Toxicity Evaluation of CSX Genesee River Sediments

Prepared for

AMEC Earth & Environmental
Edison Plaza
155 Erie Blvd.
Schenectady, NY 12305

Prepared by

AMEC Earth and Environmental
San Diego Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, California 92121
(858) 458-9044

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INTRODUCTION

Toxicity tests were conducted on 5 freshwater sediments collected at the CSX Genesee River Site in Rochester, NY. Sediment toxicity procedures were performed using the amphipod *Hyalella azteca* and the midge larvae *Chironomus tentans*. Mr. Tim Ahrens of AMEC Earth and Environmental in Schenectady, New York coordinated the sediment collection and testing programs. Testing was conducted between 29 June and 9 July 2004 at the AMEC Bioassay Laboratory (AMEC) in San Diego, California.

METHODS AND MATERIALS

Sample Collection and Transport

AMEC personnel collected sediment samples from within the plume delineation on 3 and 4 June 2004. Following collection, sediments were placed in polypropylene bags and sealed to minimize headspace. Bags were placed in ice chests with wet ice, and shipped to AMEC by priority overnight delivery service on 4 June 2004. These samples were received at AMEC on 5 June 2004. Sediment samples were identified as Lake, BIO1, BIO2, and BIO3. Upon chemistry analysis, the methylene chloride and acetone levels found in the samples were insufficient to proceed with testing.

AMEC personnel re-collected samples from within the plume delineation on 15 and 16 June 2004. Following this collection effort, sediments were placed in 2 gallon HDPE buckets and sealed to minimize headspace. Samples were stored on wet ice prior to shipment while confirming methylene chloride and acetone levels in the sediments. Buckets were then placed in ice chests with wet ice, and shipped to AMEC by priority overnight delivery service on 21 June 2004. These samples were received at AMEC on 22 June 2004. Sediment samples were identified as SS-5A, SS-16, SS-19A, and SS-24. Appropriate chain-of-custody procedures were employed during collection and transport.

Sample Receipt

Upon arrival at AMEC, coolers were opened and their contents verified. Temperature was measured in one sample from each cooler received. Interstitial porewater was collected for measurement of ammonia. Interstitial water consisted of a subsample of surface water from each site. During shipment, sediments quickly settle, often leaving a layer of interstitial water on the sediment surface. When surface water was not available, sediments were centrifuged to provide sufficient interstitial water for the

measurements specified. Samples were then placed in a 4 °C cold room until test initiation.

Sediment Preparation and Handling

In an effort to minimize the volitization of methylene chloride and acetone from the sediments, samples were not sieved prior to testing. The samples were carefully homogenized to minimize air exposure prior to distribution to each replicate chamber for testing.

Organism Procurement and Handling

Amphipod

Test specimens (*Hyalella azteca*) were obtained on 26 June 2004 from Aquatic BioSystems in Fort Collins, Colorado. The organisms were sorted by size class and then transported to AMEC in oxygen-saturated water contained in plastic bags. Fine screens were included as a substrate source. An insulated ice chest containing the bags was shipped by overnight delivery service. Upon arrival at AMEC, organism receipt information was recorded, animal condition specified, and physical parameters including pH, dissolved oxygen (DO), conductivity, and temperature were measured. The amphipods were acclimated to test conditions in order to promote and confirm animal health prior to test initiation. During these acclimation periods, the animals were observed for any indications of stress or significant mortality. Observed mortality is monitored and recorded in animal holding logbooks. Mortality is considered significant if it is greater than 10 percent during the holding and acclimation period. Obvious indications of stress include abnormal swimming behavior, discoloration, and mortality.

Midge Larvae

Test specimens (*Chironomus tentans*) were obtained from Aquatic BioSystems in Fort Collins, Colorado on 26 June 2004. The midge larvae were transported to AMEC in oxygen-saturated water contained in 500-milliliter (ml) plastic containers. Shredded paper towels were included as a substrate source. An insulated ice chest containing the organisms was shipped by overnight delivery service. Upon arrival at AMEC, organism receipt information was recorded and physical parameters and animal condition were specified. The midge larvae were acclimated to test conditions in order to promote and confirm animal health prior to test initiation. During the acclimation period, the animals were observed for any indications of stress or significant mortality.

Observed mortality is monitored and recorded in animal holding logbooks. Mortality is considered significant if it is greater than 10 percent during the holding and acclimation period. Obvious indications of stress include abnormal swimming behavior, discoloration, and mortality.

Bioassay Protocol

Bioassays were conducted in accordance with U.S. Environmental Protection Agency (EPA) protocols outlined in "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition" (2000) and with American Society for Testing and Materials (ASTM) protocols outlined in "Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates," E 1383-94 (1994).

Test Procedures

Organisms were exposed to test sediments for 10 days to determine the effects of site sediment on survival and growth. Test chambers for both species consisted of 1-liter (L) glass jars supplied with continuous aeration at a rate of three bubbles per second. The test was conducted in an environmental chamber maintained at 20 ± 1°C under a 16-hour (light): 8-hour (dark) light cycle. The experimental design consisted of five replicate jars per site arranged in a pre-determined random order on a single shelf in the environmental chamber. Two additional surrogates per site were included for verification of methylene chloride levels on days 0 and 10 of the test period. An additional replicate was also included for each site as a surrogate test chamber for routine water quality measurements. Two centimeters (cm) of sediment was placed in each chamber. Approximately 800 ml of Culligan-filtered water (Culligan) was then added to each. Culligan is obtained from a city water line connected to a permanent series of activated carbon and resin filters. Sediments were allowed to settle and the system was allowed to equilibrate for 24 hours prior to the addition of test organisms. Twenty amphipods and 10 midge larvae were added to each test chamber of their respective tests after confirmation by two technicians that the correct number of test organisms was segregated and in healthy condition. A source of food was provided to both species during the test by adding 1-ml of a mixture of ground Tetramin® flakes (0.02 grams (g) per 100 ml Culligan) per chamber every 2 to 3 days during the testing period. The feeding regime was suspended if the presence of excess food was observed on the sediment surface in several test chambers.

Temperature, DO, pH, and conductivity were monitored daily in the surrogate replicate test chamber for each site. Subsamples of interstitial porewater were collected prior to homogenization and overlying water was collected from each surrogate at the beginning and end of the test period for ammonia analysis.

Each test chamber was examined daily to ensure proper airflow. Abnormal conditions or unusual animal behavior, if observed, were also noted at this time. Examples of unusual behavior include failure to bury, erratic or slow movements, and slow response to stimulation.

Two sediment controls (field collected fresh water sediment and rinsed beach sand) and a copper chloride reference toxicant test were conducted in conjunction with the test sediments to ensure that organisms were not impacted by stresses other than contamination in the test material. The beach sand control consisted of clean washed beach sand obtained from La Jolla Shores beach in La Jolla, California. The field collected freshwater sediment control (FW) was obtained by Brezina & Associates from a protected drinking water reservoir located near Dillon Beach in northern California.

Statistical Analyses

Statistical analyses were performed using GraphPad Prism software, Version 3.0. A One-Way Analysis of Variance (ANOVA) was performed to determine if significant differences existed among sites for mean survival and growth data following exposure to control and test sediments. Multiple comparison procedures using t-tests were used to assess differences between individual test sediments and the freshwater sediment control and reference site Lake sediment. Welch's corrected t-test was used to analyze individual differences in cases of unequal variances. Prior to the analysis, differences in variance were evaluated using Bartlett's Test or F-test and normality was evaluated using Kolmogorov-Smirnov test. Survival data, expressed as a percentage, was arcsine square root transformed prior to analysis to normalize the distribution of the data and satisfy statistical assumptions for analysis. Growth data expressed as milligrams (mg) per organism was not transformed prior to analysis.

Maximum Likelihood-Probit analysis was used to calculate the median lethal concentration (LC_{50}) value and associated confidence intervals for reference toxicant tests using ToxCalc Comprehensive Toxicity Data Analysis and Database Software, Version 5.0.

RESULTS

Test results are summarized in Figures 1 and 2. Survival and growth summaries, water and sediment quality data, reference toxicant data, and statistical summaries are contained in Appendices A, B, C, and D, respectively. Chain-of-custody information is located in Appendix E.

Amphipod Bioassay

Mean survival in the two controls were 96 and 99 percent for the freshwater sediment and beach sand controls, respectively. These values exceed the recommended EPA guideline survival criterion of 80 percent. The average survival of the Lake reference site was 94 percent. Average survival of amphipods exposed to the test sediments ranged from 94 to 99 percent (Figure 1, Appendix A-1). ANOVA detected no significant reduction in survival among sites (Appendix D-1). Upon further evaluation using multiple comparison t-tests, no statistically significant reductions in survival were found when comparing site sediment data to either the freshwater sediment control or to the Lake reference sediment (Appendix D-3).

