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Office of Environmental Measurement and Evaluation
US EPA - Region I
11 Technology Drive
North Chelmsford, MA 01863-2431

January 17, 2008

To: Mr. Bart Hoskins, EPA TOPO
Via: Mr. Louis Macri, Program Manager

TDF No. 840B
Task Order No. 06
Task No. 04

Subject: Toxicity Testing Results Using Sediment Samples from Pike Hill Mine Corinth, VT.

Dear Mr. Hoskins:

The Environmental Services Assistance Team (ESAT) completed toxicity testing using thirteen sediment samples collected from Pike Hill Mine in Corinth, VT. Ten sediment samples were collected on-site and three other samples were collected at nearby tributaries and served at reference samples.

The task consisted of a 10-day sediment toxicity test using the benthic invertebrate species *Hyallela azteca* . Tests were performed according to the methods described in *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition,* EPA/600/R-99/064, March, 2000.

The task was requested by Mr. Bart Hoskins, the Task Order Project Officer (TOPO), and was authorized under Technical Direction Form (TDF) No. 840B. The final completion date for this task is January 17, 2008.

Should you have any questions or comments, please contact Erica Kensey of ESAT-TechLaw, Inc. at (617) 918-8687 located in the EPA/OEME Biology Section, North Chelmsford, MA.

Sincerely,

Erica Kensey

Erica Kensey
Staff Consultant
TechLaw, Inc.

TOXICITY TESTING RESULTS USING SEDIMENT SAMPLES FROM PIKE HILL MINE CORINTH, VERMONT

Submitted to the:

Office of Environmental Measurement and Evaluation
United States Environmental Protection Agency - New England
11 Technology Drive
North Chelmsford, Massachusetts 01863-2431

ESAT - Region I
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TDF No. 840
Task Order No. 06
Task No. 04

January 17, 2008

EP-W-06-017

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1.0 INTRODUCTION

The Pike Hill Copper Mine Site (the Site) consists of two abandoned copper (Cu) mines (the Union and Eureka Mines, but known collectively as the Pike Hill Mine) located off Pike Hill Road in the town of Corinth, VT. The Site covers about 216 acres of wooded hills in the Green Mountains of Vermont. Mining started in 1847 and occurred intermittently until 1919 when operations ceased. About 20,000 tons of mill and mine tailings are scattered in five main piles throughout the Site. Each pile consists of brownish-orange colored; fine-grained material intermixed with rock fragments. Little or no vegetation grows on the surface of these piles.

The mine waste is rich in metals and sulfides. Sulfuric acid is generated and metals are dissolved and mobilized as rain or snowmelt passes over and through these materials. This process creates Acid Rock Drainage (ARD) which releases acidity and metals in Pike Hill Brook which has its source at the Site. This brook flows into the Waits River about five miles downstream of the Site. The Waits River is a tributary to the Connecticut River. Both the Waits River and the Connecticut support recreational fishing.

A 1997 Vermont Department of Environmental Conservation (VT DEC) study of the macro-invertebrate community and fish populations in surface water near the site documented a significant impact in Pike Hill Brook just downstream of the mine. The state decided to list Pike Hill Brook as an impaired waterway due to the presence of ARD. Sediment and surface water samples collected from the Waits River have indicated that metals from the mine are present and could pose a potential ecological risk. The Site was listed on the National Priorities List (NPL) in 2004 based on the results of these preliminary investigations.

2.0 STUDY OBJECTIVES

The purpose of this study was to determine if responses by the test organisms exposed to sediment collected from Pike Hill Mine waterways differed significantly from that collected at the reference locations. Laboratory control samples were only used to verify that the organisms were healthy and that the test passed the Test Acceptability Criteria (TAC) specified in EPA (2000 a).

The toxicity endpoints were survival and growth after 10 days of exposure. Survival was determined by counting the number of live organisms at the end of the test period. Growth was measured as the biomass at the end of the test. The results of these bioassays will help determine if Site-related contamination could be adversely affecting benthic organisms in the streams draining from the Site. The results will also be used in support of a Baseline Ecological Risk Assessment (BERA).

3.0 MATERIALS AND METHODS

3.1 Sample Locations

Thirteen sediment samples were obtained from the Pike Hill Mine Site. Seven samples were collected in Pike Hill Brook (1, 4, 4A, 4C, 4E, 5, and 6) along with the reference sample 5A collected at a nearby tributary to Pike Hill Brook. Three samples were collected in the Unnamed tributary to Cookville Brook (10, 10B, and 10C) along with a reference sample (10A) collected upstream of the Unnamed tributary to Cookville Brook. Reference sample 10D was collected at Cookville Brook. See **Appendix A** for a list (**Table 1**) and site map (**Figure 1**) of the sample locations.

