19.4	4.2	6.96	155	76	80	<1.0	<0.010
Max	19.9	7.8	7.48	179	100	100	3.3	0.015

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data
Initiated April 5, 2011**

Control								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Overlying NH ₃ (mg/l)	Overlying Sulfides (mg/l)
0	21.2	8.4	6.54	122	40	68	<1.0	<0.010
1	21.0	7.7	6.90	133	---	---	---	---
2	23.1	5.8	6.55	131	---	---	---	---
3	22.8	6.3	6.86	150	---	---	---	---
4	22.7	6.5	6.77	147	---	---	---	---
5	22.8	6.4	6.84	149	40	64	<1.0	<0.010
6	22.9	6.1	6.98	161	---	---	---	---
7	22.8	6.7	7.06	152	---	---	---	---
8	22.9	6.7	7.05	158	---	---	---	---
9	22.9	6.4	7.02	163	---	---	---	---
10	22.8	6.5	7.03	161	40	64	<1.0	0.010
Mean	22.5	6.7	6.87	148	40	65	nc	nc
Min	21.0	5.8	6.54	122	40	64	<1.0	<0.010
Max	23.1	8.4	7.06	163	40	68	<1.0	0.010

NC = Not Calculable

LL-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃ (mg/l)	Overlying Sulfides (mg/l)
0	21.2	7.2	7.33	167	72	88	1.1	0.035
1	21.2	7.0	7.33	167	---	---	---	---
2	23.0	5.3	7.04	175	---	---	---	---
3	22.9	4.7	7.07	173	---	---	---	---
4	22.8	5.3	7.02	172	---	---	---	---
5	22.9	5.2	7.05	174	72	92	<1.0	<0.010
6	22.9	5.2	7.19	171	---	---	---	---
7	22.9	5.6	7.19	167	---	---	---	---
8	22.9	5.5	7.20	173	---	---	---	---
9	22.9	5.4	7.16	174	---	---	---	---
10	22.8	5.6	7.21	175	72	88	<1.0	<0.010
Mean	22.6	5.6	7.16	172	72	89	nc	nc
Min	21.2	4.7	7.02	167	72	88	<1.0	<0.010
Max	23.0	7.2	7.33	175	72	92	1.1	0.035

NC = Not Calculable

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated April 5, 2011

LL-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.2	6.6	7.15	172	80	104	2.0	0.053
1	21.2	6.6	7.19	172	---	---	---	---
2	23.0	4.8	6.91	179	---	---	---	---
3	23.0	4.8	6.99	174	---	---	---	---
4	22.8	4.8	6.90	172	---	---	---	---
5	22.9	4.8	6.92	172	68	108	2.0	<0.010
6	22.9	4.9	7.02	164	---	---	---	---
7	23.0	4.9	6.93	162	---	---	---	---
8	22.9	5.3	6.94	166	---	---	---	---
9	23.0	5.4	6.99	163	---	---	---	---
10	22.8	5.3	7.02	161	72	104	<1.0	<0.010
Mean	22.6	5.3	7.00	169	73	105	nc	nc
Min	21.2	4.8	6.90	161	68	104	<1.0	<0.010
Max	23.0	6.6	7.19	179	80	108	2.0	0.053

NC = Not Calculable

LL-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.2	6.4	7.20	164	76	76	1.2	0.068
1	21.2	6.8	7.32	165	---	---	---	---
2	23.1	5.0	7.09	170	---	---	---	---
3	22.9	5.3	7.12	171	---	---	---	---
4	22.7	5.5	7.06	170	---	---	---	---
5	22.8	5.4	7.10	172	72	90	<1.0	<0.010
6	22.9	5.0	7.19	171	---	---	---	---
7	22.8	4.8	7.15	169	---	---	---	---
8	22.7	5.2	7.15	171	---	---	---	---
9	23.0	5.2	7.05	170	---	---	---	---
10	22.8	5.1	7.04	167	72	90	<1.0	<0.010
Mean	22.6	5.4	7.13	169	73	85	nc	nc
Min	21.2	4.8	7.04	164	72	76	<1.0	<0.010
Max	23.1	6.8	7.32	172	76	90	1.2	0.068

NC = Not Calculable

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data
Initiated April 5, 2011**

LL-SED-4								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.4	6.0	7.26	160	76	88	1.5	0.056
1	21.2	6.8	7.37	166	---	---	---	---
2	23.0	5.7	7.16	173	---	---	---	---
3	22.9	5.3	7.17	173	---	---	---	---
4	22.7	5.5	7.07	173	---	---	---	---
5	22.7	5.3	7.11	172	80	88	<1.0	<0.010
6	22.8	5.2	7.17	171	---	---	---	---
7	22.9	4.9	7.15	168	---	---	---	---
8	22.9	4.9	7.19	170	---	---	---	---
9	22.7	5.0	7.09	170	---	---	---	---
10	22.8	4.8	7.10	171	76	84	<1.0	<0.010
Mean	22.5	5.4	7.17	170	77	87	nc	nc
Min	21.2	4.8	7.07	160	76	84	<1.0	<0.010
Max	23.0	6.8	7.37	173	80	88	1.5	0.056

NC = Not Calculable

MC-SED-1								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.4	6.9	7.35	164	72	92	<1.0	<0.010
1	21.3	7.2	7.37	163	---	---	---	---
2	23.1	5.9	7.11	169	---	---	---	---
3	22.9	6.0	7.23	170	---	---	---	---
4	22.6	6.1	7.11	173	---	---	---	---
5	22.8	6.0	7.18	174	80	96	<1.0	<0.010
6	22.9	5.8	7.22	173	---	---	---	---
7	22.8	5.8	7.16	172	---	---	---	---
8	22.9	5.5	7.23	173	---	---	---	---
9	22.7	5.5	7.14	170	---	---	---	---
10	22.8	5.3	7.13	173	80	96	<1.0	<0.010
Mean	22.6	6.0	7.20	170	77	95	nc	nc
Min	21.3	5.3	7.11	163	72	92	<1.0	<0.010
Max	23.1	7.2	7.37	174	80	96	<1.0	<0.010

NC = Not Calculable

**Appendix Table B-2. Ten-Day Solid-Phase Results (*Hyalella Azteca*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated April 5, 2011

MC-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.3	7.8	7.44	163	68	92	<1.0	<0.010
1	21.2	7.5	7.47	162	---	---	---	---
2	23.1	6.2	7.25	170	---	---	---	---
3	22.8	6.0	7.28	171	---	---	---	---
4	22.7	6.4	7.16	171	---	---	---	---
5	22.7	6.2	7.21	173	80	100	<1.0	<0.010
6	22.9	6.2	7.29	171	---	---	---	---
7	23.0	5.9	7.27	171	---	---	---	---
8	23.0	5.8	7.30	175	---	---	---	---
9	23.0	5.9	7.22	175	---	---	---	---
10	22.8	6.0	7.24	175	80	100	<1.0	0.013
Mean	22.6	6.4	7.28	171	76	97	nc	nc
Min	21.2	5.8	7.16	162	68	92	<1.0	<0.010
Max	23.1	7.8	7.47	175	80	100	<1.0	0.013

NC = Not Calculable

MC-SED-3								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH ₃	Overlying Sulfides (mg/l)
0	21.3	7.8	7.39	159	68	84	<1.0	<0.010
1	21.2	7.5	7.46	161	---	---	---	---
2	23.2	6.4	7.27	166	---	---	---	---
3	22.9	6.1	7.28	167	---	---	---	---
4	22.7	6.5	7.19	167	---	---	---	---
5	22.7	6.4	7.21	166	84	88	<1.0	<0.010
6	22.9	6.4	7.33	169	---	---	---	---
7	23.0	6.2	7.32	168	---	---	---	---
8	22.9	6.4	7.39	171	---	---	---	---
9	23.1	6.1	7.30	173	---	---	---	---
10	22.9	5.9	7.30	172	80	84	<1.0	<0.010
Mean	22.6	6.5	7.31	167	77	85	nc	nc
Min	21.2	5.9	7.19	159	68	84	<1.0	<0.010
Max	23.2	7.8	7.46	173	84	88	<1.0	<0.010

NC = Not Calculable

APPENDIX D - Laboratory Bench Sheets

20 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 20 day Survival

Client: Flood Snider
 Test #: 1104-TD18 thru 1104-TD24

Start Date & Time: 4/13/11 1330
 End Date & Time: 5/3/11 1330
 Test Organism: Chironomus dilutus

Site	Rep #	Cont #	Day 0	Survival Day 20				Initials/Comments
				total	#larvae	#pupae	#flies	
CON	1	153	12	11	11	0	0	X
	2	130	12	12	12	0	0	(M)
	3	150	12	11	11	0	0	CC
	4	144	12	12	12	0	0	BP
	5	138	12	11	11	0	0	X
	6	148	12	11	11	0	0	(M)
	7	163	12	11	11	0	0	CC
	8	116	12	10	10	0	0	X
LL-SED 1	1	139	12	5	5	0	0	X
	2	122	12	2	2	0	0	CC *
	3	158	12	9*	9	0	0	BP
	4	107	12	4	4	0	0	(M)
	5	108	12	12*	12	0	0	X
	6	119	12	12	12	0	0	CC
	7	140	12	12	12	0	0	BP
	8	136	12	10*	10	0	0	(M)
LL-SED 2	1	101	12	2	2	0	0	(M)
	2	141	12	1	1	0	0	BP #1
	3	128	12	8	8	0	0	X
	4	154	12	7	7	0	0	X
	5	161	12	5	5	0	0	BP
	6	155	12	3	3	0	0	CC
	7	146	12	1	1	0	0	(M)
	8	131	12	2	2	0	0	X
LL-SED 3	1	112	12	8	8	0	0	BP
	2	117	12	4	4	0	0	CC
	3	115	12	11	11	0	0	X
	4	113	12	11	11	0	0	BP
	5	150	12	4	4	0	0	(M)
	6	124	12	11	11	0	0	X
	7	157	12	12	12	0	0	BP
	8	111	12	6	6	0	0	CC
LL-SED 4	1	162	12	9	9	0	0	X *
	2	135	12	8	8	0	0	(M) *
	3	126	12	7	7	0	0	BP
	4	102	12	5	5	0	0	CC
	5	118	12	12	12	0	0	X
	6	132	12	7	7	0	0	BP
	7	110	12	11	11	0	0	(M)
	8	123	12	7	7	0	0	X
MC-SED 1	1	147	12	7	7	0	0	CC
	2	125	12	8	8	0	0	BP
	3	160	12	8	8	0	0	(M)
	4	137	12	9	9	0	0	X
	5	145	12	11	11	0	0	BP
	6	159	12	10	10	0	0	CC
	7	152	12	11	11	0	0	(M)
	8	104	12	8	8	0	0	BP

* Nematodes present
 ① invisible midge larvae present

QA Check: (M)

20 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 20 day Survival

Client: Floyd Snider
 Test #: 1104-1018 thru 1104-1024

Start Date & Time: 4/13/11 1330
 End Date & Time: 5/3/11 1330
 Test Organism: Chironomus dilutus

Site	Rep #	Cont #	Day 0	Survival Day 20				Initials/Comments
				total	#larvae	#pupae	#flies	
MC SED 2	1	121	12	9	9	0	0	CS
	2	164	12	9	9			CC
	3	151	12	8	8			CS
	4	103	12	8	8			CS
	5	114	12	10	10			CS
	6	127	12	10	10			CC
	7	129	12	10	10			CS
	8	109	12	12	12			CS
MC SED 3	1	120	12	8	8			CS
	2	149	12	10	10			CS
	3	143	12	9	9			CS
	4	142	12	9	9			CS
	5	133	12	6	6			CS
	6	134	12	7	7			CS
	7	105	12	9	9			CS
	8	106	12	9	9			BP
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					

QA Check: (M)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy., E. Suite 2
 Tacoma, WA 98424

Client: Floyd Snider Test 2
 Organism: Chironomus tentans
 Test no.: 1104-1008 thru 1104-1024