Mean growth per organism in the two controls was 0.057 milligrams (mg) and 0.054 mg for the freshwater sediment and beach sand controls, respectively. The average growth of the Lake reference site was 0.089 mg. The average growth per organism among the test sediments ranged from 0.030 mg to 0.051 mg (Figure 1, Appendix A-1). ANOVA detected a significant difference in growth among sites (Appendix D-1). Upon further evaluation, multiple comparison t-tests detected significant reduction in growth in all site sediments tested when compared the Lake reference sediment ($p < 0.001$). Sites SS-19A and SS-24 also showed a significant reduction in growth when compared to the freshwater sediment control ($p = 0.008$ and 0.002 respectively). The freshwater sediment control also exhibited a significant reduction in growth when compared to the Lake reference site (see Appendix D-3). Regression analysis revealed no significant relationship between amphipod growth and methylene chloride sediment levels at test initiation (Appendix D-4). Acetone was only detected in site SS-5A (Appendix B-3) and appeared to have no effect on *Hyalella* growth based on no significant difference in growth from the freshwater sediment control and having the highest growth amongst all of the sites tested.

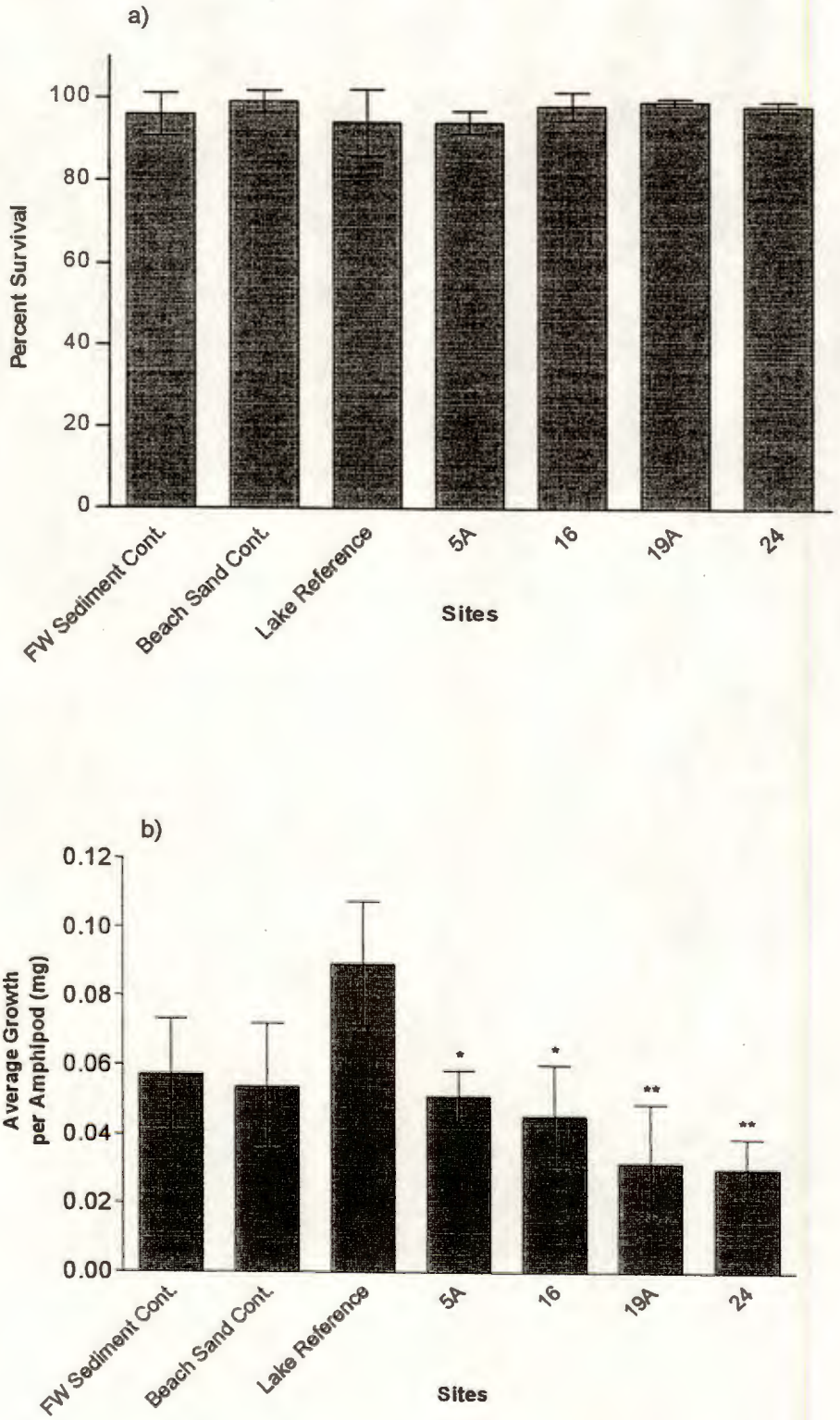

Figure 1. Summary of *Hyalella* a) Survival b) and Growth (95% CI; n=5). * Indicates a significant reduction ($p<0.05$) relative to the Lake reference. ** Indicates a significant reduction ($p<0.05$) relative to both the Lake reference and FW Sediment Control.

All water quality measurements recorded during the 10-day exposure were within the range defined as acceptable by the test protocol. Total ammonia levels in interstitial water ranged from 0.7 to 118.1 mg/L. Total ammonia in overlying water on Day 0 ranged from 1.0 to 13.3 mg/L. Total ammonia in overlying water on Day 10 ranged from 0.6 to 25.6 mg/L. No abnormal conditions or behaviors were observed throughout the duration of the test.

A concurrent reference toxicant test using copper chloride ($CuCl_2$) was conducted to assess the health of the test organisms and soundness of procedures. Mean control survival was 95 percent. An LC_{50} value of 509 micrograms per liter (µg/L) copper was determined using Maximum Likelihood-Probit analysis. The associated 95 percent confidence intervals for this value were 269 and 1060 µg/L copper. This LC_{50} value is within internal control chart limits of ± two standard deviations (Appendix C). This indicates that test organism sensitivity was similar to that of organisms historically tested at AMEC.

Midge Larvae Bioassay

Mean survival in the two controls was 98 and 96 percent for the freshwater sediment and beach sand controls, respectively. These values exceed the recommended EPA guideline survival criterion of 70 percent. Average survival of the Lake reference site was 96 percent. Average survival of midge larvae exposed to the test sediments ranged from 92 to 96 percent (Figure 2, Appendix A-2). ANOVA detected no significant reduction in survival among sites (Appendix D-2). Upon further evaluation using multiple comparison t-tests, no statistically significant reductions in survival were found when comparing site sediment data to either the freshwater sediment control or the Lake reference sediment (Appendix D-3).

Mean growth per organism in the two controls was 0.427 mg and 0.394 mg for the freshwater sediment and beach sand controls, respectively. Average growth per organism for the Lake reference site was 0.873 mg. The average growth per organism among the test sediments ranged from 0.327 mg to 0.591 mg (Figure 2, Appendix A-2). A one-way ANOVA detected significant differences in growth among the sediments (Appendix D-2). Multiple comparison t-tests demonstrated significant reductions in growth in sites SS-5A, SS-19A and SS-24 when compared to the Lake reference (Appendix D-3). The freshwater sediment control also exhibited a significant reduction in growth when compared to the Lake reference. None of the site sediments had significantly reduced growth compared to the freshwater sediment control. Regression