3.2 Sample Collection

Surficial sediment (0 to 6 inches) was collected from each location using a petit ponar sampler. The sample was placed in a cubitainer with the top cut off, and thoroughly homogenized using dedicated plastic scoops. Two 1-L Nalgene jars for the sediment toxicity test were filled with sediment from the Cubitainer for each site. All sediment samples were collected by staff from the Environmental Protection Agency (EPA) and the United States Geologic Survey (USGS). Samples 10, 10A, 10B, 10C, and 10D

were collected on October 16, 2007; samples 4A, 4C, 4E, 5, 5A, and 6 were collected on October 17, 2007 and samples 1 and 4 were collected on October 18, 2007. All jars and bottles were placed on ice and kept in coolers until they were picked up by ESAT personnel and delivered to the EPA Office of Environmental Measurement and Evaluation (OEME) facility in North Chelmsford, Massachusetts on October 19, 2007. The toxicity testing samples were held at 4°C until test initiation. The sediment toxicity tests were started on October 23, 2007. Chain-of-custody records are included in **Appendix B.**

3.3 Toxicity Test Methods

The toxicity tests were performed based on procedures detailed in the EPA OEME Biology Section Standard Operating Procedure (SOP) for Static Bulk Sediment Toxicity Testing (2005), which describes sediment toxicity test methods used by EPA/OEME according to EPA (2000 a).

Test chambers consisted of 300-mL glass beakers with stainless steel #50 mesh-covered notched openings. Flow-through was maintained by attaching small squares of cheese cloth against the outside of the notch to help break the surface tension behind the mesh. Eight replicates for the laboratory control and for each sampling location were used in the test. Each test chamber received about 100 mL of sediment. Artificial sediment consisting of fine sand, medium sand, Aspartic Acid (ASP) 400, Calcium carbonate, Alpha cellulose, and Humic acid was used for the laboratory control. Overlying water consisted of 90 mg $CaCO_3$ /L hardness process water (HPW). Prior to starting the test, 90 HPW was added through the Sediment Toxicity Testing System (STTS) to fill each beaker, which were left to sit overnight before introducing the organisms. Hardness and alkalinity was checked by titration with each new batch of water prepared.

Ten 7-14 day old *H. azteca* were randomly introduced into each of the 112 test chambers on October 23, 2007. The organisms were carefully pipetted, keeping them completely submerged in water from mass culture beakers to test chamber. Only the most healthy and active organisms were selected for the test. The organisms were maintained throughout the 10-day exposure period at 23 ± 2°C in the STTS with a 16:8 hour light/dark cycle using cool-white fluorescent lights. The room temperature was maintained at the required 23 ± 1°C in the STTS.

Water renewals were performed twice daily using the STTS automatic renewal system. The number of renewals was based on Dissolved Oxygen (DO) readings and discussions with the EPA's Task Order Project Officer (TOPO). Each *H. azteca* replicate beaker was fed 1.0 mL of a yeast-alfalfa-trout chow mixture (YAT) once a day after the morning renewal.

Temperature, pH, DO, conductivity, hardness, alkalinity, and ammonia were measured in the overlying water of each replicate at the start of the test. Temperature, pH, DO, and conductivity were measured in a composite sample of overlying water for each station (i.e., site sample, reference sample, and laboratory control sample) each subsequent morning throughout the exposure period. Temperature, pH, DO, conductivity, hardness, alkalinity, and ammonia were also measured in a composite sample of overlying water for each station at the end of the exposure period. Water chemistry data are summarized in **Appendix C** of this report.

The renewal cycle was terminated and the organisms were retrieved from the sediment toxicity test vessels at the end of the 10-day exposure period. The *H. azteca* were counted, rinsed, and placed on pre-dried, pre-numbered pans. The pan number, station, species, and number of organisms recovered were recorded on laboratory bench sheets. All pans with organisms were placed in a drying oven at 100°C for 24 hours. Dry weights were obtained for each pan after 24 hours. All laboratory bench sheets are included in **Appendix D**.

3.4 Statistical Analysis of the Toxicity Data

Statistical analyses of the survival and growth data were conducted using the Comprehensive Environmental Toxicity Information System (CETIS ®) according to the EPA decision tree in EPA (2000 a). Survival and growth data were analyzed separately.

Data were first compiled and analyzed using the Shapiro-Wilk W Test to check for normality of data, and Bartlett's test to check for homogeneity of variance. Data with normal distribution and homogeneous variance were analyzed using Dunnett's Multiple Comparison Test. Non-normal and/or heterogeneous data were analyzed using Steels's Many-One Rank Test. All of the statistical tests mentioned above were used when appropriate to determine if there was a significant difference between the Site samples and reference samples.

The CETIS ® statistical print-outs are provided in **Appendix D**. Growth for *H. azteca* was measured as dry weight and analyzed by calculating the mean dry biomass. The *H. azteca* were not ashed since ash-free dry weight (AFDW) is an impractical measure due to the small mass of these organisms.

4.0 RESULTS

4.1 *Hyallela azteca* Toxicity Test Results

The endpoints measured for *H. azteca* were survival and growth after 10 days of exposure. The results were used to determine if the percent survival and the mean biomass in the Site sample at the end of the test differed from the reference sample. The survival and growth data for this specie is presented in **Tables 1A** through **2B**.