Site	Rep #	Cont #	Pan wt. (gm)	Dry wt. (gm)	Ash wt. (gm)	Ash free dry wt. (gm)	No. organisms	Avg. per site (mg)
CON	1	153	0.05970	0.06371	0.068003		11	
	2	130	0.07691	0.08229	0.07762		12	
	3	150	0.09019	0.08822	0.08267		11	
	4	144	0.07368	0.07950	0.07478		12	
	5	138	0.06826	0.07250	0.06869		11	
	6	148	0.06940	0.07592	0.07147		11	
	7	163	0.07678	0.08304	0.07788		11	
	8	116	0.06442	0.06968	0.06503		10	
LLSED-1	1	137	0.07868	0.08385	0.078960		5	
	2	122	0.05783	0.06133	0.05839		2	
	3	158	0.06495	0.07585	0.06765		9	
	4	107	0.07197	0.08000	0.07338		4	
	5	108	0.06563	0.08027	0.06839		12	
	6	119	0.06542	0.07702	0.06745		12	
	7	140	0.07892	0.08914	0.08046		12	
	8	136	0.06620	0.07510	0.06754		10	
LLSED-2	1	101	0.06993	0.07143	0.07011		2	
	2	141	0.06629	0.06682	0.06643		1	
	3	128	0.07639	0.07666	0.07643		1	
	4	154	0.06495	0.06949	0.06562		7	
	5	161	0.07069	0.07699	0.07162		5	
	6	155	0.07146	0.07526	0.07218		3	
	7	146	0.08130	0.08290	0.08151		1	
	8	131	0.06563	0.06901	0.06604		2	
LLSED-3	1	112	0.06650	0.08339	0.07009		8	
	2	117	0.06055	0.06973	0.06226		4	
	3	115	0.06598	0.08410	0.06883		11	
	4	113	0.07066	0.08781	0.07458		11	
	5	156	0.05927	0.06628	0.06042		4	
	6	124	0.06220	0.07750	0.06488		11	
	7	157	0.06675	0.08158	0.06984		12	
	8	111	0.06134	0.07320	0.06371		6	
LLSED-4	1	162	0.07398	0.07958	0.07536		9	
	2	135	0.08148	0.08564	0.08218		8	
	3	126	0.06876	0.07844	0.07066		7	
	4	102	0.07088	0.08454	0.07395		5	
	5	118	0.06613	0.08072	0.07045		12	
	6	132	0.06874	0.07961	0.07119		7	
	7	110	0.06744	0.08097	0.07038		11	
	8	123	0.06864	0.07749	0.07096		7	
Tech Initials			ut	cc	cc		cc	

1) Dry wt. Date/time in: 5/3/11 1830 T° 61
 Dry wt. Date/time out: 5-5-11 1300 T° 64
 Dry wt. Tech: cc

2) Furnace date/time in: 5-6-11 0900 T° 550
 Furnace date/time out: 5-6-11 1100 T° 550
 Furnace tech: ut

QA Check: (M)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy., E. Suite 2
 Tacoma, WA 98424

Client: Floyd Snider Test 2
 Organism: Chironomus tentans
 Test no.: 1104-T008 thru H04-T024

Site	Rep #	Cont #	Pan wt. (gm)	Dry wt. (gm)	Ash wt. (gm)	Ash free dry wt. (gm)	No. organisms	Avg. per site (mg)
MC-SED-1	1	147	0.07078	0.08209	0.07313		7	
	2	125	0.06568	0.08866	0.07628		8	
	3	160	0.07016	0.08107	0.07323		8	
	4	137	0.07449	0.09665	0.08390		9	
	5	145	0.07571	0.08853	0.07812		11	
	6	159	0.07240	0.08654	0.07641		10	
	7	153	0.06049	0.06900	0.06229		11	
	8	104	0.07776	0.09475	0.08116		8	
MC-SED-2	1	121	0.07167	0.09529	0.08296		9	
	2	164	0.07250	0.08480	0.07561		9	
	3	151	0.07287	0.08398	0.07511		8	
	4	103	0.06223	0.07668	0.06554		8	
	5	114	0.06723	0.11395	0.09809		10	
	6	127	0.05970	0.07451	0.06367		10	
	7	129	0.07153	0.08297	0.07353		10	
	8	109	0.07407	0.09586	0.08296		12	
MC-SED-3	1	120	0.06555	0.07955	0.06895		8	
	2	149	0.07413	0.08947	0.07872		10	
	3	143	0.05881	0.07054	0.06156		9	
	4	143	0.06911	0.08594	0.07499		9	
	5	133	0.07295	0.10676	0.09693		6	
	6	134	0.06165	0.12446	0.11407		7	
	7	105	0.07799	0.09267	0.08063		9	
	8	106	0.07264	0.08511	0.07442		9	
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
Tech Initials			et	ce	cc		(V)	

1) Dry wt. Date/time in: 5-3-11 1330 T° 66
 Dry wt. Date/time out: 5-5-11 1300 T° 64
 Dry wt. Tech: ce

2) Furnace date/time in: 5-5-11 5:41 T° 550
 Furnace date/time out: 5-6-11 4:00 T° 550
 Furnace tech: et

① 0.08112

QA Check: (M)

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #:

Start Date & Time: 4/13/11 1330 Test 2

Site: 60N

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Test 2

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	0.015	52	68	6.75	131	8.1	19.6	✓	✓	✓	JS
1					6.84	127	7.0	19.9	✓	✓	✓	JS
2					7.09	145	6.8	19.7	✓	✓	✓	JS
3					7.12	137	6.5	19.6	✓	✓	✓	JS
4					7.11	139	6.4	19.5	✓	✓	✓	JS
5	<1.0	<0.010	64	92	7.11	140	6.3	19.6	✓	✓	✓	(M)
6					7.38	165	7.2	19.7	✓	✓	✓	JS
7					7.24	173	5.7	19.8	✓	✓	✓	BP
8					7.30	175	5.3	19.8	✓	✓	✓	(M)
9					7.10	178	5.4	19.6	✓	✓	✓	MF
10	1.2	<0.010	72	88	7.28	174	5.9	19.7	✓	✓	✓	MF
11					7.48	171	6.0	19.4	✓	✓	✓	MF
12					7.44	170	6.7	19.7	✓	✓	✓	BP
13					7.10	175	5.7	19.8	✓	✓	✓	JS
14					7.09	171	4.8	19.9	✓	✓	✓	JS
15	<1.0	<0.010	80	96	7.07	165	4.6	19.8	✓	✓	✓	JS
16					7.06	166	4.3	19.7	✓	✓	✓	BP
17					7.10	166	4.3	19.8	✓	✓	✓	(M)
18					7.07	168	4.4	19.7	✓	✓	✓	(M)
19					6.88	221	4.0	19.8	✓	✓	✓	BP
20	3.2	<0.010	80	88	6.93	176	4.0	19.9	✓	✓	✓	BP

QA Check: (M)

Test Chamber: PM-V

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T018

Start Date & Time: 4/13/11 1330 Test 2

Site: LL-SED1

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	0.011	76	96	7.27	169	7.0	19.5	✓	✓	✓	JS
1					7.05	171	5.7	19.7	✓	✓	✓	JS
2					7.08	173	5.7	19.6	✓	✓	✓	JS
3					7.10	173	5.8	19.6	✓	✓	✓	JS
4					7.12	177	5.7	19.5	✓	✓	✓	JS
5	<1.0	<0.010	76	84	7.11	174	5.8	19.6	✓	✓	✓	(M)
6					7.16	166	5.8	19.7	✓	✓	✓	JS
7					7.03	171	3.9	19.8	✓	✓	✓	BP
8					7.15	172	5.0	19.7	✓	✓	✓	(M)
9					7.00	173	5.0	19.6	✓	✓	✓	JS
10	<1.0	<0.010	72	88	7.21	169	5.0	19.6	✓	✓	✓	JS
11					7.34	169	5.4	19.5	✓	✓	✓	JS
12					7.40	169	5.4	19.7	✓	✓	✓	BP
13					7.07	175	5.6	19.7	✓	✓	✓	JS
14					7.30	172	4.6	19.7	✓	✓	✓	JS
15	<1.0	<0.010	76	96	7.00	172	5.0	19.7	✓	✓	✓	JS
16					7.10	171	4.5	19.6	✓	✓	✓	BP
17					7.08	172	4.3	19.8	✓	✓	✓	(M)
18					7.10	172	4.2	19.7	✓	✓	✓	(M)
19					6.99	188	4.2	19.6	✓	✓	✓	BP
20	3.0	<0.010	88	100	6.90	173	4.0	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: RMU

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

 Client: Floyd Snider

 Test #: 1104-T019

 Start Date & Time: 4/13/11 1330 Test 2

 Site: LL-SED 2

 Test Organism: Chironomus tentans

 End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk		pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	6.1	0.036	84	104	7.12	174	6.1	19.7	✓	✓	✓	JS
1					6.89	179	4.6	19.9	✓	✓	✓	JS
2					6.96	173	4.9	19.7	✓	✓	✓	JS
3					7.01	174	4.8	19.5	✓	✓	✓	JS
4					7.02	175	4.9	19.5	✓	✓	✓	JS
5	9.5	<0.010	72	88	6.96	174	4.9	19.6	✓	✓	✓	(M)
6					7.05	166	5.6	19.7	✓	✓	✓	JS
7					7.09	168	5.1	19.9	✓	✓	✓	BP
8					7.09	167	5.2	19.7	✓	✓	✓	(M)
9					7.02	166	5.6	19.5	✓	✓	✓	MF
10	2.1	<0.010	64	76	7.12	161	5.3	19.6	✓	✓	✓	MF
11					7.24	161	5.9	19.4	✓	✓	✓	MF
12					7.23	159	5.8	19.8	✓	✓	✓	BP
13					7.05	160	6.3	19.6	✓	✓	✓	JS
14					7.11	155	5.8	19.6	✓	✓	✓	JS
15	<1.0	0.010	76	76	7.06	150	5.6	19.7	✓	✓	✓	JS
16					6.95	148	5.0	19.6	✓	✓	✓	BP
17					6.99	149	4.8	19.8	✓	✓	✓	(M)
18					7.00	150	4.6	19.7	✓	✓	✓	(M)
19					6.97	158	4.4	19.7	✓	✓	✓	BP
20	2.7	<0.010	76	92	6.90	156	4.1	19.7	✓	✓	✓	BP

 QA Check: (M)

 Test Chamber: RMC

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

 Client: Floyd Smidley

 Test #: 1104-T020

 Start Date & Time: 4/13/11 1330

Test 2

 Site: LL-SED3

 Test Organism: Chironomus tentans

 End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	<1.0	0.020	72	100	7.29	165	6.8	19.6	✓	✓	✓	JS
1					7.10	166	6.3	19.9	✓	✓	✓	JS
2					7.12	166	6.3	19.7	✓	✓	✓	JS
3					7.11	167	6.2	19.6	✓	✓	✓	JS
4					7.12	167	6.3	19.6	✓	✓	✓	JS
5	<1.0	<0.010	72	96	7.09	166	6.2	19.6	✓	✓	✓	(M)
6					7.20	166	6.3	19.8	✓	✓	✓	JS
7					7.21	169	5.8	19.8	✓	✓	✓	BP
8					7.20	171	6.0	19.8	✓	✓	✓	(M)
9					7.12	172	5.6	19.7	✓	✓	✓	MF
10	<1.0	<0.010	68	88	7.29	166	6.1	19.5	✓	✓	✓	MF
11					7.35	165	6.0	19.4	✓	✓	✓	MF
12					7.31	164	6.3	19.6	✓	✓	✓	BP
13					7.09	166	6.6	19.6	✓	✓	✓	JS
14					7.22	163	6.0	19.7	✓	✓	✓	JS
15	<1.0	0.033	68	100	7.13	158	6.1	19.6	✓	✓	✓	JS
16					6.97	156	4.7	19.6	✓	✓	✓	BP
17					7.06	159	4.8	19.7	✓	✓	✓	(M)
18					7.00	156	4.8	19.8	✓	✓	✓	(M)
19					6.91	166	4.2	19.6	✓	✓	✓	BP
20	3.1	<0.010	80	96	6.95	161	4.1	19.6	✓	✓	✓	BP

 QA Check: (M)