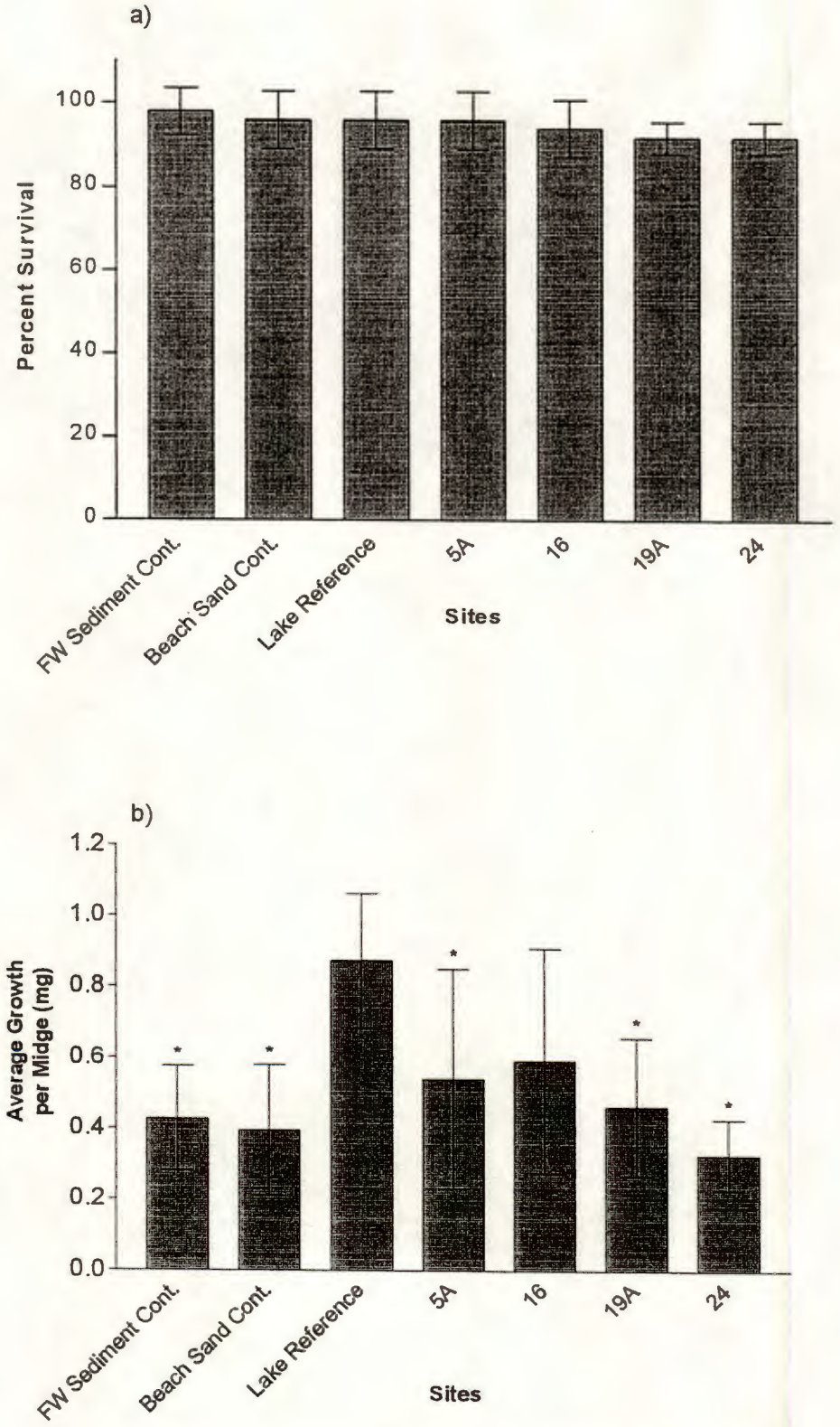

Figure 2. Summary of *Chironomus* a) Survival b) and Growth (95% CI; n=5). *Indicates a significant reduction relative to the Lake reference.

analysis revealed no significant relationship between *Chironomus* growth and methylene chloride sediment levels at test initiation (Appendix D-4). The only site containing acetone, SS-5A, also appeared to have no effect on *Chironomus* growth based on its increased growth compared to the freshwater sediment control and sites SS-19A and SS-24, both of which contained non-detectable concentrations of acetone.

All water quality measurements recorded during the 10-day exposure were within the range defined as acceptable by the test protocol. Total ammonia levels in interstitial water ranged from 0.7 to 118.1 mg/L. Total ammonia in overlying water on Day 0 ranged from 1.0 to 13.3 mg/L. Total ammonia in overlying water on Day 10 ranged from 0.6 to 25.5 mg/L. No abnormal conditions or behaviors were observed throughout the duration of the test.

A concurrent reference toxicant test using copper chloride ($CuCl_2$) was conducted to assess the health of the test organisms and soundness of procedures. Mean reference toxicant control survival was 92.5 percent. An LC_{50} value of 0.33 milligrams per liter (mg/L) copper was determined using Maximum Likelihood-Probit analysis. This LC_{50} value is within internal control chart limits of ± two standard deviations (Appendix C). This indicates that test organism sensitivity was similar to that of organisms historically tested at AMEC.

Discussion

Levels of methylene chloride and acetone in the sediments appeared to have no significant effect on survival of either species. Growth was found to be significantly different from the Lake reference in all sites tested for *Hyalella* and three of the four sites tested for *Chironomus*. Also, growth in the two controls tested was also found to be significantly different from the Lake reference for both species. However, no significant relationships were found between methylene chloride or acetone levels in the sediments and growth of the organisms. Total ammonia in the interstitial water of the samples however, was found to exceed levels that can cause toxicity to both species tested. Schubauer-Berigan et al. (1995) reported 96-hour LC_{50} values of 82 to 370 mg/L for *C. tentans* depending on water hardness. LC_{50} values for *H. azteca* have been found to range between 20 and >200 mg/L, depending on pH and water hardness (Ankley et al. 1995). A 96-hour LC_{50} value of approximately 35 mg/L total ammonia is reported for *H. azteca* following a water only exposure with conditions similar to that in this study; hard, reconstituted water at a pH of 8.50 (EPA 2000). *C. tentans* is less sensitive to ammonia than *H. azteca* with a 96-hour LC_{50} value of approximately 82

mg/L following a water only exposure at a pH of 8.60 (EPA 2000). In an effort to minimize volatilization of methylene chloride, ammonia was not purged from the sediments via water renewals prior to or during the test. The concentration of ammonia in overlying water in all sediment tests appears to be below the concentrations expected to cause acute toxicity to either species. Regression analysis revealed a significant relationship between the interstitial ammonia levels and growth of *Hyalella* ($p=0.045$, Appendix D-4). *Chironomus* exhibited no such relationship ($p=0.526$).

The increased growth of both species in the Lake reference sediment was more than likely due to a difference in sediment food source and quality. All test chambers were fed a diet of Tetramin on an as needed basis, therefore food quantity can be ruled out as a potential, source of variation. Ankley et al. (1994) reported that nutritional quality of the sediment samples is a major variable influencing test results for both *C. tentans* and *H. azteca*. Total organic carbon (TOC), a measure commonly used to predict the nutrient quantity of sediments, might shed some light on the results, however Ankley et al. (1994) and Ristola et al. (1999) state that TOC does not have a significant predictive value on the nutritional quality of sediments.

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APPENDIX A

SURVIVAL AND GROWTH SUMMARIES

HYALELLA

Appendix A-1. Amphipod Survival and Growth Results - *Hyalella azteca*
AMEC - Schenectady
CSX - MeCl
Inititated 29 June 2004

Site	Replicate	Rnd. No.	# Alive	% Survival	Mean % Survival	Total Weight (mg)	Weight per Org (mg)	Growth per Org (mg)	Mean Growth per Org. (mg)
CONTROL	A	16	19	95		1.600	0.084	0.035	
FW Control Sed.	B	11	20	100		2.160	0.108	0.059	
	C	2	19	95		2.250	0.118	0.069	
	D	26	20	100		2.230	0.112	0.063	
	E	13	18	90	96	1.960	0.109	0.060	0.057
CONTROL	A	5	20	100		2.220	0.111	0.062	
Beach Sand Cont.	B	3	19	95		2.230	0.117	0.068	
	C	22	20	100		1.730	0.087	0.038	
	D	18	20	100		1.730	0.087	0.038	
	E	21	20	100	99	2.240	0.112	0.063	0.054
Lake Reference	A	--	17	85		2.220	0.131	0.082	
	B	--	18	90		2.170	0.121	0.072	
	C	--	20	100		3.140	0.157	0.108	
	D	--	19	95		2.540	0.134	0.085	
	E	--	20	100	94	2.980	0.149	0.100	0.089
Site SS-5A	A	10	18	90		1.730	0.096	0.047	
	B	24	19	95		2.030	0.107	0.058	
	C	6	19	95		1.950	0.103	0.054	
	D	30	19	95		1.930	0.102	0.053	
	E	7	19	95	94	1.750	0.092	0.043	0.051
Site SS-16	A	27	20	100		2.080	0.104	0.055	
	B	20	20	100		1.610	0.081	0.032	
	C	15	19	95		1.940	0.102	0.053	
	D	17	20	100		2.050	0.103	0.054	
	E	23	19	95	98	1.550	0.082	0.033	0.045
Site SS-19A	A	19	19	95		1.460	0.077	0.028	
	B	8	20	100		2.010	0.101	0.052	
	C	12	20	100		1.730	0.087	0.038	
	D	9	20	100		1.440	0.072	0.023	
	E	4	20	100	99	1.310	0.066	0.017	0.031
Site SS-24	A	25	20	100		1.610	0.081	0.032	
	B	28	20	100		1.720	0.086	0.037	
	C	29	20	100		1.620	0.081	0.032	
	D	14	19	95		1.270	0.067	0.018	
	E	1	19	95	98	1.520	0.080	0.031	0.030

CHIRONOMUS

Appendix A-2. Midge Larvae Survival and Growth Results - *Chironomus tentans*
AMEC - Schenectady
CSX - MeCl
Initiated 29 June 2004