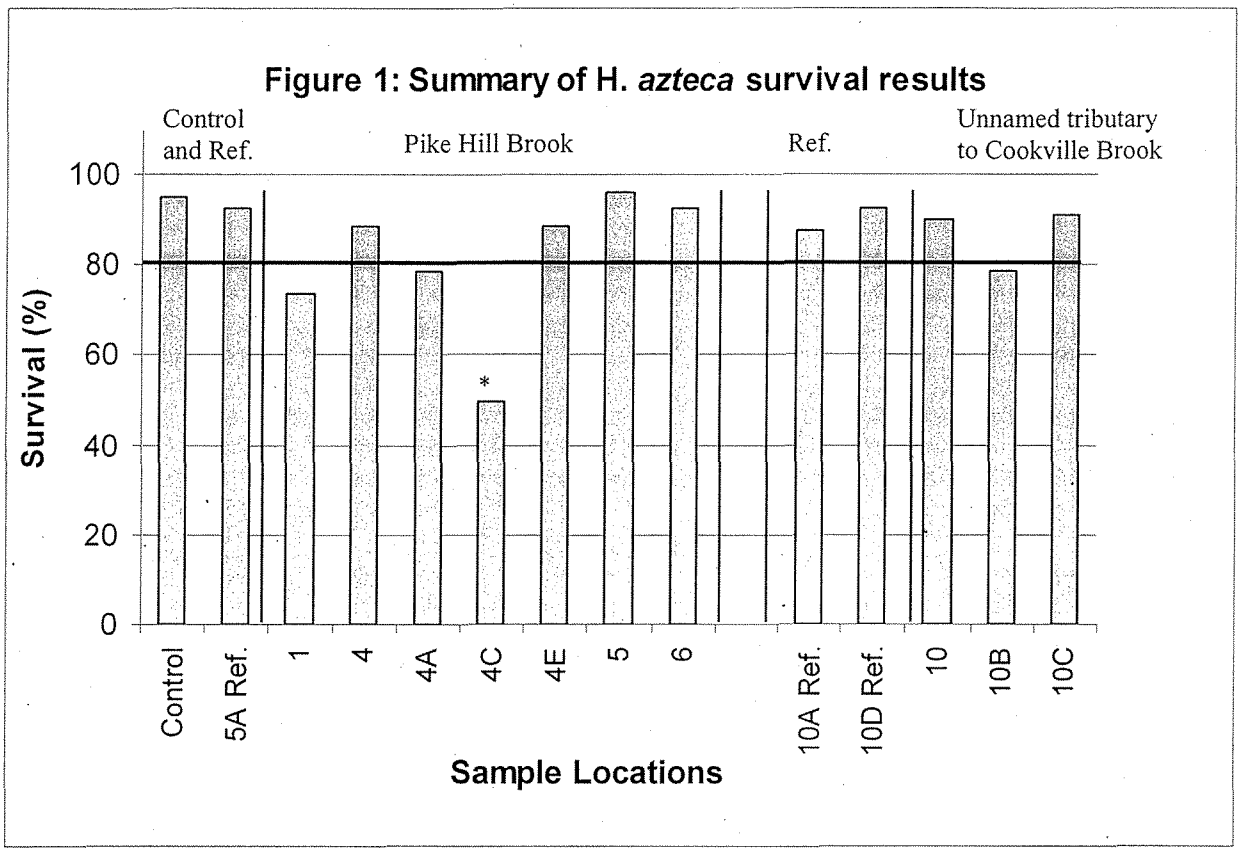
Table 1A: Pike Hill Mine Sediment Toxicity Testing: *H. azteca* Survival

Replicate	Laboratory Control	Site 5A Ref.	Site 1	Site 4	Site 4A	Site 4C	Site 4E	Site 5	Site 6
	Number of Organisms Surviving at End of Test								
1	10	10	10	10	7	4	8	10	10
2	7	6	7	5	8	2	9	10	10
3	9	9	9	9	7	6	10	9	10
4	10	10	10	10	10	9	9	10	9
5	10	10	6	8	8	6	8	10	10
6	10	10	8	9	9	3	7	10	5
7	10	10	4	10	7	5	10	8	10
8	10	9	5	10	7	5	10	10	10
% Survival	95	92.5	73.75	88.75	78.75	50	88.75	96.25	92.5

Table 1B (continued): Pike Hill Mine Sediment Toxicity Testing: *H. azteca* Survival						
Replicate	Laboratory Control [a]	Site 10A Ref.	Site 10D Ref.	Site 10	Site 10B	Site 10C
	Number of Organisms Surviving at End of Test					
1	10	10	10	10	4	10
2	7	7	10	9	9	10
3	9	10	7	9	10	6
4	10	8	10	6	10	9
5	10	8	10	8	9	10
6	10	7	9	10	5	8
7	10	10	10	10	7	10
8	10	10	8	10	9	10
% Survival	95	87.5	92.5	90	78.75	91.25

[a] the laboratory control sample is the same laboratory control sample listed in Table 1A.