 Test Chamber: Rm

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T021

Start Date & Time: 4/13/11 1330 Test 4

Site: LL-SED4

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk (mg/L as CaCO ₃)	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
									am	pm		
0	<1.0	0.029	76	96	7.35	165	6.6	19.5	✓	✓	✓	JS
1					7.08	162	5.3	19.8	✓	✓	✓	JS
2					7.12	169	5.7	19.7	✓	✓	✓	JS
3					7.14	168	5.4	19.6	✓	✓	✓	JS
4					7.13	169	5.5	19.7	✓	✓	✓	JS
5	<1.0	<0.010	80	100	7.11	170	5.2	19.6	✓	✓	✓	(M)
6					7.19	169	5.8	19.7	✓	✓	✓	JS
7					7.19	171	5.0	19.6	✓	✓	✓	BP
8					7.23	171	5.2	19.7	✓	✓	✓	(M)
9					7.10	151	4.9	19.6	✓	✓	✓	MF
10	5.0 <1.0	0.013	76	88	7.30	171	5.2	19.6	✓	✓	✓	MF
11					7.53	174	5.4	19.4	✓	✓	✓	MF
12					7.28	168	6.2	19.7	✓	✓	✓	BP
13					7.23	179	5.3	19.7	✓	✓	✓	JS
14					7.27	174	5.0	19.6	✓	✓	✓	JS
15	<1.0	0.023	88	88	7.10	169	4.6	19.5	✓	✓	✓	JS
16					7.07	164	4.7	19.5	✓	✓	✓	BP
17					7.16	170	4.6	19.6	✓	✓	✓	(M)
18					7.09	166	4.7	19.7	✓	✓	✓	(M)
19					6.84	176	4.2	19.6	✓	✓	✓	BP
20	3.4	<0.010	88	100	6.84	171	4.0	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: RMC

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T022

Start Date & Time: 4/13/11 1330

Test 2

Site: MC-8ED1

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	<0.01	729	96	7.35	160	6.9	19.6	✓	✓	✓	JS
1					7.20	160	6.5	19.6	✓	✓	✓	JS
2					7.18	164	6.6	19.4	✓	✓	✓	JS
3					7.17	165	6.4	19.6	✓	✓	✓	JS
4					7.19	163	6.5	19.6	✓	✓	✓	JS
5	<1.0	<0.010	76	100	7.22	166	6.4	19.7	✓	✓	✓	(M)
6					7.23	165	6.5	19.7	✓	✓	✓	JS
7					7.23	171	5.9	19.7	✓	✓	✓	BP
8					7.23	172	6.0	19.7	✓	✓	✓	(M)
9					7.13	176	5.9	19.6	✓	✓	✓	MF
10	<1.0	<0.010	80	88	7.29	164	6.1	19.6	✓	✓	✓	MF
11					7.21	169	6.3	19.3	✓	✓	✓	MF
12					7.23	168	6.1	19.7	✓	✓	✓	BP
13					7.10	169	6.1	19.6	✓	✓	✓	JS
14					7.19	164	5.3	19.7	✓	✓	✓	JS
15	80 <1.0	<0.010	80	120	7.13	162	4.9	19.6	✓	✓	✓	JS
16					7.05	162	4.4	19.7	✓	✓	✓	BP
17					7.05	165	4.5	19.7	✓	✓	✓	(M)
18					7.00	166	4.4	19.8	✓	✓	✓	(M)
19					6.93	173	4.0	19.7	✓	✓	✓	BP
20	2.9	<0.010	80	104	6.93	167	4.1	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: R.M.C

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #: 1104-T023

Start Date & Time: 4/13/11 1330 Test 2

Site: MC-SED2

Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	<1.0	<0.010	80	88	7.40	134	7.3	19.7	✓	✓	✓	JS
1					7.26	163	6.8	19.6	✓	✓	✓	JS
2					7.26	166	7.1	19.6	✓	✓	✓	JS
3					7.27	167	7.0	19.5	✓	✓	✓	JS
4					7.27	165	7.0	19.4	✓	✓	✓	JS
5	<1.0	<0.010	96	104	7.26	166	6.8	19.7	✓	✓	✓	(M)
6					7.29	164	7.2	19.7	✓	✓	✓	JS
7					7.26	169	^{SP} 7.64	19.8	✓	✓	✓	BP
8					7.23	171	6.0	19.7	✓	✓	✓	(M)
9					7.13	175	6.0	19.6	✓	✓	✓	MF
10	<1.0	<0.010	76	92	7.30	170	6.2	19.9	✓	✓	✓	MF
11					7.31	168	6.1	19.3	✓	✓	✓	MF
12					7.33	168	6.0	19.7	✓	✓	✓	BP
13					7.12	170	5.5	19.5	✓	✓	✓	JS
14					7.22	165	5.2	19.7	✓	✓	✓	JS
15	<1.0	<0.010	88	100	7.13	1604 1608	4.7	19.6	✓	✓	✓	JS
16					7.09	158	4.5	19.6	✓	✓	✓	BP
17					7.12	160	4.5	19.6	✓	✓	✓	(M)
18					7.09	159	4.6	19.7	✓	✓	✓	(M)
19					6.90	174	4.0	19.6	✓	✓	✓	BP
20	2.6	<0.010	84	100	6.94	167	4.0	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: Rm. C

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Smider Test #: 1104-T024

Start Date & Time: 4/13/11 1330 Test 2

Site: MC-8003 Test Organism: Chironomus tentans

End Date & Time: 5/3/11 1330

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech.
			(mg/L as CaCO ₃)						am	pm		Initials
0	<1.0	0.015	80	88	7.43	155	7.8	19.8	✓	✓	✓	JS
1					7.33	157	7.2	19.9	✓	✓	✓	JS
2					7.33	163	7.4	19.7	✓	✓	✓	JS
3					7.27	162	7.1	19.5	✓	✓	✓	JS
4					7.29	161	7.0	19.4	✓	✓	✓	JS
5	<1.0	<0.010	76	96	7.33	163	6.8	19.7	✓	✓	✓	(M)
6					7.48	169	7.4	19.8	✓	✓	✓	JS
7					7.34	173	6.3	19.8	✓	✓	✓	BP
8					7.28	175	5.8	19.8	✓	✓	✓	(M)
9					7.19	179	5.1	19.6	✓	✓	✓	MF
10	<1.0	<0.010	88	88	7.28	174	5.4	19.5	✓	✓	✓	MF
11					7.49	169	6.0	19.4	✓	✓	✓	MF
12					7.41	170	6.4	19.7	✓	✓	✓	BP
13					7.16	170	6.1	19.7	✓	✓	✓	JS
14					7.27	164	5.9	19.7	✓	✓	✓	JS
15	<1.0	<0.010	88 100	80	7.19	160	5.5	19.7	✓	✓	✓	JS
16					7.12	159	4.7	19.6	✓	✓	✓	BP
17					7.16	162	4.8	19.7	✓	✓	✓	(M)
18					7.11	166	4.6	19.8	✓	✓	✓	(M)
19					6.97	175	4.2	19.7	✓	✓	✓	BP
20	3.3	<0.010	84	100	6.96	170	4.2	19.6	✓	✓	✓	BP

QA Check: (M)

Test Chamber: RM-C

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Survival

Client: Floud Snidly Start Date & Time: 4/5/11 1445
 Test #: 1104-1008 thru 1104-1014 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Conc. or site	Cont. #	Survival	
		Day 0	Day 10
(N)	29	10	10
	64	10	9
	14	10	10
	39	10	10
	43	10	10
	31	10	9
	37	10	10
	54	10	9
LL-SED 1	63	10	9
	49	10	10
	27	10	10
	16	10	10
	4	10	9
	51	10	10
	55	10	10
	17	10	8
LL-SED 2	52	10	10
	18	10	10
	44	10	10
	22	10	9
	46	10	9
	10	10	9
	13	10	10
	41	10	10
LL-SED 3	33	10	10
	50	10	9
	56	10	10
	19	10	10
	6	10	10
	35	10	9
	12	10	10
	40	10	9
LL-SED 4	11	10	10
	58	10	10
	28	10	10
	25	10	10
	34	10	10
	21	10	10
	2	10	10
	5	10	10
		10	
		10	
	Tech Initials	<u>AS/N</u>	<u>9+</u>

Animal Source: APB Aquatic
 Date Received: 4/1/11
 Age at test initiation: 9 days

QA Check: (N)

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floud Snider
 Conc. or Site: CAH
 Test #: _____

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃										
0	40	68	<1.0	<0.01	6.54	122	8.4	21.2	CC		DS
1					6.90	133	7.7	21.0 ^U	(M)		DS
2					6.55	131	5.8	23.1	BP		DS
3					6.86	150	6.3	22.8	(M)		BP
4					6.77	147	6.5	22.7	BP		BP
5	40	64	<1.0	<0.01	6.84	149	6.4	22.8	BP		BP
6					6.98	161	6.1	22.9	(M)		(M)
7					7.06	152	6.7	22.8	DS		DS
8					7.05	158	6.7	22.9	DS		DS
9					7.02	163	6.4	22.9	MA		DS
10	40	64	<1.0	0.010	7.03	161	6.5	22.8	ST		ST

Test Chamber: RM. B QA Check: (M)

① Temp. increased in chamber

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL-SED 1
 Test #: 1104-TD08

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	(mg/L as CaCO ₃)	(mg/L)										
0	72	88		1.1	0.035	7.33	147	7.2	21.2	✓		SS
1						7.33	107	7.0	21.2	Ⓜ		SS
2						7.04	175	5.3	23.0	BP		SS
3						7.07	173	4.7	22.9	Ⓜ		BP
4						7.02	172	5.3	22.8	BP		BP
5	72	92		<1.0	<0.01	7.05	174	5.2	22.9	BP		BP
6						7.19	171	5.2	22.9	Ⓜ		Ⓜ
7						7.19	167	5.6	22.9	SS		SS
8						7.20	173	5.5	22.9	SS		SS
9						7.16	174	5.4	22.9	MA		SS
10	72	88		<1.0	<0.01	7.21	175	5.6	22.8	ST		ST

Test Chamber: RM. B QA Check: Ⓜ

① Test chamber temperature turned up

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL SED 2
 Test #: 1104-TD09
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	(mg/L as CaCO ₃)	(mg/L)										
0	80	104		2.0	0.053	7.15	172	6.6	21.2	✓		SS
1						7.19	172	6.6	21.2	(M)		SS
2						6.91	179	4.8	23.0	SP		SS
3						6.99	174	4.8	23.0	(M)		SP
4						6.90	172	4.8	22.8	SP		SP
5	68	108		2.0	50.01	6.92	172	4.8	22.9	SP		SP
6						7.02	164	4.9	22.9	(M)		(M)
7						6.93	162	4.9	23.0	SP		SS
8						6.94	166	5.3	22.9	SP		SS
9						6.99	163	5.4	23.0	SH		SS
10	72	104		<1.0	<0.01	7.02	161	5.3	22.8	GT		GT

Test Chamber: R.M.B QA Check: (M)

① Test chamber temperature up

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snyder
 Conc. or Site: LL5FD3
 Test #: 1104-T01D
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃	Hard									
0	76	76	1.2	0.068	7.20	164	6.4	21.2	CR		SS
1					7.32	165	6.8	21.2	(M)		SS
2					7.09	170	5.0	23.1	SP		SS
3					7.12	171	5.3	22.9	(M)		BP
4					7.06	170	5.5	22.7	BP		BP
5	72	90	<1.0	<0.01	7.10	172	5.4	22.8	BP		BP
6					7.19	171	5.0	22.9	(M)		(M)
7					7.15	169	4.8	22.8	SS		SS
8					7.15	171	5.2	22.7	SS		SS
9					7.05	170	5.2	23.0	MA		SS
10	72	90	<1.0	<0.01	7.04	167	5.1	22.8	SP		SP

Test Chamber: RM. B QA Check: (M)

① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL SED 4
 Test #: 1104-TO11
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	mg/L	as CaCO ₃										
0	710	86		1.5	0.056	7.26	160	6.0	21.4	CE		SS
1						7.37	166	6.8	21.2	(M)		SS
2						7.16	173	5.7	23.0	BP		SS
3						7.17	173	5.3	22.9	(M)		BP
4						7.07	173	5.5	22.7	BP		BP
5	80	88		<1.0	<0.01	7.11	172	5.3	22.7	BP		BP
6						7.17	171	5.2	22.8	(M)		(M)
7						7.15	168	4.9	22.9	SS		SS
8						7.19	170	4.9	22.9	SS		SS
9						7.09	170	5.0	22.7	SH		SS
10	76	84		<1.0	<0.01	7.10	171	4.8	22.8	BT		BT

Test Chamber: RM. B QA Check: (M)