Site	Replicate	Rnd. No.	# Alive	% Survival	Mean % Survival	Total Weight (mg)	Weight per Org (mg)	Growth per Org (mg)	Mean Growth per Org. (mg)
CONTROL	A	16	9	90		6.580	0.731	0.597	
FW Control Sed.	B	11	10	100		5.800	0.580	0.446	
	C	2	10	100		4.490	0.449	0.315	
	D	26	10	100		4.450	0.445	0.311	
	E	13	10	100	98	5.980	0.598	0.464	0.427
CONTROL	A	5	10	100		7.190	0.719	0.585	
Beach Sand Cont.	B	3	9	90		4.530	0.503	0.369	
	C	22	9	90		3.110	0.346	0.212	
	D	18	10	100		4.420	0.442	0.308	
	E	21	10	100	96	6.280	0.628	0.494	0.394
Lake Reference	A	--	9	90		8.530	0.948	0.814	
	B	--	10	100		7.870	0.787	0.653	
	C	--	10	100		11.450	1.145	1.011	
	D	--	9	90		10.390	1.154	1.020	
	E	--	10	100	96	9.990	0.999	0.865	0.873
Site SS-5A	A	10	9	90		4.480	0.498	0.364	
	B	24	9	90		7.470	0.830	0.696	
	C	6	10	100		5.900	0.590	0.456	
	D	30	10	100		10.240	1.024	0.890	
	E	7	10	100	96	4.210	0.421	0.287	0.539
Site SS-16	A	27	10	100		10.920	1.092	0.958	
	B	20	9	90		7.060	0.784	0.650	
	C	15	10	100		5.670	0.567	0.433	
	D	17	9	90		3.750	0.417	0.283	
	E	23	9	90	94	6.880	0.764	0.630	0.591
Site SS-19A	A	19	8	80		5.320	0.665	0.531	
	B	8	9	90		3.040	0.338	0.204	
	C	12	10	100		5.780	0.578	0.444	
	D	9	9	90		5.810	0.646	0.512	
	E	4	10	100	92	7.520	0.752	0.618	0.462
Site SS-24	A	25	8	80		2.810	0.351	0.217	
	B	28	9	90		5.140	0.571	0.437	
	C	29	9	90		3.890	0.432	0.298	
	D	14	10	100		4.790	0.479	0.345	
	E	1	10	100	92	4.700	0.470	0.336	0.327

APPENDIX B

WATER QUALITY RESULTS

HYALELLA

Appendix Table B-1. Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Fresh Water Sediment Control						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.93	816	8.7	20.4	0.7	1.0
1	7.94	812	8.7	20.4	---	---
2	7.88	806	8.8	20.1	---	---
3	7.96	795	8.4	20.0	---	---
4	8.03	791	8.6	20.3	---	---
5	8.02	781	8.8	20.4	---	---
6	7.89	707	9.1	20.9	---	---
7	7.75	792	8.6	20.6	---	---
8	7.93	785	8.4	20.9	---	---
9	7.78	780	8.5	20.9	---	---
10	7.71	773	8.1	20.6	---	0.6

Appendix Table B-1(Cont.). Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Beach Sand Control						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.17	865	8.5	20.4	0.7	1.2
1	8.37	889	8.7	20.3	---	---
2	8.33	895	9.3	20.1	---	---
3	8.44	900	8.7	19.9	---	---
4	8.39	907	8.6	20.0	---	---
5	8.43	904	9.1	20.2	---	---
6	8.37	827	9.4	20.7	---	---
7	8.31	898	8.8	20.5	---	---
8	8.38	892	8.5	20.8	---	---
9	8.29	896	8.4	20.9	---	---
10	8.24	894	8.4	20.6	---	0.6

Appendix Table B-1(Cont.). Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Lake Reference						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.91	850	8.2	19.9	1.0	1.7
1	8.18	865	8.4	20.2	---	---
2	8.11	863	8.7	20.2	---	---
3	8.27	861	8.5	19.9	---	---
4	8.30	864	8.8	19.8	---	---
5	8.37	856	9.0	20.1	---	---
6	8.29	776	9.3	20.6	---	---
7	8.34	830	8.7	20.4	---	---
8	8.26	831	8.2	20.7	---	---
9	8.32	833	8.4	20.9	---	---
10	8.27	833	8.5	20.6	---	1.0

Appendix Table B-1(Cont.). Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-5A						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.06	922	8.5	20.3	78.6	10.4
1	8.10	967	8.6	20.2	---	---
2	8.17	982	9.1	20.0	---	---
3	8.43	989	8.7	19.8	---	---
4	8.36	1001	8.6	19.9	---	---
5	8.39	998	9.1	20.1	---	---
6	8.35	910	9.4	20.7	---	---
7	8.30	977	8.8	20.5	---	---
8	8.17	982	8.2	20.8	---	---
9	8.08	980	8.1	20.9	---	---
10	7.99	967	8.2	20.5	---	12.6

Appendix Table B-1(Cont.). Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-16						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.93	1254	8.4	20.3	63.3	7.3
1	7.94	1405	8.6	20.2	---	---
2	7.93	1480	9.0	20.1	---	---
3	8.08	1541	8.6	19.8	---	---
4	8.09	1607	8.6	19.9	---	---
5	8.15	1642	9.1	20.1	---	---
6	8.09	1525	9.3	20.6	---	---
7	8.18	1658	8.9	20.5	---	---
8	8.13	1690	8.4	20.7	---	---
9	8.16	1708	8.5	20.9	---	---
10	8.14	1721	8.2	20.5	---	15.9

Appendix Table B-1(Cont.). Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-19A						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.10	1022	8.2	20.3	118.1	13.3
1	8.16	1101	8.6	20.1	---	---
2	8.18	1133	9.1	20.0	---	---
3	8.39	1149	8.6	19.8	---	---
4	8.40	1164	8.7	19.8	---	---
5	8.45	1162	9.2	20.1	---	---
6	8.43	1060	9.3	20.6	---	---
7	8.45	1141	8.6	20.5	---	---
8	8.35	1155	8.5	20.7	---	---
9	8.39	1165	8.5	20.8	---	---
10	8.51	1173	8.4	20.5	---	25.6

Appendix Table B-1(Cont.). Ten-Day Solid-Phase Results (*Hyalella azteca*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-24						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.92	1072	8.4	20.4	82.2	7.7
1	7.97	1171	8.4	20.2	---	---
2	8.02	1216	8.9	20.0	---	---
3	8.27	1251	8.7	19.8	---	---
4	8.29	1279	8.8	19.8	---	---
5	8.38	1283	9.1	20.0	---	---
6	8.33	1167	9.5	20.5	---	---
7	8.37	1258	8.8	20.5	---	---
8	8.33	1267	8.5	20.7	---	---
9	8.32	1275	8.4	20.8	---	---
10	8.27	1277	8.4	20.5	---	16.0

Appendix Table B-2. Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Fresh Water Sediment Control						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.93	816	8.7	20.4	0.7	1.0
1	8.03	788	8.7	20.2	---	---
2	7.92	778	9.0	20.0	---	---
3	7.99	791	8.7	19.8	---	---
4	8.01	764	8.7	19.8	---	---
5	8.07	751	9.1	20.1	---	---
6	8.02	675	9.4	20.4	---	---
7	7.97	718	8.7	20.2	---	---
8	7.90	716	8.4	20.7	---	---
9	8.04	712	8.5	20.7	---	---
10	8.04	706	8.6	20.6	---	0.6

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Beach Sand Control						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.17	865	8.5	20.4	0.7	1.2
1	8.29	867	8.7	20.0	---	---
2	8.16	874	8.9	20.0	---	---
3	8.28	880	8.6	19.7	---	---
4	8.34	887	8.6	19.8	---	---
5	8.42	882	9.0	20.1	---	---
6	8.39	804	8.4	20.6	---	---
7	8.35	862	8.9	20.3	---	---
8	8.29	871	8.4	20.7	---	---
9	8.23	876	8.4	20.8	---	---
10	8.22	875	8.1	20.5	---	1.2

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Lake Reference						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.91	850	8.2	19.9	1.0	1.7
1	8.19	855	8.5	20.3	---	---
2	8.07	852	8.8	20.2	---	---
3	8.30	850	8.5	19.9	---	---
4	8.25	851	8.6	19.9	---	---
5	8.34	846	8.8	20.2	---	---
6	8.30	768	9.2	20.6	---	---
7	8.29	826	8.8	20.4	---	---
8	8.23	825	8.3	20.8	---	---
9	8.27	828	8.4	20.9	---	---
10	8.25	830	8.3	20.6	---	1.1

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-5A						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.06	922	8.5	20.3	78.6	10.4
1	8.16	942	8.6	20.0	---	---
2	8.20	956	9.1	20.0	---	---
3	8.35	962	8.7	19.7	---	---
4	8.37	967	8.7	19.8	---	---
5	8.44	960	9.1	20.1	---	---
6	8.39	871	9.4	20.6	---	---
7	8.40	932	8.8	20.4	---	---
8	8.27	941	8.4	20.7	---	---
9	8.26	943	8.4	20.8	---	---
10	8.14	935	8.3	20.4	---	14.2