The TAC for survival for this test is 80% as specified in EPA (2000 a). Survival in the laboratory control was 95% which met the TAC. Survival in the reference samples was 92.5% (5A), 87.5% (10A) and 92.5% (10D) which exceeded the minimum acceptable survival threshold of 80%. Survival in all of the sediment samples from the Site was above 80% except for four samples (Site 1, Site 4A, Site 4C, and Site 10B). Site 4C was the only location where survival was significantly impaired when compared to survival in the reference sample (**Figure 1**).



TAC reference line for the laboratory control sample.

* Survival results were significantly different compared to the reference sample.

Table 2A: Pike Hill Mine Sediment Toxicity Testing: *H. azteca* Biomass (mg)									
Replicate [a]	Control	Site 5A Ref.	Site 1	Site 4	Site 4A	Site 4C	Site 4E	Site 5	Site 6
1	0.106	0.108	0.072	0.054	0.038	0.020	0.033	0.101	0.073
2	0.073	0.041	0.058	0.024	0.039	0.013	0.069	0.096	0.071
3	0.074	0.063	0.041	0.039	0.049	0.036	0.055	0.059	0.097
4	0.121	0.104	0.110	0.065	0.055	0.037	0.039	0.556	0.055
5	0.073	0.075	0.058	0.045	0.047	0.027	0.030	0.077	0.077
6	0.099	0.099	0.077	0.073	0.036	0.012	0.071	0.119	0.034
7	0.041	0.067	0.035	0.059	0.027	0.040	0.041	0.042	0.056
8	0.105	0.068	0.035	0.065	0.044	0.018	0.062	0.064	0.07
Average Sample Dry Biomass (mg) [b]	0.087	0.078	0.061	0.053	0.042	0.025	0.050	0.139	0.067

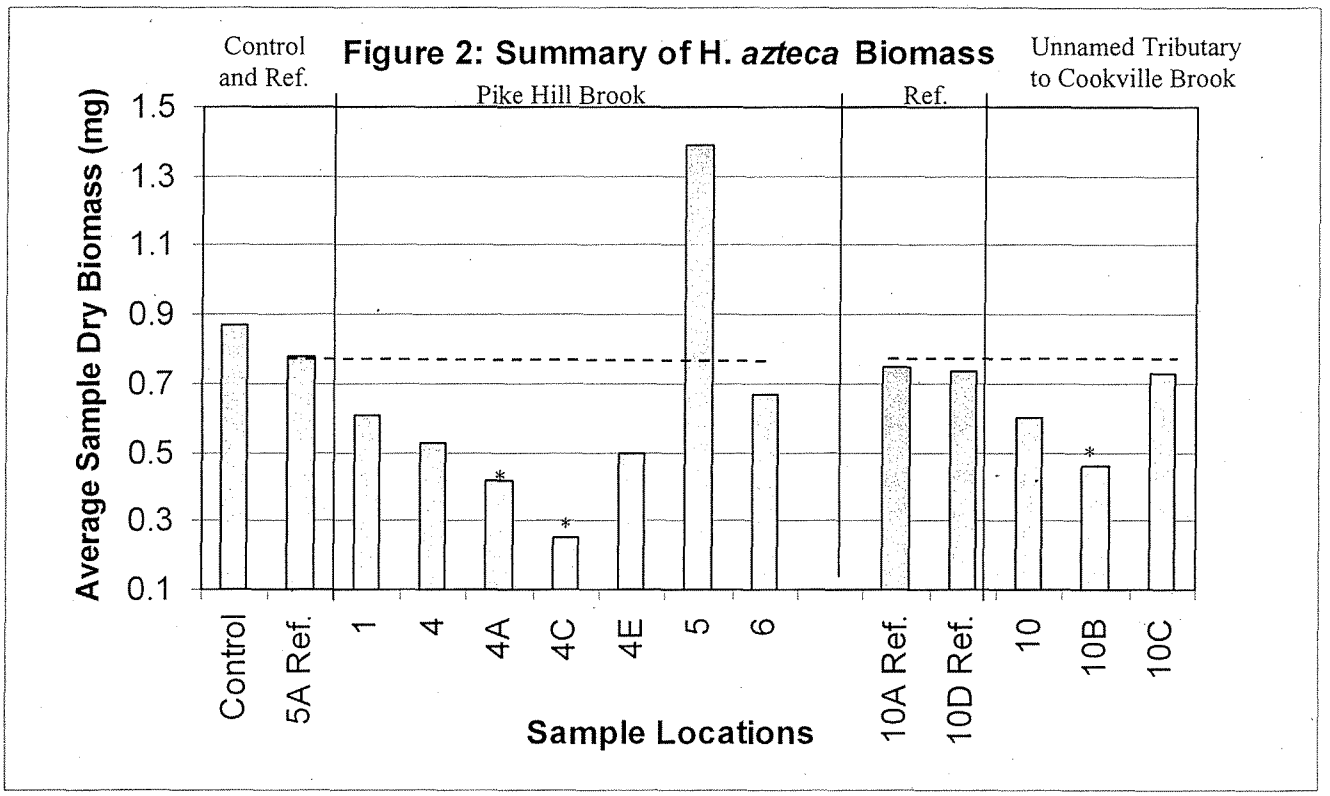
[a] the replicate dry biomass = measured dry weight ÷ number of organisms originally exposed