*@Test chamber turned
Temperature
UP*

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SEDI
 Test #: 1104-T012
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk		Hard	Ammonia	Sulfide	pH	Conductivity	Dissolved O ₂	Temp	Fed	Comments	Technician
	(mg/L as CaCO ₃)	(mg/L)										
0	72	<1.0	92	<0.01	7.35	164	6.9	21.4		ce		DS
1					7.37	163	7.2	21.3		(M)		DS
2					7.11	169	5.9	23.1		BP		DS
3					7.23	170	6.0	22.9		(M)		BP
4					7.11	173	6.1	22.6		BP		BP
5	80	<1.0	96	<0.01	7.18	174	6.0	22.8		BP		BP
6					7.22	173	5.8	22.9		(M)		(M)
7					7.16	172	5.8	22.8		DS		DS
8					7.23	173	5.5	22.9		DS		DS
9					7.14	170	5.5	22.7		NA		DS
10	80	<1.0	96	<0.01	7.13	173	5.3	22.8		gt		gt

Test Chamber: FM. B QA Check: (M)
 Test Chamber Temperature Increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SEED
 Test #: 1104-TO13
 Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk (mg/L as CaCO ₃)	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
0	08	92	<1.0	<0.01	7.44	163	7.8	21.3			SS
1					7.47	162	7.5	21.2			SS
2					7.25	170	170	23.1			SS
3					7.28	171	6.0	22.8			BP
4					7.16	171	6.4	22.7			BP
5	80	100	<1.0	<0.01	7.21	173	6.2	22.7			BP
6					7.29	171	6.2	22.9			BP
7					7.27	171	5.9	23.0			SS
8					7.30	175	5.8	23.0			SS
9					7.22	175	5.9	23.0			SS
10	80	100	<1.0	0.013	7.24	175	6.0	22.8			BT

Test Chamber: RM.B QA Check: RM

① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SED3
 Test #: 1104-T014

Start Date & Time: 4/5/11 1445
 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	(mg/L as CaCO ₃)										
0	608	84	<1.0	<0.01	7.39	159	7.8	21.3	CL		DS
1					7.40	161	7.5	21.2	MP		DS
2					7.27	166	6.4	23.2	SP		DS
3					7.28	167	6.1	22.9	MP		SP
4					7.19	167	6.5	22.7	SP		SP
5	84	88	<1.0	<0.01	7.21	166	6.4	22.7	SP		SP
6					7.33	169	6.4	22.9	MP		MP
7					7.32	168	6.2	23.0	DS		DS
8					7.39	171	6.4	22.9	DS		DS
9					7.30	173	6.1	23.1	SP		DS
10	80	84	<1.0	<0.010	7.30	172	5.9	22.9	SP		SP

Test Chamber: RM. B QA Check: MP
 ① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Survival

Client: Flouid Snidly Start Date & Time: 4/5/11 1445
 Test #: 1104-1008 thru 1104-1014 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Conc. or site	Cont. #	Survival	
		Day 0	Day 10
(N)	29	10	10
	64	10	9
	14	10	10
	39	10	10
	43	10	10
	31	10	9
	37	10	10
	54	10	9
LL-SED 1	103	10	9
	49	10	10
	27	10	10
	16	10	10
	4	10	9
	51	10	10
	55	10	10
	17	10	8
LL-SED 2	52	10	10
	18	10	10
	44	10	10
	22	10	9
	46	10	9
	10	10	9
	13	10	10
	41	10	10
LL-SED 3	33	10	10
	50	10	9
	56	10	10
	19	10	10
	6	10	10
	35	10	9
	12	10	10
	40	10	9
LL-SED 4	11	10	10
	58	10	10
	28	10	10
	25	10	10
	34	10	10
	21	10	10
	2	10	10
	5	10	10
		10	
		10	
	Tech Initials	AS/N	9+

Animal Source: APB Aquatic
 Date Received: 4/1/11
 Age at test initiation: 9 days

QA Check: (N)

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: CON
 Test #: _____

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃										
0	40	68	<1.0	<0.01	6.54	122	8.4	21.2	CC		JS
1					6.90	133	7.7	21.0 ^①	(M)		JS
2					6.55	131	5.8	23.1	BP		JS
3					6.86	150	6.3	22.8	(M)		BP
4					6.77	147	6.5	22.7	BP		BP
5	40	64	<1.0	<0.01	6.84	149	6.4	22.8	BP		BP
6					6.98	161	6.1	22.9	(M)		(M)
7					7.06	152	6.7	22.8	JS		JS
8					7.05	158	6.7	22.9	JS		JS
9					7.02	163	6.4	22.9	NH		JS
10	40	64	<1.0	0.010	7.03	161	6.5	22.8	BT		BT

Test Chamber: Rm. B

QA Check: (M)

① Temp. increased in chamber

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Smider
 Conc. or Site: LL-SED 1
 Test #: 1104-TD08

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	72	88	1.1	0.035	7.33	147	7.2	21.2	CC		JS
1					7.33	167	7.0	21.2	(M)		JS
2					7.04	175	5.3	23.0	BP		JS
3					7.07	173	4.7	22.9	(M)		BP
4					7.02	172	5.3	22.8	BP		BP
5	72	92	<1.0	<0.01	7.05	174	5.2	22.9	BP		BP
6					7.19	171	5.2	22.9	(M)		(M)
7					7.19	167	5.6	22.9	JS		JS
8					7.20	173	5.5	22.9	JS		JS
9					7.16	174	5.4	22.9	MA		JS
10	72	88	<1.0	<0.01	7.21	175	5.6	22.8	ET		ET

Test Chamber: RM. B

QA Check: (M)

① Test chamber temperature turned up

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: LL-SED2
 Test #: 1104-T009

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	mg/L as CaCO ₃										
0	80	104	2.0	0.053	7.15	172	6.6	21.2	CP		JS
1					7.19	172	6.6	21.2	(M)		JS
2					6.91	179	4.8	23.0	BP		JS
3					6.99	174	4.8	23.0	(M)		BP
4					6.90	172	4.8	22.8	BP		BP
5	68	108	2.0	0.01	6.92	172	4.8	22.9	BP		BP
6					7.02	164	4.9	22.9	(M)		(M)
7					6.93	162	4.9	23.0	JS		JS
8					6.94	166	5.3	22.9	JS		JS
9					6.99	163	5.4	23.0	NH		JS
10	72	104	2.0 <1.0	<0.01	7.02	161	5.3	22.8	ET		ET

Test Chamber: Rm. B

QA Check: (M)

① Test chamber temperature turned up

10 Day Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 10 day Water Chemistries

Client: Flouyd Snider
 Conc. or Site: LL-SED 3
 Test #: 1104-T010

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	mg/L as CaCO ₃										Initials
0	76	76	1.2	0.068	7.20	164	6.4	21.2	CP		JS
1					7.32	165	6.8	21.2	(M)		JS
2					7.09	170	5.0	23.1	JS		JS
3					7.12	171	5.3	22.9	(M)		BP
4					7.06	170	5.5	22.7	BP		BP
5	72	90	<1.0	<0.01	7.10	172	5.4	22.8	BP		BP
6					7.19	171	5.0	22.9	(M)		(M)
7					7.15	169	4.8	22.8	JS		JS
8					7.15	171	5.2	22.7	JS		JS
9					7.05	170	5.2	23.0	MA		JS
10	72	90	<1.0	<0.01	7.04	167	5.1	22.8	JS		JS

Test Chamber: Rm. B

QA Check: (M)

① Test chamber temperature increased

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snidler
 Conc. or Site: LL-SED4
 Test #: 1104-T011

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	76	86	1.5	0.056	7.26	160	6.0	21.4	CP		JS
1					7.37	166	6.8	21.2	(M)		JS
2					7.16	173	5.7	23.0	BP		JS
3					7.17	173	5.3	22.9	(M)		BP
4					7.07	173	5.5	22.7	BP		BP
5	80	88	<1.0	<0.01	7.11	172	5.3	22.7	BP		BP
6					7.17	171	5.2	22.8	(M)		(M)
7					7.15	168	4.9	22.9	JS		JS
8					7.19	170	4.9	22.9	JS		JS
9					7.09	170	5.0	22.7	SH		JS
10	76	84	<1.0	<0.01	7.10	171	4.8	22.8	Et		Et

Test Chamber: Rm. B

@ Test chamber
 Temperature turned
 up

QA Check: (M)

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SEDI
 Test #: 1104-TO12

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	mg/L as CaCO ₃										Initials
0	72	92	<1.0	<0.01	7.35	164	6.9	21.4	ce		JS
1					7.37	163	7.2	21.3	(m)		JS
2					7.11	169	5.9	23.1	BP		JS
3					7.23	170	6.0	22.9	(m)		BP
4					7.11	173	6.1	22.6	BP		BP
5	80	96	<1.0	<0.01	7.18	174	6.0	22.8	BP		BP
6					7.22	173	5.8	22.9	(m)		(m)
7					7.16	172	5.8	22.8	JS		JS
8					7.23	173	5.5	22.9	JS		JS
9					7.14	170	5.5	22.7	SH		JS
10	80	96 96	<1.0	<0.01	7.13	173	5.3	22.8	Et		Et

Test Chamber: Rm. B

① Test chamber temperature increased

QA Check: (m)

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SED2
 Test #: 1104-T013

Start Date & Time: 4/5/11 1445
 End Date & Time: 4-15-11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician Initials
	(mg/L as CaCO ₃)										
0	096	92	<1.0	<0.01	7.44	163	7.8	21.3	BP		JS
1					7.47	162	7.5	21.2	(M)		JS
2					7.25	170	170 6.2	23.1	BP		JS
3					7.28	171	6.0	22.8	(M)		BP
4					7.16	171	6.4	22.7	BP		BP
5	80	100	58. <1.0	<0.01	7.21	173	6.2	22.7	BP		BP
6					7.29	171	6.2	22.9	(M)		(M)
7					7.27	171	5.9	23.0	JS		JS
8					7.30	175	5.8	23.0	JS		JS
9					7.22	175	5.9	23.0	SH		JS
10	80	100	<1.0	0.013	7.24	175	6.0	22.8	ET		ET

Test Chamber: RM. B

① Test chamber temperature increased

QA Check: (M)

10 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 10 day Water Chemistries

Client: Floyd Snider
 Conc. or Site: MC-SED3
 Test #: 1104-T014

Start Date & Time: 4/5/11 1445
 End Date & Time: 4/15/11 1500
 Test Organism: H. azteca

Day	Alk	Hard	Ammonia (mg/L)	Sulfide (mg/L)	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp (°C)	Fed	Comments	Technician
	(mg/L as CaCO ₃)										Initials
0	68	84	<1.0	<0.01	7.39	159	7.8	21.3	CL		JS
1					7.46	161	7.5	21.2	(M)		JS
2					7.27	166	6.4	23.2	BP		JS
3					7.28	167	6.1	22.9	(M)		BP
4					7.19	167	6.5	22.7	BP		BP
5	84	88	<1.0	<0.01	7.21	166	6.4	22.7	BP		BP
6					7.33	169	6.4	22.9	(M)		(M)
7					7.32	168	6.2	23.0	JS		JS
8					7.39	171	6.4	22.9	JS		JS
9					7.30	173	6.1	23.1	SA		JS
10	80	84	<1.0	<0.010	7.30	172	5.9	22.9	ET		ET

Test Chamber: RM. B

① Test chamber temperature increased

QA Check: (M)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Raw Data Sheet
 Microtox
 100% Sediment Porewater Toxicity

Client Name: Floyd Smider Test Date: 3/31/11

Sample ID: LLSED1, LLSED2
LLSED3, LLSED4 Test No.: 1103-T061, 1103-T062
1103-T063, 1103-T064

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	I ₍₀₎	5 min	99	105	106	112	110
	I ₍₅₎	10min	93	99	97	106	100
	I ₍₁₅₎	20 min	82	91	87	94	87
LLSED 1	I ₍₀₎	5 min	91	83	85	86	70
	I ₍₅₎	10min	83	78	81	79	62
	I ₍₁₅₎	20 min	73	69	75	68	58
LLSED 2	I ₍₀₎	5 min	66	61	62	70	65
	I ₍₅₎	10min	63	57	59	65	62
	I ₍₁₅₎	20 min	59	54	55	60	56
LLSED 3	I ₍₀₎	5 min	80	77	76	79	77
	I ₍₅₎	10min	75	75	69	73	72
	I ₍₁₅₎	20 min	68	60	61	66	65
LLSED 4	I ₍₀₎	5 min	67	76	70	68	67
	I ₍₅₎	10min	65	70	65	68	63
	I ₍₁₅₎	20 min	59	60	56	58	56
	I ₍₀₎	5 min					
	I ₍₅₎	10min					
	I ₍₁₅₎	20 min					