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-5A						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.06	922	8.5	20.3	78.6	10.4
1	8.16	942	8.6	20.0	---	---
2	8.20	956	9.1	20.0	---	---
3	8.35	962	8.7	19.7	---	---
4	8.37	967	8.7	19.8	---	---
5	8.44	960	9.1	20.1	---	---
6	8.39	871	9.4	20.6	---	---
7	8.40	932	8.8	20.4	---	---
8	8.27	941	8.4	20.7	---	---
9	8.26	943	8.4	20.8	---	---
10	8.14	935	8.3	20.4	---	14.2

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-16						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.93	1254	8.4	20.3	63.3	7.3
1	7.98	1377	8.6	20.1	---	---
2	8.01	1439	9.1	20.1	---	---
3	8.15	1488	8.6	19.8	---	---
4	8.18	1528	8.8	19.8	---	---
5	8.22	1542	9.0	20.1	---	---
6	8.21	1417	9.3	20.6	---	---
7	8.25	1529	8.8	20.3	---	---
8	8.21	1553	8.4	20.7	---	---
9	8.18	1565	8.5	20.8	---	---
10	8.15	1563	8.3	20.4	---	12.4

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-19A						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	8.10	1022	8.2	20.3	118.1	13.3
1	8.06	1079	8.5	20.2	---	---
2	8.12	1107	8.9	20.1	---	---
3	8.30	1123	8.6	19.8	---	---
4	8.36	1135	8.6	19.8	---	---
5	8.42	1130	9.1	20.1	---	---
6	8.40	1027	9.4	20.6	---	---
7	8.41	1100	8.9	20.3	---	---
8	8.35	1114	8.4	20.7	---	---
9	8.36	1122	8.6	20.9	---	---
10	8.32	1122	8.3	20.5	---	25.5

Appendix Table B-2(Cont.). Ten-Day Solid-Phase Results (*Chironomus tentans*)
AMEC - Schenectady
CSX - MeCl
Water Quality Data

Initiated 29 June 2004

Site SS-24						
Day	pH (units)	Conductivity (umhos/cm)	DO (mg/L)	Temp (°C)	Total NH_3 (mg/L) Interstitial	Overlying
0	7.92	1072	8.4	20.4	82.2	7.7
1	8.12	1117	8.6	20.2	---	---
2	8.08	1156	9.0	20.1	---	---
3	8.18	1184	8.6	19.8	---	---
4	8.25	1206	8.7	19.8	---	---
5	8.28	1209	9.1	20.1	---	---
6	8.29	1104	9.3	20.6	---	---
7	8.34	1187	8.9	20.3	---	---
8	8.25	1199	8.4	20.7	---	---
9	8.30	1204	8.3	20.9	---	---
10	8.27	1205	8.3	20.5	---	14.0

Appendix B-3. Levels of Methylene Chloride and Acetone in Site Sediments at Test Initiation

Sample	Methylene Chloride (ppm)	Acetone (ppm)
SS-5A	0.018	0.22
SS-16	260	ND
SS-19A	1000	ND
SS-24	14	ND

ND - not detected

APPENDIX C

REFERENCE TOXICANT TESTS

HYALELLA

Appendix Table C-1. Ten-Day Solid-Phase Results (*Hyalella azteca*)
Reference Toxicant Data
Initiated 30 June 2004

$CuCl_2$ Concentration	Rep	Temp. (°C)					DO (mg/L)					pH (units)					Cond (umhos/cm)					Survival	
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Control	A	20.2	20.1	20.1	20.0	20.1	8.6	9.1	8.3	8.4	8.5	8.37	8.24	8.20	8.18	8.23	865	885	885	882	867	10	10
	B																					10	9
	C																					10	10
	D																					10	9
0.1 mg/L	A	20.2	20.1	20.1	20.0	20.1	8.8	9.0	8.6	8.6	8.9	8.37	8.27	8.27	8.22	8.28	853	874	874	875	865	10	10
	B																					10	10
	C																					10	10
	D																					10	10
0.2 mg/L	A	20.2	20.1	20.1	20.0	20.1	8.8	9.2	8.7	8.7	9.0	8.37	8.27	8.26	8.23	8.30	852	872	873	874	864	10	10
	B																					10	8
	C																					10	10
	D																					10	8
0.4 mg/L	A	20.4	20.1	20.2	20.0	20.1	8.8	9.3	8.7	8.8	9.1	8.35	8.27	8.27	8.22	8.28	850	871	871	871	862	10	5
	B																					10	4
	C																					10	4
	D																					10	4
0.8 mg/L	A	20.3	20.1	20.2	19.9	20.1	8.8	9.3	8.7	8.8	9.1	8.37	8.24	8.24	8.21	8.27	847	869	869	869	859	10	1
	B																					10	1
	C																					10	5
	D																					10	1
1.6 mg/L	A	20.3	20.2	20.2	19.9	20.0	8.8	9.3	8.7	8.8	8.9	8.22	8.18	8.21	8.19	8.24	842	861	862	862	853	10	1
	B																					10	0
	C																					10	1
	D																					10	5

Amphipod 10-day Survival Bioassay-Survival

Start Date:	06/30/2004	Test ID:	040630hara	Sample ID:	REF-Ref Toxicant
End Date:	07/04/2004	Lab ID:	AEESD-AMEC Bioassay SD	Sample Type:	CUCL-Copper chloride
Sample Date:		Protocol:	EPA 2000 Sediment	Test Species:	HA-Hyalella azteca
Comments:					

Conc-ug/L	1	2	3	4
Lab Control	1.0000	0.9000	1.0000	0.9000
100	1.0000	1.0000	1.0000	1.0000
200	1.0000	0.8000	1.0000	0.8000
400	0.5000	0.4000	0.4000	0.4000
800	0.1000	0.1000	0.5000	0.1000
1600	0.1000	0.0000	0.1000	0.5000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
Lab Control	0.9500	1.0000	1.3305	1.2490	1.4120	7.072	4			2	40
100	1.0000	1.0526	1.4120	1.4120	1.4120	0.000	4	22.00	10.00	0	40
200	0.9000	0.9474	1.2596	1.1071	1.4120	13.974	4	16.00	10.00	4	40
*400	0.4250	0.4474	0.7099	0.6847	0.7854	7.091	4	10.00	10.00	23	40
*800	0.2000	0.2105	0.4377	0.3218	0.7854	52.969	4	10.00	10.00	32	40
*1600	0.1750	0.1842	0.3969	0.1588	0.7854	68.059	4	10.00	10.00	33	40

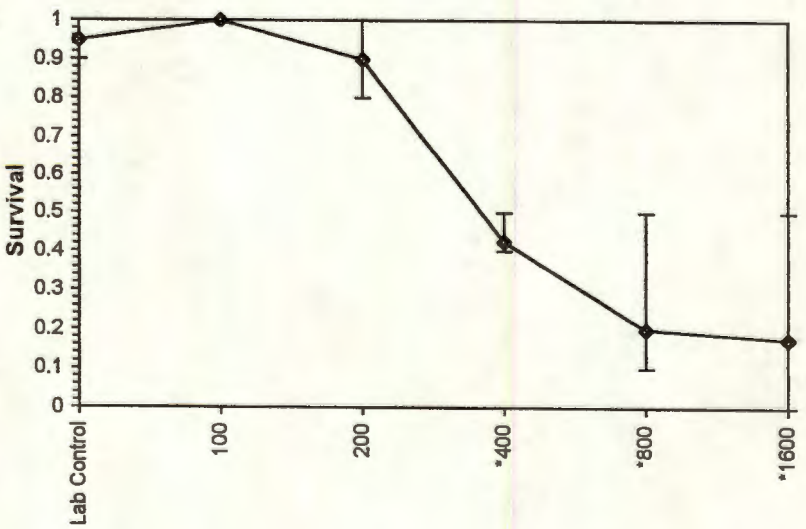
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.90008	0.884	1.18793	1.6249
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	200	400	282.843	

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	2.85472	0.56781	1.04769	4.66174	0.05	10.2042	7.81472	0.02	2.70654	0.3503	50
Intercept	-2.7264	1.51962	-7.5625	2.10972							
TSCR	0.04391	0.02494	-0.0355	0.12328							