[b] the average sample dry biomass = the sum of the replicate dry biomass ÷ number of replicates

Table 2B (Continued): Pike Hill Mine Sediment Toxicity Testing: *H. azteca* Biomass (mg)						
Replicate [a]	Control [c]	Site 10A (Ref.)	Site 10D (Ref.)	Site 10	Site 10B	Site 10C
1	0.106	0.072	0.068	0.063	0.021	0.058
2	0.073	0.075	0.064	0.063	0.048	0.089
3	0.074	0.078	0.054	0.062	0.039	0.047
4	0.121	0.061	0.094	0.042	0.030	0.062
5	0.073	0.072	0.123	0.033	0.089	0.086
6	0.099	0.064	0.065	0.058	0.041	0.087
7	0.041	0.099	0.080	0.069	0.052	0.067
8	0.105	0.081	0.040	0.086	0.049	0.091
Average Sample Dry Biomass (mg) [b]	0.087	0.075	0.074	0.060	0.046	0.073

[a] the replicate dry biomass = measured dry weight ÷ number of organisms originally exposed
[b] the average sample dry biomass = the sum of the replicate dry biomass ÷ number of replicates
[c] the laboratory control sample is the same laboratory control sample listed in Table 2A

The growth data met TAC, which required that the control samples have measurable growth during the test. Steel's Many One Rank Test was used to determine whether biomass in the Site samples 1 through 6 differed significantly from the reference sample 5A. Sites 4A and 4C had a statistically significant differences in biomass compared to the reference sediment sample 5A. Dunnett's Multiple Comparison Test was used determine whether biomass in the Site samples 10 through 10C differed significantly from the reference sample 10A and 10D. The biomass of site 10B was also significantly different from biomass of reference samples 10A and 10D (**Figure 2**).



* Biomass results were significantly different compared to the reference sample.
--- Background sample reference line.

5.0 DISCUSSION AND CONCLUSIONS

The laboratory controls in the *H. azteca* toxicity tests met the TAC for survival and growth. The test showed that survival and/or growth at Sites 4A and 4C in Pike Hill Brook were significantly reduced when compared to their reference sample site 5A. It also showed a significant reduction in growth (but no effect on mortality) at Site 10B in the Unnamed Tributary to Cookville Brook when compared to its two reference samples (Sites 10A and 10D).

Ammonia was not a major factor affecting toxicity. All of the ammonia data were less than 0.10 ppm for all replicates at the start and the end of the test.

6.0 REFERENCES

U.S. Environmental Protection Agency. 2000 a. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA/600/R-99/064, March, 2000.

CETIS™ v1.1.1 rev C. Tidepool Scientific Software. Copyright 2001-2005. Michael A. Ives.

U.S. Environmental Protection Agency. 2005. Standard Operating Procedure for Static Bulk Sediment Toxicity Testing, Revision #4, July 21, 2005.

Appendix A

Sediment Sampling Stations

Table 1: Sediment Sampling Stations, Pike Hill Mine, Corinth, VT

Location	USGS Station Number	Station Name	Latitude	Longitude	Drainage Area (mi^2)
5A Ref.	011398378	Tributary to Pike Hill Brook at Brook Road near Bradford, VT	44° 02' 54"	72° 15' 20"	.26
1	01139830	Pike Hill Brook above Richardson Road, near Bradford, VT	44° 03' 50"	72° 18' 07"	0.11
4	01139833	Pike Hill Brook at Pike Hill Road, west crossing, near Bradford, VT	44° 03' 28"	72° 16' 54"	1.10
4A	01139834	Pike Hill Brook above wetlands near Bradford, VT	44° 03' 15"	72° 16' 23"	1.60
4C	440305072160101	Pike Hill Brook at center of wetlands near Bradford, VT	44° 03' 05"	72° 16' 01"	1.88
4E	440310072154801	Pike Hill Brook below wetlands near Bradford, VT	44° 03' 10"	72° 15' 48"	2.45
5	01139838	Pike Hill Brook at Pike Hill Road, near Bradford, VT	44° 03' 12"	72° 15' 12"	3.64
6	01139839	Pike Hill Brook at Miller Road, near Bradford, VT	44° 03' 19"	72° 14' 45"	4.39
10A Ref.	440317072181101	Unnamed tributary to Cookville Brook above geologic breakout near Bradford, VT	44° 03' 17"	72° 18' 11"	.09
10D Ref.	440243072215501	Cookville Brook at Washington State Forest near Bradford, VT	44° 02' 43"	72° 21' 55"	3.29
10	01139940	Unnamed tributary to Cookville Brook near Bradford, VT	44° 02' 43"	72° 17' 56"	.41
10B	440312072180901	Unnamed tributary to Cookville Brook below geologic breakout near Bradford, VT	44° 03' 12"	72° 18' 09"	.11
10C	440208072175901	Unnamed tributary to Cookville Brook below wetlands near Bradford, VT	44° 02' 08"	72° 17' 59"	.70