Comments: QC check - (m)

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Raw Data Sheet
 Microtox
 100% Sediment Porewater Toxicity

Client Name: Floyd Snider Test Date: 3/31/11

Sample ID: MCSED1, MCSED2, MCSED3 Test No.: 1103-T065, 1103-T066
1103-T067

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	I ₍₀₎	5 min	94	98	96	99	94
	I ₍₅₎	10min	90	91	89	90	91
	I ₍₁₅₎	20 min	91	89	84	84	82
MCSED 1	I ₍₀₎	5 min	100	94	89	97	94
	I ₍₅₎	10min	89	91	85	90	91
	I ₍₁₅₎	20 min	82	86	79	83	81
MC SED 2	I ₍₀₎	5 min	88	85	86	85	86
	I ₍₅₎	10min	86	83	83	82	86
	I ₍₁₅₎	20 min	79	76	77	76	81
MC SED 3	I ₍₀₎	5 min	89	90	90	90	85
	I ₍₅₎	10min	84	85	87	90	79
	I ₍₁₅₎	20 min	77	80	77	79	76
	I ₍₀₎	5 min					
	I ₍₅₎	10min					
	I ₍₁₅₎	20 min					
	I ₍₀₎	5 min					
	I ₍₅₎	10min					
	I ₍₁₅₎	20 min					

Comments: QC check - @

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Physical and Chemical
 Measurements of Porewaters
 Sediment Bioassays

Analyst: Ut

Client: Floyd Snider

Test Date: 3/31/11

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 1103-T061, -T067

Test Species: Vibrio fischeri

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O. (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
CON	19.4	19.4	7.9	7.9	8.17	-	-	-	(1)
MCSED1	0.0	20.6	7.7	7.7	8.19	-	-	-	
MCSED2	0.0	20.8	7.8	7.8	8.03	-	-	-	
MCSED3	0.0	19.2	7.8	7.8	8.29	8.16	20µL 0.1 N HCl	99.9%	
LLSED1	0.0	19.4	7.7	7.7	7.92	-	-	-	
LLSED2	0.0	20.5	7.9	7.9	7.37	7.93	50µL 0.1 N NaOH	99.8%	
LLSED3	0.1	19.2	7.9	7.9	7.66	8.00	30µL 0.1 N NaOH	99.8%	

Sample Description: _____

Comments: _____

QA Check: (M)

See sample
 check in

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy. E., Suite 2
 Tacoma, WA 98424

Physical and Chemical
 Measurements of Porewaters
 Sediment Bioassays

Analyst: gt

Client: Floyd Snider

Test Date: 3/31/11

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 1103-T061,-T067

Test Species: Vibrio fischeri

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O. (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
LLSED4	0.0	20.2	7.9	7.9	7.85	8.01	10 mL 0.1N NaOH	99.9%	Sample checked in

Sample Description: _____

Comments: _____

QA Check: (m)

APPENDIX E - Reference Toxicant Tests

Chironomus 96-h Acute Survival Test

Nautilus Environmental WA

Test Type: Survival (96h)

Organism: Chironomus tentans (Midge)

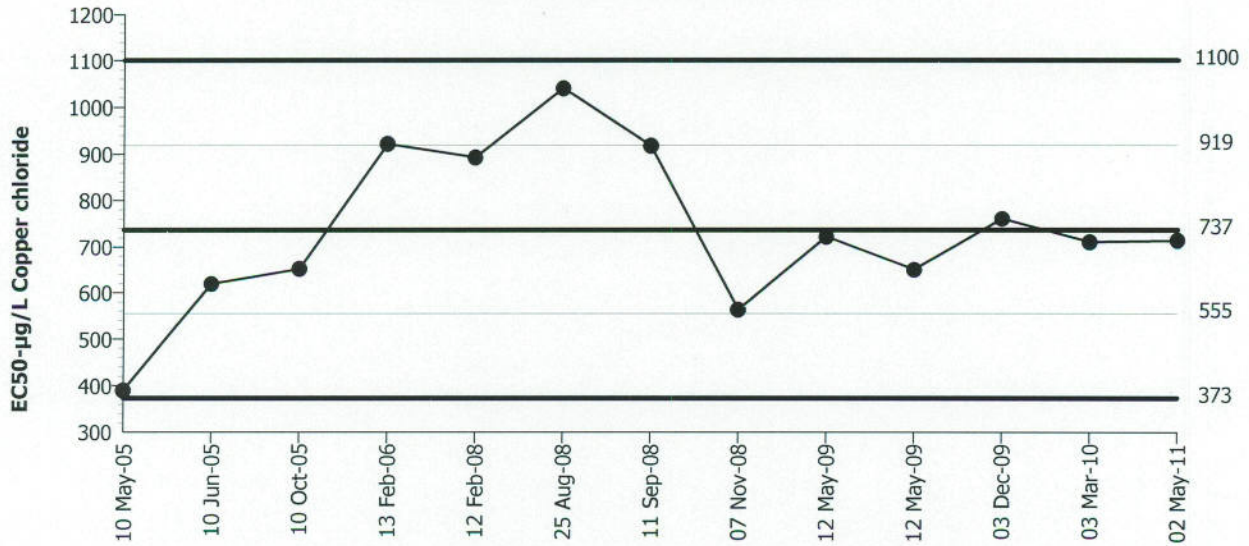
Material: Copper chloride

Protocol: EPA/600/R-99/064 (2000)

Endpoint: 96h Survival Rate

Source: Reference Toxicant-REF

Chironomus 96-h Acute Survival Test



Mean: 736.6 Count: 12 -1s Warning Limit: 554.7 -2s Action Limit: 372.8
 Sigma: 181.9 CV: 24.70% +1s Warning Limit: 918.5 +2s Action Limit: 1100

Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2005	May	10	389.8	-346.8	-1.907	(-)		03-9785-3768	06-1599-1620
2		Jun	10	619.3	-117.3	-0.6446			08-3314-6775	08-1540-4607
3		Oct	10	651.6	-84.96	-0.4671			08-1025-4680	04-9254-8883
4	2006	Feb	13	921.9	185.3	1.019	(+)		08-9851-1226	07-3219-0331
5	2008		12	892.6	156	0.8574			15-6976-5200	18-3934-0764
6		Aug	25	1040	303.3	1.667	(+)		06-6119-9769	09-7546-4295
7		Sep	11	917.7	181.1	0.9959			12-5480-0473	10-6515-6515
8		Nov	7	563	-173.6	-0.9545			11-4948-7713	17-3277-7072
9	2009	May	12	721.9	-14.71	-0.08084			07-7016-2012	11-9025-1031
10			12	650.3	-86.31	-0.4745			10-1811-8659	15-1190-7362
11		Dec	3	760.9	24.26	0.1334			06-1499-1772	06-0264-7224
12	2010	Mar	3	710.4	-26.21	-0.1441			17-7743-6517	09-5758-4695
13	2011	May	2	713.8	-22.83	-0.1255			05-0735-0656	07-1751-6097

CETIS Summary Report

Report Date: 06 May-11 14:51 (p 1 of 1)
 Test Code: RA050211CT | 05-0735-0656

Chironomus 96-h Acute Survival Test				Nautilus Environmental WA			
Batch ID:	10-9064-4993	Test Type:	Survival (96h)	Analyst:	Cat Curran		
Start Date:	02 May-11 14:00	Protocol:	EPA/600/R-99/064 (2000)	Diluent:	Diluted Mineral Water (8:2)		
Ending Date:	06 May-11 14:00	Species:	Chironomus tentans	Brine:			
Duration:	96h	Source:	Aquatic Biosystems, CO	Age:	23in		
Sample ID:	08-4898-7155	Code:	RA020511CT	Client:	Reference Toxicant Test		
Sample Date:	02 May-11	Material:	Copper chloride	Project:			
Receive Date:	02 May-11	Source:	Reference Toxicant				
Sample Age:	14h	Station:					

Comparison Summary							
Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
05-9024-2029	96h Survival Rate	375	750	530.3	22.7%		Steel Many-One Rank Test

Point Estimate Summary							
Analysis ID	Endpoint	Level	µg/L	95% LCL	95% UCL	TU	Method
07-1751-6097	96h Survival Rate	EC50	713.8	557.5	913.8		Trimmed Spearman-Kärber

96h Survival Rate Summary											
Conc-µg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
187.5		4	0.85	0.7785	0.9215	0.6	1	0.09574	0.1915	22.53%	15.0%
375		4	0.85	0.7785	0.9215	0.6	1	0.09574	0.1915	22.53%	15.0%
750		4	0.45	0.3785	0.5215	0.2	0.6	0.09574	0.1915	42.55%	55.0%
1500		4	0.15	0.1127	0.1873	0	0.2	0.05	0.1	66.67%	85.0%
3000		4	0	0	0	0	0	0	0	100.0%	100.0%

96h Survival Rate Detail					
Conc-µg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
187.5		0.8	1	0.6	1
375		0.8	1	1	0.6
750		0.4	0.2	0.6	0.6
1500		0.2	0	0.2	0.2
3000		0	0	0	0

96 Hour Reference Toxicity Test Data Sheet - Nautilus Environmental
Freshwater Sediment 96-hr Chronic

Client: Reference Toxicant

Start Date & Time: 5/2/11 1400

Sample ID: CuCl₂

End Date & Time: 5/6/11 1400

Test #: RA020511CT

Test Organism: Chironomus tentans

Conc. CuCl ₂	Cont. #	Survival		Dissolved O ₂ (mg/L)					pH (units)					Cond. µS/cm					Temperature (°C)				
		0	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
0 ug/L	22	5	5	7.2	8.1	7.3	8.1	7.9	7.62	7.34	7.43	7.63	7.63	162	172	177	168	172	23.0	22.6	23.5	20.0	20.1
	20	5	5																				
	2	5	5																				
	18	5	5																				
187.5 ug/L	8	5	4	8.5	8.3	7.2	8.0	7.7	7.75	7.42	7.41	7.64	7.66	161	169	174	163	168	22.2	22.8	23.8	19.9	20.2
	14	5	5																				
	21	5	3																				
	11	5	5																				
375 ug/L	23	5	4	8.4	8.6	8.0	8.2	8.0	7.79	7.46	7.43	7.68	7.69	162	169	174	162	166	22.1	22.7	23.8	20.0	20.4
	3	5	5																				
	13	5	5																				
	16	5	3																				
750 ug/L	9	5	2	8.4	8.7	7.6	8.1	7.8	7.77	7.46	7.53	7.66	7.69	158	170	175	163	166	22.2	22.7	23.6	20.2	20.4
	5	5	1																				
	12	5	3																				
	24	5	3																				
1500 ug/L	19	5	1	8.2	8.7	8.0	8.3	7.8	7.65	7.40	7.64	7.70	7.66	163	170	174	163	166	22.2	22.7	23.8	20.3	20.4
	17	5	0																				
	6	5	1																				
	10	5	1																				
3000 ug/L	7	5	0	8.7	8.7	8.0	8.4	8.1	7.43	7.38	7.67	7.76	7.69	163	171	175	163	166	22.2	22.8	23.9	20.2	20.2
	1	5	0																				
	4	5	0																				
	15	5	0																				