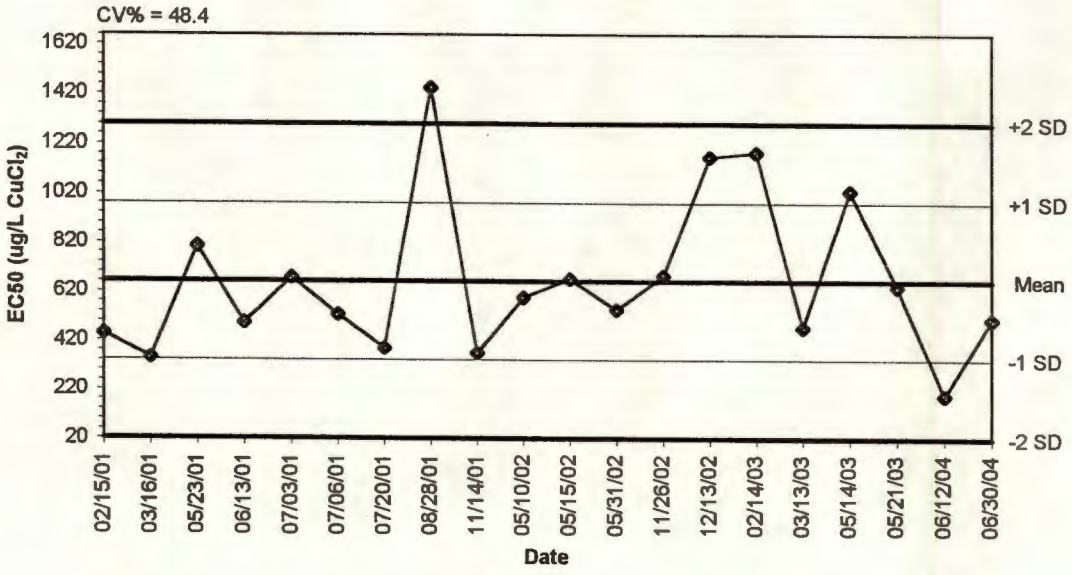
Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	77.9163	3.08154	176.479
EC05	3.355	135.006	13.1501	258.936
EC10	3.718	180.975	28.0058	323.275
EC15	3.964	220.537	46.0297	380.472
EC20	4.158	258.062	67.4996	438.323
EC25	4.326	295.305	92.5925	501.066
EC40	4.747	414.759	189.369	761.157
EC50	5.000	508.795	268.97	1059.84
EC60	5.253	624.151	357.77	1575.8
EC75	5.674	876.627	515.834	3395.54
EC80	5.842	1003.14	582.483	4715.33
EC85	6.036	1173.82	664.224	6985.77
EC90	6.282	1430.43	774.998	11581.6
EC95	6.645	1917.48	960.051	24858.4
EC99	7.326	3322.44	1398.69	106834



ToxCalc v5.0

Reviewed by: 7-16-04

Reference Toxicant Control Chart - *Hyalella azteca* 96hr Survival



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
02/15/01	447.9034	659.8988	340.5696	21.2403	979.2280	1298.5572
03/16/01	350.8374	659.8988	340.5696	21.2403	979.2280	1298.5572
05/23/01	803.5751	659.8988	340.5696	21.2403	979.2280	1298.5572
06/13/01	491.3767	659.8988	340.5696	21.2403	979.2280	1298.5572
07/03/01	676.3369	659.8988	340.5696	21.2403	979.2280	1298.5572
07/06/01	526.2626	659.8988	340.5696	21.2403	979.2280	1298.5572
07/20/01	389.7241	659.8988	340.5696	21.2403	979.2280	1298.5572
08/28/01	1444.6654	659.8988	340.5696	21.2403	979.2280	1298.5572
11/14/01	371.1761	659.8988	340.5696	21.2403	979.2280	1298.5572
05/10/02	597.1113	659.8988	340.5696	21.2403	979.2280	1298.5572
05/15/02	670.4742	659.8988	340.5696	21.2403	979.2280	1298.5572
05/31/02	545.9552	659.8988	340.5696	21.2403	979.2280	1298.5572
11/26/02	683.6768	659.8988	340.5696	21.2403	979.2280	1298.5572
12/13/02	1165.7377	659.8988	340.5696	21.2403	979.2280	1298.5572
02/14/03	1185.0593	659.8988	340.5696	21.2403	979.2280	1298.5572
03/13/03	473.1248	659.8988	340.5696	21.2403	979.2280	1298.5572
05/14/03	1029.1087	659.8988	340.5696	21.2403	979.2280	1298.5572
05/21/03	639.6626	659.8988	340.5696	21.2403	979.2280	1298.5572
06/12/04	197.4122	659.8988	340.5696	21.2403	979.2280	1298.5572
06/30/04	508.7947	659.8988	340.5696	21.2403	979.2280	1298.5572

CHIRONOMUS

Appendix Table C-2. Ten-Day Solid-Phase Results (*Chironomus tentans*)
Reference Toxicant Data
Initiated 30 June 2004

$CuCl_2$ Concentration	Rep	Temp. (°C)					DO (mg/L)					pH (units)					Cond (umhos/cm)					Survival	
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Control	A	20.0	20.2	19.9	20.2	20.2	8.8	9.0	8.4	8.5	8.5	8.37	8.23	8.22	8.19	8.20	851	882	884	882	877	10	9
	B																					10	8
	C																					10	10
	D																					10	10
0.19 mg/L	A	20.2	20.1	19.9	20.0	20.1	8.8	9.2	8.6	8.6	8.7	8.39	8.26	8.26	8.23	8.25	852	883	898	884	889	10	10
	B																					10	9
	C																					10	10
	D																					10	6
0.38 mg/L	A	20.1	20.1	19.9	19.9	20.2	8.7	9.0	8.6	8.6	8.9	8.38	8.25	8.26	8.20	8.28	850	880	881	881	875	10	2
	B																					10	2
	C																					10	7
	D																					10	2
0.75 mg/L	A	20.2	20.1	19.9	19.9	20.2	8.7	9.2	8.6	8.6	8.9	8.40	8.26	8.24	8.19	8.25	848	886	845	888	883	10	0
	B																					10	1
	C																					10	2
	D																					10	1
1.5 mg/L	A	20.3	20.1	20.0	19.9	20.2	8.6	9.2	8.8	8.6	9.0	8.30	8.20	8.21	8.18	8.24	842	880	881	881	871	10	5
	B																					10	1
	C																					10	2
	D																					10	1
3.0 mg/L	A	20.3	20.2	20.0	19.9	20.1	8.9	9.3	8.7	8.6	9.0	8.01	8.08	8.13	8.12	8.23	831	887	881	888	869	10	1
	B																					10	0
	C																					10	0
	D																					10	1

Chironomus tentans-% Survival

Start Date:	06/30/2004	Test ID:	040630ctra	Sample ID:	REF-Ref Toxicant
End Date:	07/04/2004	Lab ID:	AEESD-AMEC Bioassay SD	Sample Type:	CUCL-Copper chloride
Sample Date:		Protocol:	EPA 2000 Sediment	Test Species:	CT-Chironomus tentans
Comments:					

Conc-mg/L	1	2	3	4
Lab Control	0.9000	0.8000	1.0000	1.0000
0.19	1.0000	0.9000	1.0000	0.6000
0.38	0.2000	0.2000	0.7000	0.2000
0.75	0.0000	0.1000	0.2000	0.1000
1.5	0.5000	0.1000	0.2000	0.1000
3	0.1000	0.0000	0.0000	0.1000

			Transform: Untransformed						1-Tailed			
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Lab Control	0.9250	1.0000	0.9250	0.8000	1.0000	10.351	4				0.9250	0.0000
0.19	0.8750	0.9459	0.8750	0.6000	1.0000	21.634	4	0.442	2.410	0.2724	0.8750	0.0541
*0.38	0.3250	0.3514	0.3250	0.2000	0.7000	76.923	4	5.308	2.410	0.2724	0.3250	0.6486
*0.75	0.1000	0.1081	0.1000	0.0000	0.2000	81.650	4	7.298	2.410	0.2724	0.1000	0.8919
*1.5	0.2250	0.2432	0.2250	0.1000	0.5000	84.132	4	6.193	2.410	0.2724	0.2250	0.7568
*3	0.0500	0.0541	0.0500	0.0000	0.1000	115.470	4	7.741	2.410	0.2724	0.0500	0.9459

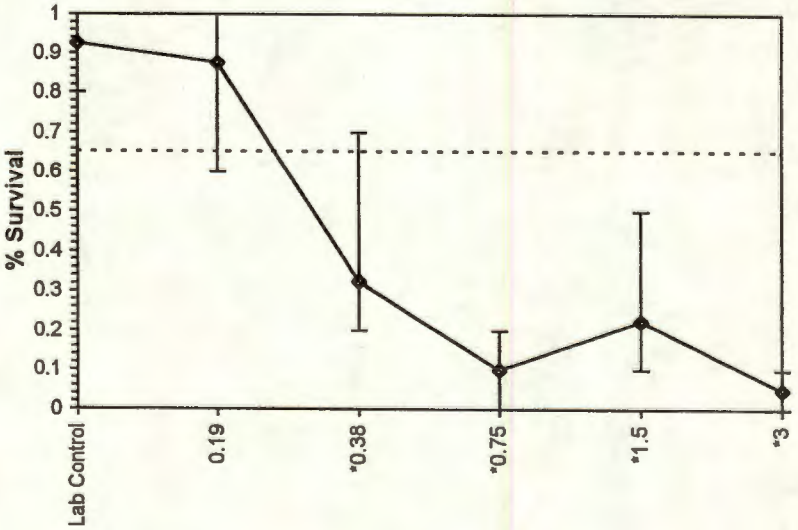
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93821	0.884	0.7672	1.28773
Bartlett's Test indicates equal variances (p = 0.18)	7.53045	15.0863		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.19	0.38	0.2687		0.27242	0.29451	0.59867	0.02556	2.7E-07	5, 18