Appendix B

Chain-of-Custody Records

ENVIRONMENTAL PROTECTION AGENCY

REGION 1

CHAIN OF CUSTODY RECORD TOXHA

PROJ. NO.	PROJECT NAME
07100055	Pike Hill Mine Sediment Toxicity Testing

SAMPLERS: (Signature) Rich Kirk USGS
Bart Hoskins EPA

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Ten Day Hyalella Sed Tox Test						REMARKS
PKS-10	10/16	10:15		✓	Pike Hill ~~Mine~~ Brook	2	✓						Sediment
PKS-10A		14:30		✓		2	✓						
PKS-10B		13:20		✓		2	✓						
PKS-10C		11:45		✓		2	✓						
PKS-10D		17:30		✓		2	✓						
PKS-11		16:25		✓		2	✓						
PKS-12	↓	15:40		✓		2	✓						
PKS-4A	10/17	16:30		✓		2	✓						
PKS-4C		14:00		✓		2	✓						
PKS-4E		15:00		✓		2	✓						
PKS-5		8:25		✓		2	✓						
PKS-5A		9:30		✓		2	✓						
PKS-6	↓	11:00		✓		2	✓						↓

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Bart Hoskins	10·19·07 1730 hrs				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

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1-16885

Appendix C

Toxicity Test Chemistry Summary

Hyalella azteca Sediment Toxicity 10-Day Exposure Test-Mohawk Tannery

H.azteca 10-day Exposure Test Initial Chemistry–Day 0 (10/23/07)							
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**	**Hardness (mg/L $CaCO_3$)**	**Alkalinity (mg/L $CaCO_3$)**	**Total Ammonia (ppm NH_3)**
Control	8.15	7.83	24.39	369	108	67	0.05
1	7.37	6.75	24.60	352	112	39	0.03
4	7.46	7.78	24.57	342	108	73	0.04
4A	7.25	7.57	24.59	342	108	75	0.01
4C	7.20	7.48	24.60	347	100	57	0.04
4E	7.50	7.76	24.55	334	108	72	0.03
5	7.51	7.57	24.59	337	104	76	0.02
5A	7.53	7.66	24.79	362	108	75	0.03
6	7.46	7.67	24.78	334	108	73	0.02
10	7.56	7.80	24.74	329	108	77	0.30
10A	7.31	7.73	24.72	332	108	74	0.098
10B	7.26	7.63	24.75	331	112	74	0.04
10C	7.22	7.69	24.75	337	112	79	0.03
10D	7.51	7.77	24.79	325	108	76	0.03

H. azteca 10-Day Exposure Test Waste Chemistry-Day 1 (10/24/07)				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	7.82	7.94	22.54	329
1	6.59	6.99	22.28	340
4	7.71	7.94	22.42	334
4A	7.47	7.80	22.45	322
4C	7.37	7.58	22.93	318
4E	7.46	7.71	22.75	327
5	7.42	7.78	22.77	315
5A	7.57	7.84	22.77	327
6	7.63	7.84	22.81	328
10	7.57	7.89	23.35	327
10A	7.33	7.90	23.27	334
10B	7.57	7.87	23.24	322
10C	7.42	7.88	23.22	333
10D	7.61	8.07	23.33	323

Pike Hill Mine Sediment Toxicity Test
Sediment Toxicity Test Chemistry
Hyalella azteca

H. azteca 10-Day Exposure Test Waste Chemistry-Day 2 (10/25/07)				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	6.70	7.58	23.96	295
1	6.66	6.65	23.49	286
4	6.73	7.51	23.83	277
4A	6.15	7.52	23.92	280
4C	6.79	7.40	23.93	269
4E	6.81	7.66	23.89	271
5	6.91	7.54	23.72	274
5A	6.68	7.58	23.70	284
6	6.84	7.54	23.70	274
10	7.09	7.62	23.84	271
10A	5.21	7.57	23.72	275
10B	6.61	7.60	23.73	276
10C	6.71	7.63	23.83	283
10D	7.11	7.66	23.78	273

H. azteca 10-Day Exposure Test Waste Chemistry-Day 3 (10/26/07)				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	6.64	6.69	22.98	275
1	6.52	7.46	22.85	270
4	6.46	7.49	22.88	272
4A	6.90	7.34	22.92	263
4C	7.08	7.53	23.05	273
4E	6.43	7.47	23.00	269
5	6.53	7.49	22.90	273
5A	6.72	7.49	22.95	265
6	6.87	7.58	23.05	271
10	6.18	7.53	23.14	270
10A	7.23	7.67	22.99	270
10B	6.37	7.58	22.99	274
10C	7.09	7.64	23.02	274
10D	6.37	7.38	23.19	292