Tech. Initials: ET BP ET NF ET

Test Chamber: Room A

Comments: _____

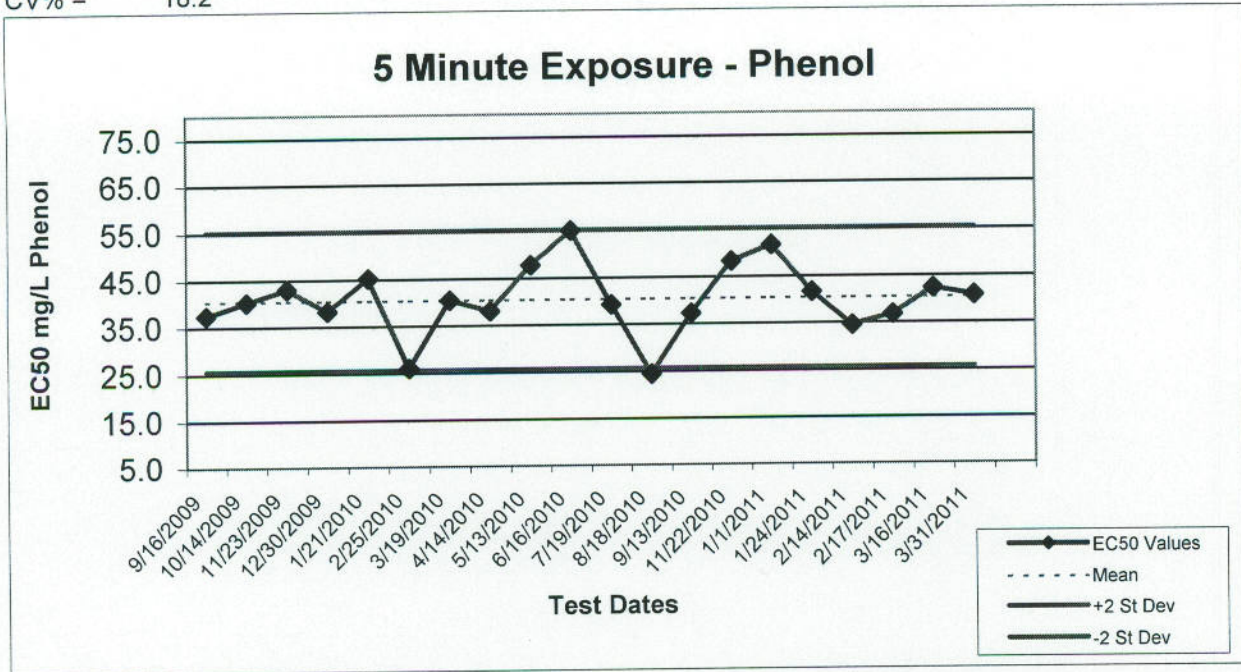
QA Check: (M)

Animal Source: ABS Date Received: 4/12/11

Age at test initiation: 2nd-3rd instar

Reference Toxicant Control Chart Microtox 5-Minute Exposure

CV% = 18.2

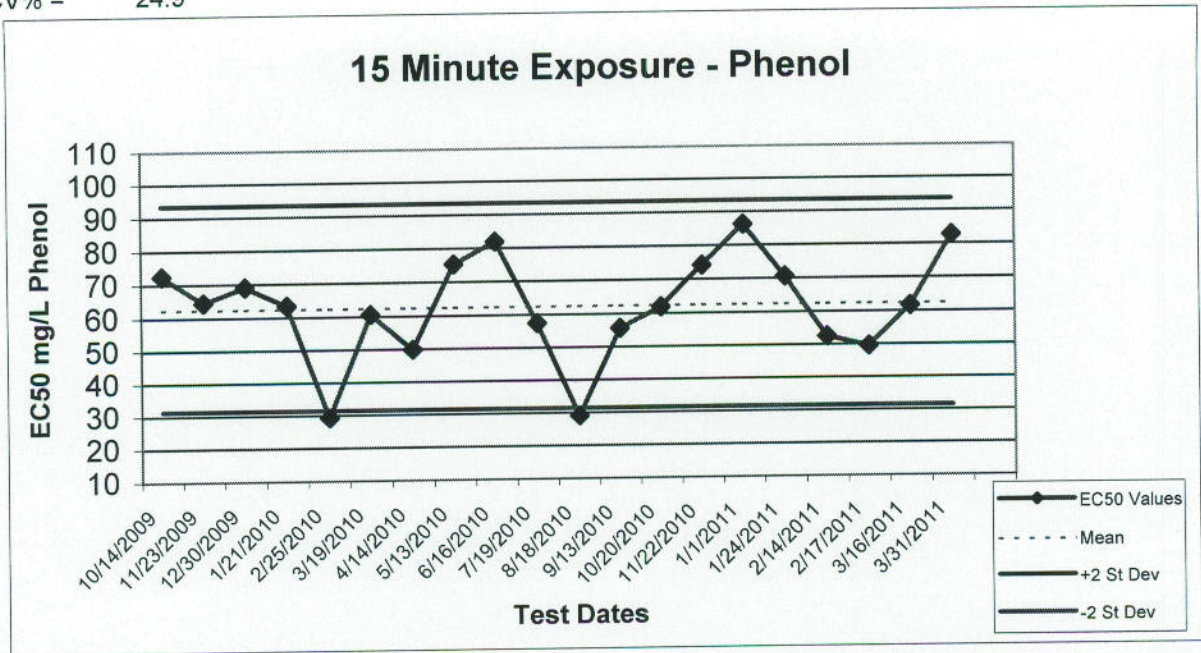


Date	Time	EC50 %	EC50 mg/L Phenol ^a	Mean	StDev	-2 SD	+2 SD
9/16/2009	1229	22.0	37.4	40.4	7.4	25.7	55.2
10/14/2009	926	23.7	40.2	40.4	7.4	25.7	55.2
11/23/2009	1011	25.3	43.0	40.4	7.4	25.7	55.2
12/30/2009	911	22.5	38.3	40.4	7.4	25.7	55.2
1/21/2010	1015	26.6	45.2	40.4	7.4	25.7	55.2
2/25/2010	1223	15.3	26.0	40.4	7.4	25.7	55.2
3/19/2010	833	23.8	40.5	40.4	7.4	25.7	55.2
4/14/2010	934	23.8	38.1	40.4	7.4	25.7	55.2
5/13/2010	939	29.9	47.8	40.4	7.4	25.7	55.2
6/16/2010	912	34.4	55.0	40.4	7.4	25.7	55.2
7/19/2010	830	24.5	39.2	40.4	7.4	25.7	55.2
8/18/2010	1018	15.3	24.4	40.4	7.4	25.7	55.2
9/13/2010	1214	23.3	37.3	40.4	7.4	25.7	55.2
11/22/2010	1100	30.2	48.3	40.4	7.4	25.7	55.2
1/1/2011	1436	32.3	51.7	40.4	7.4	25.7	55.2
1/24/2011	829	26.0	41.7	40.4	7.4	25.7	55.2
2/14/2011	1339	21.6	34.5	40.4	7.4	25.7	55.2
2/17/2011	1010	23.0	36.8	40.4	7.4	25.7	55.2
3/16/2011	812	26.5	42.3	40.4	7.4	25.7	55.2
3/31/2011	1154	25.5	40.8	40.4	7.4	25.7	55.2

a - Highest concentration of Phenol is 160 mg/L

Reference Toxicant Control Chart Microtox 15-Minute Exposure

CV% = 24.9



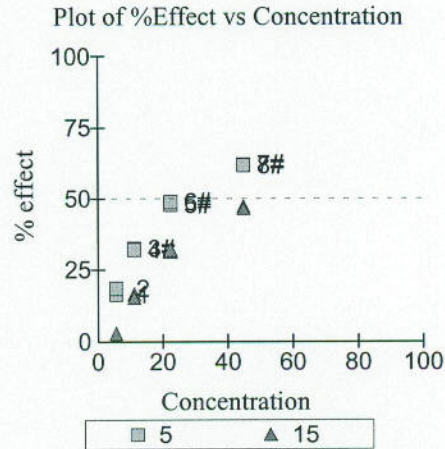
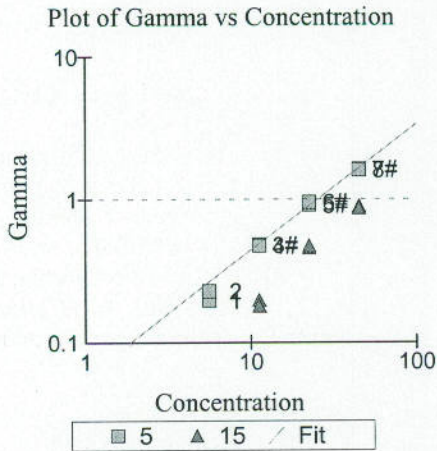
Date	Time	EC50 %	EC50 mg/L Phenol ^a	Mean	StDev	-2 SD	+2 SD
10/14/2009	926	42.6	72.4	62.4	15.5	31.3	93.4
11/23/2009	1011	37.9	64.4	62.4	15.5	31.3	93.4
12/30/2009	911	40.6	69.0	62.4	15.5	31.3	93.4
1/21/2010	1015	37.3	63.3	62.4	15.5	31.3	93.4
2/25/2010	1223	17.2	29.2	62.4	15.5	31.3	93.4
3/19/2010	833	35.6	60.5	62.4	15.5	31.3	93.4
4/14/2010	934	31.2	49.9	62.4	15.5	31.3	93.4
5/13/2010	939	47.0	75.2	62.4	15.5	31.3	93.4
6/16/2010	912	51.2	81.9	62.4	15.5	31.3	93.4
7/19/2010	830	35.9	57.4	62.4	15.5	31.3	93.4
8/18/2010	1018	18.2	29.1	62.4	15.5	31.3	93.4
9/13/2010	1214	34.8	55.7	62.4	15.5	31.3	93.4
10/20/2010	904	38.7	61.9	62.4	15.5	31.3	93.4
11/22/2010	1100	46.4	74.2	62.4	15.5	31.3	93.4
1/1/2011	1436	53.9	86.2	62.4	15.5	31.3	93.4
1/24/2011	829	44.1	70.5	62.4	15.5	31.3	93.4
2/14/2011	1339	32.9	52.6	62.4	15.5	31.3	93.4
2/17/2011	1010	31.0	49.6	62.4	15.5	31.3	93.4
3/16/2011	812	38.5	61.6	62.4	15.5	31.3	93.4
3/31/2011	1154	51.6	82.6	62.4	15.5	31.3	93.4

a - Highest concentration of Phenol is 160 mg/L

MicrotoxOmni Test Report

Date: 03/31/2011 11:54 AM

Test Protocol: Basic Test
 Sample: 160mg/L Phenol
 Toxicant: 160mg/L Phenol
 Reagent Lot no.: 10K1032
 Test description: Reference Toxicant
 Test name: RT033111VF
 Database file: C:\Program Files\MicrotoxOmni\Edge Analytical.mdb



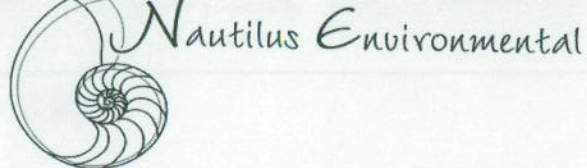
Sample	Conc	5 Mins Data:				15 Mins Data:		
		Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	95.21	91.27	0.9586 #		62.45	0.6559 #	
Control	0.000	95.78	90.90	0.9490 #		62.23	0.6497 #	
1	5.625	95.01	75.83	0.1951	16.32%	61.24	0.0128 *	1.264%
2	5.625	99.24	77.17	0.2266	18.48%	62.94	0.0293 *	2.849%
3	11.25	97.10	62.66	0.4781 #	32.35%	52.98	0.1965	16.42%
4	11.25	97.94	63.59	0.4691 #	31.93%	54.22	0.1792	15.20%
5	22.50	100.26	50.05	0.9107 #	47.66%	44.96	0.4558 #	31.31%
6	22.50	101.02	49.36	0.9521 #	48.77%	44.90	0.4688 #	31.92%
7	45.00	99.27	36.02	1.629 #	61.96%	34.25	0.8921 #	47.15%
8	45.00	100.13	36.63	1.607 #	61.65%	35.00	0.8676 #	46.46%

- used in calculation; * - invalid data; D - deleted from calcs.
 Autocalc has been used.