Maximum Likelihood-Probit

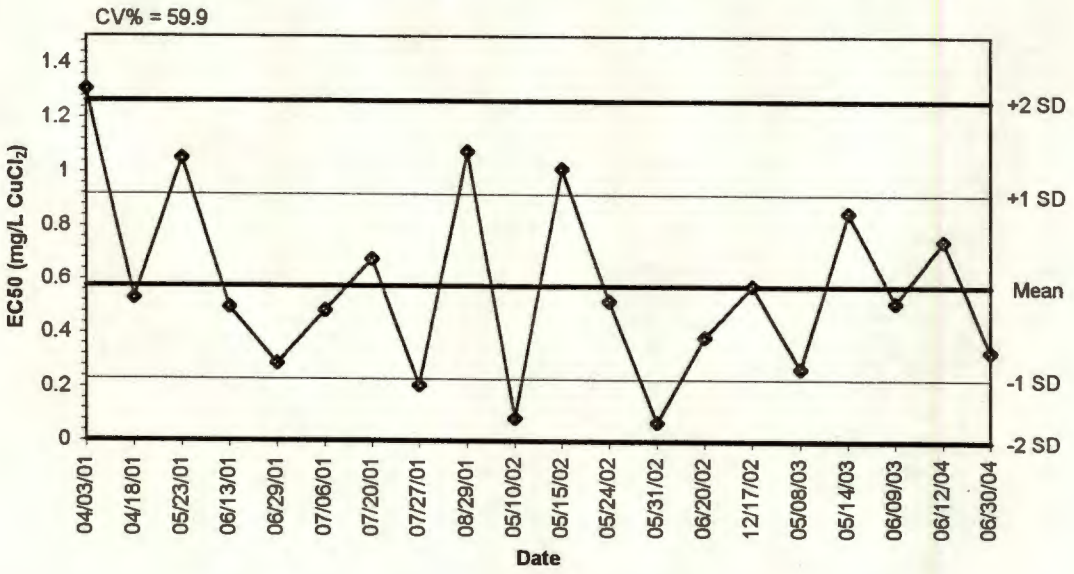
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	5.55972	3.18071	-4.5627	15.6822	0	9.79354	7.81472	0.02	-0.4761	0.17987	13
Intercept	7.64676	1.50109	2.86961	12.4239							
TSCR											

Point	Probits	mg/L	95% Fiducial Limits
EC01	2.674	0.1275	
EC05	3.355	0.16908	
EC10	3.718	0.19653	
EC15	3.964	0.21753	
EC20	4.158	0.23581	
EC25	4.326	0.25271	
EC40	4.747	0.30087	
EC50	5.000	0.33415	
EC60	5.253	0.37112	
EC75	5.674	0.44183	
EC80	5.842	0.4735	
EC85	6.036	0.51329	
EC90	6.282	0.56813	
EC95	6.645	0.66038	
EC99	7.326	0.87573	



Reviewed by: LLC 7·16·04

Reference Toxicant Control Chart- *Chironomus tentans* 96hr Survival



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
04/03/01	1.3058	0.5745	0.2305	0.0000	0.9184	1.2623
04/18/01	0.5286	0.5745	0.2305	0.0000	0.9184	1.2623
05/23/01	1.0523	0.5745	0.2305	0.0000	0.9184	1.2623
06/13/01	0.4961	0.5745	0.2305	0.0000	0.9184	1.2623
06/29/01	0.2863	0.5745	0.2305	0.0000	0.9184	1.2623
07/06/01	0.4850	0.5745	0.2305	0.0000	0.9184	1.2623
07/20/01	0.6776	0.5745	0.2305	0.0000	0.9184	1.2623
07/27/01	0.2061	0.5745	0.2305	0.0000	0.9184	1.2623
08/29/01	1.0777	0.5745	0.2305	0.0000	0.9184	1.2623
05/10/02	0.0856	0.5745	0.2305	0.0000	0.9184	1.2623
05/15/02	1.0140	0.5745	0.2305	0.0000	0.9184	1.2623
05/24/02	0.5191	0.5745	0.2305	0.0000	0.9184	1.2623
05/31/02	0.0703	0.5745	0.2305	0.0000	0.9184	1.2623
06/20/02	0.3863	0.5745	0.2305	0.0000	0.9184	1.2623
12/17/02	0.5769	0.5745	0.2305	0.0000	0.9184	1.2623
05/08/03	0.2716	0.5745	0.2305	0.0000	0.9184	1.2623
05/14/03	0.8530	0.5745	0.2305	0.0000	0.9184	1.2623
06/09/03	0.5153	0.5745	0.2305	0.0000	0.9184	1.2623
06/12/04	0.7474	0.5745	0.2305	0.0000	0.9184	1.2623
06/30/04	0.3341	0.5745	0.2305	0.0000	0.9184	1.2623

APPENDIX D

STATISTICAL SUMMARIES

Appendix D-1. AMEC - CSX
Amphipod ANOVA Summary Tables

Amphipod Survival

Parameter	Value	Data Set-B	Data Set-C
Table Analyzed			
Surv arcsin sqrt Trans			
One-way analysis of variance			
P value	0.1212		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	7		
F	1.872		
R squared	0.2863		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	6.617		
P value	0.3578		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	0.06254	6	0.01042
Residual (within columns)	0.1559	28	0.005569
Total	0.2185	34	

Amphipod Growth

Parameter	Value	Data Set-B	Data Set-C
Table Analyzed			
Amphipod Growth			
One-way analysis of variance			
P value	P<0.0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	7		
F	13.74		
R squared	0.7465		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	4.628		
P value	0.5923		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	0.01185	6	0.001974
Residual (within columns)	0.004023	28	0.0001437
Total	0.01587	34	

Appendix D-2. AMEC - CSX
Chironomus ANOVA Summary Tables

Chironomus Survival

Parameter	Value	Data Set-B	Data Set-C
Table Analyzed			
Surv arcsin sqrt Trans			
One-way analysis of variance			
P value	0.7837		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	7		
F	0.5260		
R squared	0.1013		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	0.8166		
P value	0.9916		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	0.03932	6	0.006553
Residual (within columns)	0.3488	28	0.01246
Total	0.3881	34	

Chironomus Growth

Parameter	Value	Data Set-B	Data Set-C
Table Analyzed			
Midge Growth			
One-way analysis of variance			
P value	0.0010		
P value summary	**		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	7		
F	5.236		
R squared	0.5288		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	6.615		
P value	0.3579		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	0.9753	6	0.1625
Residual (within columns)	0.8692	28	0.03104
Total	1.844	34	

Appendix D-3. t-test Results for 10-day Survival and Growth
AMEC - Schenectady
CSX - MeCl

Hyalella

Site Name	Survival[a]		Growth	
	FW Sediment Cont.	Lake Reference	FW Sediment Cont.	Lake Reference
FW Sediment Cont.	--	0.368	--	**0.003**
Beach Sand Cont.	0.102	0.080	0.354	**0.002**
Lake Reference	--	--	--	--
SS-5A	0.115 (0.132)	0.281 (0.289)	0.181	**<0.001**
SS-16	0.234	0.168	0.086	**<0.001**
SS-19A	0.102	0.080	**0.008**	**<0.001**
SS-24	0.234	0.168	**0.002**	**<0.001**

Chironomus

Site Name	Survival[a]		Growth	
	FW Sediment Cont.	Lake Reference	FW Sediment Cont.	Lake Reference
FW Sediment Cont.	--	0.272	--	**<0.001**
Beach Sand Cont.	0.272	0.500	0.354	**<0.001**
Lake Reference	--	--	--	--
SS-5A	0.272	0.500	0.196	**0.034**
SS-16	0.121	0.290	0.114	0.066
SS-19A	0.102	0.232	0.350	**0.003**
SS-24	0.102	0.232	0.079	**<0.001**

Note: Values in parenthesis had Welch's correction applied; variances were found to be significantly different.
Bold values indicate statistically significantly reduction ($p<0.05$).
[a] = Percent survival data were arcsin sqare-root transformed prior to analysis.