H. azteca 10-Day Exposure Test Waste Chemistry-Day 4 (10/27/07)				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	7.61	7.47	23.40	287
1	8.17	6.85	23.11	275
4	7.48	7.48	23.13	271
4A	6.89	7.43	23.24	269
4C	8.29	7.38	23.25	266
4E	8.01	7.55	23.53	270
5	7.61	7.56	23.30	266
5A	7.81	7.58	23.45	273
6	8.17	7.54	23.49	267
10	8.34	7.59	23.60	268
10A	7.65	7.58	23.68	269
10B	8.54	7.63	23.62	273
10C	8.19	7.62	23.69	271
10D	8.53	7.67	23.82	271

Pike Hill Mine Sediment Toxicity Test
Sediment Toxicity Test Chemistry
Hyalella azteca

***H. azteca* 10-Day Exposure Test Waste Chemistry-Day 5 (10/28/07)**				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	6.21	7.59	23.48	305
1	6.41	6.77	23.27	281
4	6.46	7.54	23.41	272
4A	6.36	7.56	23.42	277
4C	6.55	7.38	23.39	269
4E	6.66	7.61	23.40	270
5	6.53	7.52	23.40	272
5A	6.16	7.51	23.50	276
6	6.53	7.57	23.50	271
10	6.55	7.67	23.53	272
10A	6.43	7.59	23.48	272
10B	6.55	7.62	23.55	276
10C	6.41	7.62	23.60	278
10D	6.72	7.61	23.57	268

***H. azteca* 10-Day Exposure Test Waste Chemistry-Day 6 (10/29/07)**				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	5.72	7.47	23.11	297
1	6.38	6.84	23.03	278
4	6.55	7.59	22.92	269
4A	6.16	7.47	22.90	275
4C	6.58	7.40	22.99	266
4E	6.81	7.59	23.09	267
5	6.54	7.58	23.04	273
5A	6.40	7.62	22.98	279
6	6.58	7.56	23.03	273
10	6.75	7.64	23.05	273
10A	6.44	7.59	23.27	274
10B	6.28	7.61	23.29	277
10C	6.37	7.64	23.18	277
10D	6.69	7.63	23.16	273

***H. azteca* 10-Day Exposure Test Waste Chemistry-Day 7 (10/30/07)**				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	6.07	7.39	23.47	294
1	6.42	6.84	23.23	278
4	6.40	7.43	23.20	270
4A	6.16	7.40	23.05	275
4C	6.08	7.29	23.07	267
4E	6.44	7.40	23.13	271
5	6.62	7.49	22.96	265
5A	6.55	7.51	22.98	276
6	6.60	7.46	23.10	268
10	6.69	7.56	23.35	270
10A	6.38	7.58	23.23	272
10B	6.67	7.58	23.37	275
10C	6.50	7.59	23.43	275
10D	6.65	7.59	23.45	270

Pike Hill Mine Sediment Toxicity Test
Sediment Toxicity Test Chemistry
Hyalella azteca

***H. azteca* 10-Day Exposure Test Waste Chemistry-Day 8 (10/31/07)**				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	5.15	7.35	23.49	314
1	5.90	6.60	23.07	300
4	5.57	7.30	23.00	280
4A	5.62	7.26	22.89	282
4C	5.71	7.25	22.96	272
4E	5.70	7.33	22.96	278
5	5.11	7.40	22.94	280
5A	5.75	7.43	22.97	288
6	5.79	7.34	22.98	276
10	5.89	7.43	22.81	276
10A	5.66	7.41	22.80	279
10B	5.80	7.38	22.77	285
10C	5.62	7.48	22.77	286
10D	6.08	7.42	22.83	281

***H. azteca* 10-Day Exposure Test Waste Chemistry-Day 9 (11/01/07)**				
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**
Control	5.34	7.38	23.48	333
1	5.93	6.86	23.21	318
4	5.76	7.51	23.24	307
4A	5.81	7.46	23.26	314
4C	6.30	7.36	23.21	306
4E	4.93	7.47	23.16	311
5	6.58	7.56	23.16	312
5A	5.98	7.58	23.18	314
6	5.13	7.47	13.10	308
10	5.88	7.56	23.04	312
10A	6.12	7.54	23.06	312
10B	6.73	7.58	22.61	314
10C	5.69	7.57	22.77	314
10D	6.28	7.61	23.08	310

Pike Hill Mine Sediment Toxicity Test
Sediment Toxicity Test Chemistry
Hyalella azteca