Calculations on 5 Mins data:
 EC50 Concentration: 25.53% (95% confidence range: 24.24 to 26.90)
 95% Confidence Factor: 1.054
 Estimating Equation: $\text{LOG C} = 1.124 \times \text{LOG G} + 1.407$
 Coeff. of Determination (R^2): 0.9958
 Slope: 0.8863
 Correction Factor: 0.9538

Calculations on 15 Mins data:
 EC50 Concentration: 51.61% (95% confidence range: 47.70 to 55.83)
 95% Confidence Factor: 1.082
 EC50 value was calculated from extrapolated data.
 Estimating Equation: $\text{LOG C} = 1.075 \times \text{LOG G} + 1.713$
 Coeff. of Determination (R^2): 0.9981
 Slope: 0.9286

APPENDIX F - Chain-of-Custody Forms



TESTING LOCATION (Please Check Box)

California
 5550 Morehouse Drive, Suite 150
 San Diego, CA 92121
 Phone 858.587.7333
 Fax 858.587.3961

Washington
 5009 Pacific Highway East, Suite 2
 Tacoma, WA 98424
 Phone 253.922.4296
 Fax 253.922.5814

British Columbia
 8664 Commerce Court
 Burnaby, British Columbia, Canada V5A 4N3
 Phone 604.420.8773
 Fax 604.357.1361

Chain of Custody

Date 3/30/11 Page 1 of 1

Sample Collection By: Floyd Snider

Report to: Enn Breckel
 Company: ~~Floyd Snider~~
 Address: Two Union Square, 601 Union St, Suite 600
 City/State/Zip: Seattle, WA 98101
 Contact: Enn Breckel
 Phone: 206-292-2078
 Email: enn.breckel@floyd.snider.com

Invoice To:
 Company: same
 Address: _____
 City/State/Zip: _____
 Contact: _____
 Phone: _____
 Email: _____

ANALYSES REQUIRED			Receipt Temperature (°C)
10-day (Hyalella caelestis)	20-day chronic midge (Chironomus dilutus)	15-min 100% Porewater Miretoxin Bioassay	
X	X	X	S11-039 8.1 ^(M) 7.5
X	X	X	S11-040 5.5
X	X	X	S11-041 7.5
X	X	X	S11-042 6.2
X	X	X	S11-043 8.2
X	X	X	S11-044 9.0
X	X	X	S11-045 5.5 8.2

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS
1 LL-SED1-0-15-032911	3/29/11	14:05	Sediment	Plastic Jar	3	Extra volume collected
2 LL-SED2-0-15-032911		12:00			3	↓
3 LL-SED3-0-15-032911		11:10			3	↓
4 LL-SED4-0-15-032911		13:10			3	↓
5 MC-SED1-0-10-032911		16:50			1	
6 MC-SED2-0-10-032911		16:35			1	
7 MC-SED3-0-10-032911		16:15			1	
8						
9						
0						

PROJECT INFORMATION		SAMPLE RECEIPT		RELINQUISHED BY (CLIENT)		RELINQUISHED BY (COURIER)	
Client:		Total No. of Containers	15	(Signature)	<u>Enn Breckel</u>	(Signature)	
PO No.:		Received Good Condition?	✓	(Time)	10:40	(Time)	
Shipped Via:		Matches Test Schedule?	✓	(Printed Name)	Enn Breckel	(Printed Name)	
SPECIAL INSTRUCTIONS/COMMENTS:				(Date)	3/30/11	(Date)	
				(Company)	Floyd Snider	(Company)	
				RECEIVED BY (COURIER)		RECEIVED BY (LABORATORY)	
(Signature)		(Signature)	<u>Maria Brayfield</u>				
(Time)		(Time)	1040				
(Printed Name)		(Printed Name)	Maria Brayfield				
(Date)		(Date)	3/30/11				
(Company)		(Company)	Nautilus Log-in's above				

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.



Nautilus Environmental

May 16, 2011

Ms. Erin Breckel
Floyd Snider Inc.
601 Union St. Ste 600
Seattle, WA 98101

Subject: Repeat Testing for LL Sed 2

Dear Erin,

As discussed previously, Lora Lake sediment from sampling location LL Sed 2 was found to be toxic (77% mortality compared to only 7% in the control) during recent sediment bioassays, with the species *Chironomus dilutus*. However, it was noted during test termination that *Chaoborus sp.* known as the "invisible midge", was found in 7 of the 8 replicates run for this sample with reduced survival of the *Chironomus dilutus*. *Chaoborus* are carnivorous and could have been responsible for the mortality of *Chironomus dilutus* observed in this sample and therefore, possibly the reason the sediment was found to be toxic.

As we cannot be certain the *Chaoborus* are the cause of the toxicity, we recommend repeating the testing on this sample after sieving the sediment through a 0.5 mm sieve to remove any *Chaoborus* larvae or eggs. This will help determine if the *Chaoborus* did in fact alter the toxicity of the sample.

A photo of the *Chaoborus* is below. It was taken of an organism found within one of the replicates.

Please call if you have any questions.

Sincerely,

Cat Curran, M.S.

Washington Laboratory Manager



California

5550 Morehouse Drive
Suite 150
San Diego, California 92121
858.587.7333
fax: 858.587.3961

Washington

5009 Pacific Highway East
Suite 2
Tacoma, Washington 98424
253.922.4296
fax: 253.922.5814

British Columbia

8664 Commerce Court
Burnaby, British Columbia
V5A 4N7
604.603.9381
fax: 604.603.9381



Nautilus Environmental

June 27, 2011

Ms. Erin Breckel
Floyd Snider Inc.
601 Union St. Ste 600
Seattle, WA 98101

Subject: Repeat Testing for LLSSED-2

Dear Erin,

Enclosed are the results from the repeat testing using *Chironomus dilutus* conducted on sample LLSSED-2 in June 2011, due to the presence of *Chaoborus.sp.* in the initial testing of this sample. The sample was sieved prior to the repeat testing to remove any remaining organisms. While there was less mortality in the sample compared to the initial testing, the sample does still meet the RSET one-hit criteria for mortality.

Please let me know if there are any questions.

Sincerely,

A handwritten signature in black ink that reads "Cat Curran".

Cat Curran, M.S.

Washington Laboratory Manager

California

4340 Vandever Ave
San Diego, California 92120
858.587.7333
fax: 858.587.3961

Washington

5009 Pacific Highway East
Suite 2
Tacoma, Washington 98424
253.922.4296
fax: 253.922.5814

British Columbia

8664 Commerce Court
Burnaby, British Columbia
V5A 4N7
604.603.9381
fax: 604.603.9381

Client: Floyd Snider

Sample Id: LL-SED2-0-15-032911 (LL-SED2)

INTRODUCTION AND METHODS:

This report summarizes additional biological toxicity testing conducted on Lora Lake sediment sample LL-SED2-0-15-032911 (LL-SED2), collected within the Port of Seattle's Lora Lake Parcel on March 29th, 2011. During testing originally conducted on this sample in April 2011 using the test species *Chironomus dilutus*, this sample was found to contain *Chaoborus sp.*, in conjunction with low survival (77.1 % mortality). The presence of *Chaoborus*, which are carnivorous and could have been responsible for the mortality of *C. dilutus* observed in this sample, could therefore have been the reason the sediment from LL-SED2 failed the one-hit criterion and was found to be more toxic than compared to the other Lora Lake sediment samples tested. In an attempt to confirm or rule out those initial results, the *C. dilutus* 20-day survival and growth bioassay with LL-SED2 was repeated with the sample sieved (0.5 mm) prior to test initiation to remove the *Chaoborus*. The repeat testing was initiated on May 18, 2011, within the 8-week holding time, which expired on May 24, 2011. Details of test procedures are summarized in Table 1. Performance in the test sample was compared to a negative control.

Table 1. Summary of methods for the 20-day test with *Chironomus dilutus*

Test initiation date	May 18, 2011
Test termination date	June 7, 2011
Test organism source	Aquatic BioSystems; Fort Collins, Colorado
Organism age at test initiation	< 4 hours post-emergence from egg case
Feeding	1.5 mL of 4.0 g/L Tetrafin mixture every day; frequency reduced if excess food observed
Test chamber	475-mL glass beaker
Test sediment volume	100 mL
Dilution water type & volume	175 mL diluted mineral water
Water renewal	Twice daily
Control sediment	Sand mixed with peat (1/2 Tbsp)
Number of organisms/replicate	12
Number of replicates/sample	8 plus water quality surrogates
Test temperature	20± 1°C ¹
Illumination	16 hours light : 8 hours dark
Aeration	Initiated day 7
Reference toxicant	Copper chloride
Acceptability Criteria	≤32% mortality, ≥0.48 mg/individual AFDW

¹ Test temperature below the EPA recommended 23°C in order to prevent molting, per the RI/FS workplan

TOXICITY RESULTS:

The test met negative control criteria. Mortality and growth results are summarized in Table 2.

Mean mortality was 10.4 percent in the control, and 51.0 percent in LL-SED2. There were no *Chaoborus*, observed in the sample replicates upon termination of this test. This 40.6 percent difference between LL-SED2 and the control was significantly different. These results are consistent with the initial testing.

Mean growth was 0.81 mg/individual ash-free dry weight (AFDW) in the control and 0.75 mg/individual AFDW in LL-SED2. This difference was not significantly different from the control and is consistent with the initial testing.

Table 2. Results of *Chironomus dilutus* tests. Samples with statistically reduced survival or growth are underlined, and values failing one-hit RSET criteria are shaded gray.¹

Sample	Percent Mortality (Mean ± SD)	Mortality Percent Difference from Control	Ash-Free Dry Weight per Org (mg) (Mean ± SD)	Ash-Free Dry Weight Percent of Control
Control	10.4 ± 9.7	--	0.81 ± 0.19	--
LL-SED2	<u>51.0 ± 31.0</u>	40.6	0.75 ± 0.44	92.5

¹Criteria for one-hit failure is significant decrease in mortality (p<0.05), and mortality greater than 25% of control (RSET 2009)

QA/QC:

The *C. dilutus* were received in good condition. All water quality parameters remained within acceptable ranges throughout the tests. Aeration was initiated in all test chambers starting on Day 7, due to concerns the dissolved oxygen levels might fall below the criterion. A summary of the water quality parameters is presented in Table 3. The test was run at 20°C, as agreed to in the RI/FS workplan to prevent molting of larvae into pupae (Floyd Snider 2011). There were no other deviations from the protocols. The toxicity test with this species met the control acceptability criterion (≤32 percent mortality, ≥0.48 mg/ind AFDW).

Table 3. Summary of water quality parameters for *C. dilutus* tests (means and ranges). Required values are shown in brackets.

Analyte	Control	LL-SED2
		Mean (Min-Max)
Temp. (°C) [20 ± 1°C]	20.0 (19.5-20.7)	19.8 (19.5-20.2)
DO (mg/L) [>2.5 mg/L]	7.6 (4.0-9.3)	7.2 (4.2-9.2)
pH [6-9]	7.36 (6.58-8.31)	7.28 (6.81-8.19)
Cond. (µS/cm) [NA]	184 (119-253)	174 (162-190)
Alkalinity (mg/L CaCO ₃) [<50% variable]	68 (44-80)	70 (64-76)
Hardness (mg/L CaCO ₃) [<50% variable]	78 (56-88)	94 (84-124)
Total Overlying NH ₃ (mg/L) [<50% variable]	2.1 ^a (<1.0-3.3)	2.5 (1.5-2.9)
Total Overlying Sulfides (mg/L) [NA]	0.012 ^a (<0.010-0.015)	0.015 ^a (<0.010-0.033)

^a estimated value

The result of the reference toxicant test conducted in conjunction with this testing program is provided in Table 4. This test was run with the same batch of organisms used in the testing program. The result of this test fell within the range of mean ± two standard deviations of historical results, indicating that the sensitivity of the test organisms was appropriate.

Table 4. *C. dilutus* reference toxicant test results.

Species	Test date	Toxicant	LC50	Acceptable Range	CV (%)
<i>Chironomus dilutus</i>	June 2, 2011	Cu	750 µg/L	386 - 1083 µg/L	23.7

DISCUSSION

The extent and degree of toxicity observed in the initial round of testing was slightly reduced in the current test (Mortality 77 percent compared with 51 percent, respectively), so it appears the *Chaoborus* being present did impact the results but only to a limited extent. Ammonia and sulfide concentrations were comparable between the control and LL-SED2, suggesting these were not responsible for the increase in toxicity. Based on current results, sample LL-SED2 does fail the RSET one-hit criteria of mortality greater than 25 percent of controls and significantly different.

REFERENCES

- American Society of Testing and Materials (ASTM). 2000. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Designation E 1706-00.
- Floyd Snider. 2011. Port of Seattle, Lora Lake Parcel, Remedial Investigation/Feasibility Study Work Plan
- Regional Sediment Evaluation Team (RSET). 2009. Sediment Evaluation Framework for the Pacific Northwest. May 2009.
- U.S. Environmental Protection Agency (USEPA). 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.