Appendix Table D-4. Summary of Regression Analyses with Amphipod and Midge Larvae Growth

AMEC - CSX Genesee River

Hyalella

	Interstitial Total Ammonia	Methylene Chloride - Day 0
p- value	0.045	0.553
N	7	4
r^2	0.586	0.200
Significance?	YES	NO

Chironomus

	Interstitial Total Ammonia	Methylene Chloride - Day 0
p- value	0.526	0.943
N	7	4
r^2	0.085	0.003
Significance?	NO	NO

APPENDIX E

CHAIN-OF-CUSTODY FORMS

Chain of Custody

Earth & Environmental, Inc.
AMEC San Diego Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, CA 92121
Phone: 858-458-9044 FAX 858-587-3961

Date 6/4/04 Page 1 of 1

Sample Collection by: T. Ahrens / J. LaRock

Company AMEC
Address 55 Erie Blvd.
City Schenectady State NY Zip 12305
Contact Tim Ahrens
Phone No. 518 372 1962

Mail Report to (if different)

Company
Address
City State Zip
Contact
Phone No.

ANALYSIS REQUIRED

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NUMBER OF CONTAINERS	COMMENTS	Growth	Survival
BIO 1	6/3/04	1310	Sed	Bag	1	Great Lakes Protocol (Testing Ongoing)	X	X
BIO 2	6/3/04	1335	Sed	Bag	1		X	X
BIO 3	6/3/04	1400	Sed	Bag	1		X	X
Lake	6/4/04	8:30	Sed	Bag	1		X	X

PROJECT INFORMATION

CLIENT CSX
P.O. NO.
SHIPPED VIA: Fed Ex

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	4
CHAIN OF CUSTODY SEALS	
REC'D. GOOD CONDITION/COLD	
CONFORMS TO RECORD	

SPECIAL INSTRUCTIONS/COMMENTS:

Return non AMEC coolers

RELINQUISHED BY

(Signature) T. Ahrens (Time) 10:15
(Printed Name) Tim Ahrens (Date) 6/4/04
(Company) AMEC

RECEIVED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) 0900 (Time)
Steven Hackford 6-5-04
(Printed Name) (Date)
04-0037 → 0040
AMEC Bioassay Lab Log-in No.

Additional disposal charges may apply.

DISTRIBUTION: WHITE, CANARY - AMEC Bioassay Lab, PINK - Originator

Chain of Custody

Earth & Environmental, Inc.
AMEC San Diego Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, CA 92121
Phone: 858-458-9044 FAX 858-587-3961

155 Erie Blvd.

Date 6/7/04 Page 1 of 1

Sample Collection by: JR

Company Amec E+E
Address 5550 Morehouse Dr. #B
City San Diego State CA Zip 92121
Contact John Rudolph
Phone No. 858-458-9044

Mail Report to (if different)

Company Amec E+E
Address Edison Plaza, 2nd Floor
City Schenectady State NY Zip 12305
Contact Tim Ahrens
Phone No. 518-372-0905

ANALYSIS REQUIRED

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NUMBER OF CONTAINERS	COMMENTS	Methylene Chloride	Acetone										
Bio 1 Pre	6/7/04	1000	Sed	8oz glass	1		X	X										
Bio 1 Post							X	X										
Bio 2 Pre							X	X										
Bio 2 Post							X	X										
Bio 3 Pre							X	X										
Bio 3 Post							X	X										
Lake Pre							X	X										

PROJECT INFORMATION

CLIENT CSX
P.O. NO.
SHIPPED VIA:

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS
CHAIN OF CUSTODY SEALS
REC'D. GOOD CONDITION/COLD
CONFORMS TO RECORD

SPECIAL INSTRUCTIONS/COMMENTS:

Call Tim Ahrens with results ASAP.
*Need 24 hr. turnaround.

RELINQUISHED BY

(Signature) [signature] (Time) 1430
(Printed Name) John Rudolph (Date) 6/7/04
(Company) Amec E+E

RECEIVED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) (Time)
(Printed Name) (Date)
AMEC Bioassay Lab Log-In No.

Additional disposal charges may apply.

DISTRIBUTION: WHITE, CANARY - AMEC Bioassay Lab, PINK - Originator

Chain of Custody

Earth & Environmental, Inc.
AMEC San Diego Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, CA 92121
Phone: 858-458-9044 FAX 858-587-3961

Date 6/21/04 Page 1 of 1

Sample Collection by: Jeff LaRock	Mail Report to (if different)
Company AMEC E&E	Company
Address 155 Erie Blvd.	Address
City Schenectady State NY Zip 12305	City State Zip
Contact Tim Ahrens / Jeff LaRock	Contact
Phone No. 518-372-0905	Phone No.

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NUMBER OF CONTAINERS	COMMENTS	ANALYSIS REQUIRED: Grain Size Survival
SS-19A	6/15/04	17:55	Sediment	Bucket	1	A = ND MC = 1,200,000 PPB	X
SS-24	6/16/04	8:00	Sediment		1	A = ND MC = 15,000 PPB	X
SS-5A	6/15/04	15:45	Sediment		1	A = ND MC = 10 PPB	X
SS-16	6/15/04	17:25	Sediment		1	A = ND MC = 420,000 PPB	X

PROJECT INFORMATION	SAMPLE RECEIPT	
CLIENT CSXT	TOTAL NO. OF CONTAINERS	4
P.O. NO.	CHAIN OF CUSTODY SEALS	Y
SHIPPED VIA: Fed Ex	REC'D. GOOD CONDITION/COLD	Y
	CONFORMS TO RECORD	N

SPECIAL INSTRUCTIONS/COMMENTS:
Samples arrived in small plastic buckets with some headspace.

RELINQUISHED BY	RELINQUISHED BY
(Signature) (Time) 17:30	(Signature) (Time)
(Printed Name) Jeff LaRock (Date) 6/21/04	(Printed Name) (Date)
(Company) AMEC	(Company)
RECEIVED BY	**RECEIVED BY (LABORATORY)**
(Signature) (Time)	(Signature) R. Bauer (Time) 09:15
(Printed Name) (Date)	(Printed Name) Rib Gamber (Date) 6-22-04
(Company)	AMEC Bioassay Lab Log-in No. 04-00412 → 0044

Additional disposal charges may apply.

DISTRIBUTION: WHITE, CANARY - AMEC Bioassay Lab, PINK - Originator

QC: JR

Chain of Custody

Earth & Environmental, Inc.
AMEC San Diego Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, CA 92121
Phone: 858-458-9044 FAX 858-587-3961

Date 6/30/04 Page 1 of 1

Sample Collection by: _____

Company AMEC
Address 5550 Morehouse Dr
City San Diego State CA Zip 92121
Contact John Rudolph
Phone No. 858-458-9044 x 388

Mail Report to (if different)

Company _____
Address _____
City _____ State _____ Zip _____
Contact _____
Phone No. _____

ANALYSIS REQUIRED

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NUMBER OF CONTAINERS	COMMENTS	Methylene Chloride
SS-5A-In:	6/28/04	1100	S-d	16oz Glass	1		X
SS-16-In:	↓	↓	↓	↓	↓		↓
SS-19A-In:							
SS-24-In:	↓	↓		↓			
SS-5A-DO	6/30/04	1400		4oz Glass			
SS-16-DO	↓	↓		↓			
SS-19A-DO							
SS-24-DO	↓	↓	↓	↓	↓		↓

PROJECT INFORMATION

CLIENT AMEC
P.O. NO.
SHIPPED VIA: F-d Ex

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
REC'D. GOOD CONDITION/COLD	
CONFORMS TO RECORD	

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY

(Signature) _____ (Time) 1530
(Printed Name) Chris Stransky (Date) 6/30/04
(Company) AMEC

RECEIVED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) (Time)
(Printed Name) (Date)
AMEC Bioassay Lab Log-In No.

Additional disposal charges may apply.

DISTRIBUTION: WHITE, CANARY - AMEC Bioassay Lab, PINK - Originator

Chain of Custody

Earth & Environmental, Inc.
AMEC San Diego Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, CA 92121
Phone: 858-458-9044 FAX 858-587-3961

Date 7-10-04 Page 1 of 1

Sample Collection by: SH/MC

Company Amec E+E
Address 5550 Morehouse Dr. # B
City San Diego State CA Zip 92121
Contact John Rudolph
Phone No. 858-458-9044 x388

Mail Report to (if different)

Company Amec E+E
Address 151 Erie Blvd.
City Schenectady State ~~NY~~ Zip 12305
Contact Tim Ahrens
Phone No. 518-372-0905

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NUMBER OF CONTAINERS	COMMENTS	ANALYSIS REQUIRED: Methylene Chloride
Site 5A	7/11/04		Sed.	4oz. glass	1		X
Site 16	↓		↓		1		X
Site 19					1		X
Site 24	↓		↓		1		X

PROJECT INFORMATION

CLIENT CSX Genessee
P.O. NO.
SHIPPED VIA: Fed Ex

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
REC'D. GOOD CONDITION/COLD	
CONFORMS TO RECORD	

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY

(Signature) [signature] (Time) 1000
(Printed Name) Chris Stransky (Date) 7/12/04
(Company) AMEC

RECEIVED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) (Time)
(Printed Name) (Date)
AMEC Bioassay Lab Log-In No.

Additional disposal charges may apply.

DISTRIBUTION: WHITE, CANARY - AMEC Bioassay Lab, PINK - Originator