**Appendix A-1. 20-Day Solid Phase *Chironomous dilutus* Survival & Growth
Port of Seattle Lora Lake RIFS Sediment Characterization**

Test Initiation: May 18, 2011

^aNumber of pupae and flies

^bAFDW = Ash-Free Dry Weight. Weights are for larvae only, not pupated animals

^c One-tailed t-test. Survival data arcsine square-root transformed prior to analysis. Growth data either square root or log transformed prior to analysis Alpha = 0.05

Shaded values fail RSET one-hit criteria (Test sediment mortality - Control sediment mortality >25% and significantly different; Test sediment Growth/Control sediment Growth <0.7 and significantly different)

Site	Replicate	Rnd. No.	# Alive	# Pupated ^a	% Mortality	Mean % Mortality	St Dev	Total org AFDW (mg) ^b	AFDW per Org (mg)	Mean AFDW per Org (mg)	St Dev	Significant Decrease Compared to Control ^c	
												Survival	Growth
Control	1	9	10	0	16.7			6.12	0.61				
	2	6	9	0	25.0			4.97	0.55				
	3	15	10	0	16.7			9.20	0.92				
	4	11	12	0	0.0	10.4	9.7	8.33	0.69	0.81	0.19	--	--
	5	5	12	0	0.0			11.31	0.94				
	6	16	11	0	8.3			8.11	0.74				
	7	14	10	0	16.7			9.62	0.96				
	8	3	12	0	0.0			12.82	1.07				
LL- SED 2	1	1	4	0	66.7			4.81	1.20				
	2	2	10	0	16.7			14.28	1.43				
	3	10	10	0	16.7			5.91	0.59				
	4	8	1	0	91.7	51.0	31.0	0.40	0.40	0.75	0.44	Yes	No
	5	12	9	0	25.0			6.75	0.75				
	6	4	1	0	91.7			0.12	0.12				
	7	7	7	0	41.7			3.33	0.48				
	8	13	5	0	58.3			4.97	0.99				

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 18 May 2011

Control								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Sulfides (mg/l)
0	20.7	7.6	6.58	119	44	56	<1.0	0.015
1	19.9	6.8	6.82	140	---	---	---	---
2	19.7	6.9	7.07	158	---	---	---	---
3	19.7	6.9	7.00	156	---	---	---	---
4	20.1	6.1	7.00	179	---	---	---	---
5	19.9	6.0	6.87	180	60	80	1.2	<0.010
6	20.0	5.8	7.01	175	---	---	---	---
7	19.8	4.0	6.88	175	---	---	---	---
8	19.5	5.1	7.40	171	---	---	---	---
9	19.9	8.2	7.60	171	---	---	---	---
10	19.9	8.3	7.59	179	76	80	1.8	0.011
11	20.1	8.6	7.65	185	---	---	---	---
12	20.0	8.4	7.55	188	---	---	---	---
13	20.0	8.3	7.67	194	---	---	---	---
14	19.9	8.9	7.77	199	---	---	---	---
15	19.9	8.8	8.31	236	80	84	3.1	<0.010
16	19.9	9.1	7.37	253	---	---	---	---
17	20.0	9.0	7.47	200	---	---	---	---
18	19.9	9.1	7.57	234	---	---	---	---
19	20.3	9.0	7.65	194	---	---	---	---
20	20.7	9.3	7.70	176	80	88	3.3	0.013
Mean	20.0	7.6	7.36	184	68	78	nc	nc
Min	19.5	4.0	6.58	119	44	56	<1.0	<0.010
Max	20.7	9.3	8.31	253	80	88	3.3	0.015

**Appendix Table B-1. Twenty-Day Solid-Phase Results (*Chironomus tentans*)
Port of Seattle Lora Lake RIFS Sediment Characterization
Water Quality Data**

Initiated 18 May 2011

LL-SED-2								
Day	Temp (°C)	D.O. (mg/l)	pH (units)	Conductivity (umhos/cm)	Alkalinity (mg/L CaCO3)	Hardness (mg/L CaCO3)	Total Overlying NH₃ (mg/l)	Total Sulfides (mg/l)
0	20.2	6.3	6.87	162	64	124	2.4	0.010
1	19.8	5.6	6.81	171	---	---	---	---
2	19.6	6.0	6.94	170	---	---	---	---
3	19.7	5.8	6.99	172	---	---	---	---
4	19.9	6.5	6.91	182	---	---	---	---
5	19.9	5.8	6.89	172	76	84	2.9	0.033
6	19.8	5.9	6.95	177	---	---	---	---
7	19.7	5.2	6.89	176	---	---	---	---
8	19.5	5.1	7.29	178	---	---	---	---
9	19.8	8.2	7.51	169	---	---	---	---
10	19.8	8.1	7.56	170	64	84	2.7	0.011
11	19.8	8.5	7.56	170	---	---	---	---
12	20.0	8.3	7.55	166	---	---	---	---
13	20.0	8.2	7.26	188	---	---	---	---
14	19.8	4.2	7.02	190	---	---	---	---
15	19.9	8.8	8.19	171	76	84	2.8	<0.010
16	19.9	9.2	7.33	178	---	---	---	---
17	19.8	9.0	7.45	176	---	---	---	---
18	19.9	9.1	7.56	176	---	---	---	---
19	19.9	8.4	7.84	171	---	---	---	---
20	20.0	9.1	7.48	167	68	96	1.5	0.010
Mean	19.8	7.2	7.28	174	70	94	2.5	nc
Min	19.5	4.2	6.81	162	64	84	1.5	<0.010
Max	20.2	9.2	8.19	190	76	124	2.9	0.033

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider

Test #:

Start Date & Time: 5/18/11 1215

Site: CON

Test Organism: Chironomus tentans

End Date & Time: 6/7/11 1245

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk (mg/L as CaCO ₃)	Hard	pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
									am	pm		
0	<1.0	0.015	44	56	6.58	119	7.6	20.7	✓	✓	✓	JS
1					6.82	140	6.8	19.9	✓	✓	✓	JS
2					7.07	158	6.9	19.7	✓	✓	✓	BP
3					7.00	156	6.9	19.7	✓	✓	✓	(M)
4					7.00	179	6.1	20.1	✓	✓	✓	(M)
5	1.2	<0.01	60	80	6.87	(M) 182 180	6.0	19.9	✓	✓	✓	BP
6					7.01	179	5.8	20.0	✓	✓	✓	MF
7					6.88	178	4.0	19.8	✓	✓	✓	JS
8					7.40	171	5.1	19.5	✓	✓	✓	et
9					7.60	171	8.2	19.9	✓	✓	✓	MF
10	1.8	0.011	76	80	7.59	179	8.3	19.9	✓	✓	✓	CC
11					7.65	185	8.6	20.1	✓	✓	Ⓢ	CC
12					7.55	188	8.4	20.0	✓	✓	✓	(M)
13					7.67	194	8.3	20.0	✓	✓	✓	MF
14					7.77	199	8.9	19.9	✓	✓	✓	JS
15	3.1	<0.010	80	84	8.31	236	8.8	19.9	✓	✓	✓	MF
16					7.37	253	9.1	19.9	✓	✓	✓	BP
17					7.47	200	9.0	20.0	✓	✓	✓	BP
18					7.57	234	9.1	19.9	✓	✓	✓	BP
19					7.65	194	9.0	20.3	✓	✓	✓	et
20	3.3	<0.010 0.013	80	88	7.70	176	9.3	20.7	✓	✓	✓	JS

0.013

QA Check: (M)

Test Chamber: Room B

Ⓢ Skipped excess food

Ⓢ Aeration began day 7

20 Day Toxicity Test Data Sheet -- Nautilus Environmental

Freshwater Sediment 20 Day Water Chemistries

Client: Floyd Snider Test #: 1105-T063
 Site: LL-Sed 2 Test Organism: Chironomus tentans

Start Date & Time: 5/18/11 1215
 End Date & Time: 6/7/11 1245

Day	NH ₃ (mg/L)	Sulfide (mg/L)	Alk		pH (units)	Conductivity (umhos/cm)	Dissolved O ₂ (mg/L)	Temp. (°C)	Renewed		Fed	Tech. Initials
			(mg/L as CaCO ₃)						am	pm		
0	2.4	0.010	64	124	6.87	162	6.3	20.2	✓	✓	✓	JS
1					6.81	171	5.6	19.8	✓	✓	✓	JS
2					6.94	170	6.0	19.6	✓	✓	✓	BP
3					6.99	172	5.8	19.7	✓	✓	✓	(M)
4					6.91	182	6.5	19.9	✓	✓	✓	(M)
5	2.9	0.033	76	84	6.89	172	5.8	19.9	✓	✓	✓	BP
6					6.95	177	5.9	19.8	✓	✓	✓	MF
7					6.89	176	5.2	19.7	✓	✓	✓	JS (2)
8					7.29	178	5.1	19.5	✓	✓	✓	ET
9					7.51	169	8.2	19.8	✓	✓	✓	MF
10	2.7	0.011	64	84	7.56	170	8.1	19.8	✓	✓	✓	CC
11					7.56	170	8.5	19.8	✓	✓	⊙	CC
12					7.55	166	8.3	20.0	✓	✓	✓	(M)
13					7.26	188	8.2	20.0	✓	✓	✓	MF
14					7.02	190	4.2	19.8	✓	✓	✓	JS
15	2.8	<0.010	76	84	8.19	171	8.8	19.9	✓	✓	✓	MF
16					7.33	178	9.2	19.9	✓	✓	✓	BP
17					7.45	176	9.0	19.8	✓	✓	✓	BP
18					7.56	176	9.1	19.9	✓	✓	✓	BP
19					7.84	171	8.4	19.9	✓	✓	✓	ET
20	1.9	0.010	68	96	7.48	167	9.1	20.0	✓	✓	✓	JS

QA Check: (M)

Test Chamber: Rm. B

⊙ Skipped excess food
 ⊙ Aeration began day 7

20 Day Toxicity Test Data Sheet - Nautilus Environmental

Freshwater Sediment 20 day Survival

Client: Floyd Snider
 Test #: 1105+T0103

Start Date & Time: 5/18/11 1215
~~5/7/11 1215~~
 End Date & Time: 6/7/11 1245
 Test Organism: Chironomus dilutus

Site	Rep #	Cont #	Day 0	Survival Day 20				Initials/Comments
				total	#larvae	#pupae	#flies	
CON	1	9	12	10	10	0	0	JS
	2	6	12	9	9	0	0	
	3	15	12	10	10	0	0	
	4	11	12	12	12	0	0	
	5	3	12	12	12	0	0	
	6	16	12	11	11	0	0	
	7	14	12	10	10	0	0	
	8	3	12	12	12	0	0	
LLsed2	1	1	12	4	4	0	0	↓
	2	2	12	10	10	0	0	
	3	10	12	9/10	9/10	0	0	
	4	8	12	9	9	0	0	
	5	12	12	9	9	0	0	
	6	4	12	1	1	0	0	
	7	7	12	7	7	0	0	
	8	13	12	5	5	0	0	
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					
	1		12					
	2		12					
	3		12					
	4		12					
	5		12					
	6		12					
	7		12					
	8		12					

QA Check: W

Nautilus Environmental
 Washington Laboratory
 5009 Pacific Hwy., E. Suite 2
 Tacoma, WA 98424

Client: Floyd Snider
 Organism: Chironomus tentans
 Test no.: 1105-TD03

Site	Rep #	Cont #	Pan wt. (gm)	Dry wt. (gm)	Ash wt. (gm)	Ash free dry wt. (gm)	No. organisms	Avg. per site (mg)
LN	1	9	0.07139	0.07899	0.07287		10	
	2	6	0.07906	0.08792	0.08295		9	
	3	15	0.08176	0.10259	0.09339		10	
	4	11	0.09748	0.09980	0.09147		12	
	5	5	0.07779	0.09847	0.08716		12	
	6	16	0.08589	0.10436	0.09625		11	
	7	14	0.08549	0.10684	0.09700	0.09722	10	
	8	3	0.07618	0.10502	0.09220		12	
LSEA2	1	1	0.07889	0.08464	0.07983		4	
	2	2	0.07839	0.09650	0.08222		10	
	3	10	0.07943	0.08640	0.08049		10	
	4	8	0.08325	0.08375	0.08335		1	
	5	12	0.08312	0.09130	0.08455		9	
	6	4	0.07939	0.07962	0.07950		1	
	7	7	0.07545	0.07970	0.07637		7	
	8	13	0.07900	0.08470	0.07973		5	
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
Tech Initials			EF	KS	EF		JS	

1) Dry wt. Date/time in: 6/7/11 1245 T° 63 2) Furnace date/time in: 6/9/11 1100 T° 550
 Dry wt. Date/time out: 6/8/11 1530 T° 67 Furnace date/time out: 6/9/11 1330 T° 550
 Dry wt. Tech: JS Furnace tech: EF

QA Check: (M)