10-Day Exposure Test Waste Chemistry-Day 10 (11/02/07)							
Sample ID	**DO (mg/L)**	**pH**	**Temperature (°C) +**	**Conductivity (µmhos/cm)**	**Hardness (mg/L $CaCO_3$)**	**Alkalinity (mg/L $CaCO_3$)**	**Total Ammonia (ppm NH_3)**
Control	5.13	7.33	22.82	331	108	84	
1	5.89	6.78	22.83	315	110	54.5	0.07
4	6.07	7.42	22.37	304	86	77	0.02
4A	5.94	7.54	22.39	310	90	77.5	0.04
4C	6.31	7.37	22.32	305	100	74	0.02
4E	6.24	7.52	22.29	309	104	76	0.03
5	6.13	7.53	22.66	310	108	78	0.03
5A	6.35	7.40	22.76	315	108	80.5	0.02
6	6.57	7.54	22.76	309	108	77	0.02
10	6.24	7.58	22.54	308	108	78	0.03
10A	6.52	7.61	22.60	311	108	79	0.02
10B	6.20	7.57	22.65	313	108	78	0.03
10C	6.02	7.59	22.49	313	106	81	0.02
10D	6.53	7.64	22.74	307	108	78.5	0.02

Appendix D

Bench Sheets and Statistical Test Print-outs

10-day H. azteca Pike Hill Sediment Toxicity Test

Organism H. azteca
Study Pike HIll Sediment Toxicity Test
Test Date 10/23/2007

Site Name	Rep	Position	Number Alive	Number Dead	% Survival	Comments	Initials
Site 1	2	1	7	3	70%		MF
Site 5	7	2	8	2	80%		SP
Site 10B	8	3	9	1	90%		MF
Site 10B	6	4	5	5	50%		MF
Site 6	3	5	10	0	100%		SP
Site 4A	2	6	8	2	80%		BK
Control	7	7	10	0	100%		MF
Site 5A	7	8	10	0	100%		MD
Site 4A	7	9	7	3	70%		SP
Site 10C	2	10	10	0	100%		EB
Site 4	2	11	5	5	50%		EB
Site 5A	3	12	9	1	90%		BK
Site 10D	8	13	8	2	80%		MD
Site 4C	2	14	2	8	20%		SP
Site 10B	4	15	10	0	100%		MF
Site 1	3	16	9	1	90%		EB
Site 4C	4	17	9	1	90%		EB
Site 6	4	18	9	1	90%		BK
Site 1	5	19	6	4	60%		EB
Site 5	6	20	10	0	100%		BK
Site 4C	6	21	3	7	30%		SP
Site 10C	3	22	6	4	60%		MD
Site 5	8	23	10	0	100%		BK
Site 10D	4	24	10	0	100		BK
Site 10B	1	25	4	6	40%		EB
Site 4E	4	26	9	1	90%		EB
Site 4	1	27	10	0	100%		EK
Site 10A	4	28	8	2	80%		EK
Site 10	3	29	9	1	90%		PAR
Site 6	5	30	10	0	100%	not very active.	BGK
Site 6	1	31	10	0	100%		SP
Site 4A	6	32	9	1	90%		EB
Site 10C	4	33	9	1	90%		SP
Site 10	1	34	10	0	100		BGK
Site 5	3	35	9	1	90		EK
Site 10A	1	36	10	0	100		PAR
Site 4	8	37	10	0	100		PAR
Site 10D	1	38	10	0	100		BGK
Control	4	39	10	0	100%		MF
Control	1	40	10	0	100%		MF
Site 4E	7	41	10	0	100%		PAR
Site 4E	1	42	8	2	80%		PAR
Site 10D	5	43	10	0	100%		EB
Site 4E	3	44	10	0	100	big + healthy looking	BGK
Site 10D	7	45	10	0	100		BGK
Site 6	6	46	5	5	50%		EB
Site 10C	8	47	10	0	100		EK
Site 10	4	48	6	4	60%		PAR
Site 10B	3	49	10		100		BGK
Site 4	7	50	10	0	100		EB
Site 10C	6	51	8	2	80		EK

10-day H. azteca Pike Hill Sediment Toxicity Test

Site Name	Rep	Position	Number Alive	Number Dead	% Survival	Comments	Initials
Site 10D	2	52	10	0	100%		MF
Site 10B	7	53	7	3	70		BGK
Site 4	4	54	10	0	100%		PAR
Site 4C	3	55	6	4	60%		EB
Site 5A	8	56	9	1	100%		PAR
Site 5	5	57	10	0	100%		PAR
Control	8	58	10	0	100%		MDD
Site 10C	1	59	10	0	100%		MF
Site 10A	3	60	10	0	100%		EB
Control	5	61	10	0	100%		MF
Site 6	8	62	10	0	100%		MD
Site 1	4	63	11	0	110%		EB
Site 5A	5	64	12	0	100%		EB
Site 10	8	65	10	0	100%		SP
Site 4E	8	66	10	0	100%		MD
Site 5	2	67	10	0	100%		EB
Site 10C	7	68	10	0	100%		SP
Site 4A	5	69	8	2	80%		EB
Control	6	70	10	0	100%		MF
Site 10B	2	71	9	1	90%		SP
Site 10	2	72	9	1	90%		MF
Site 10A	2	73	7	2?	70%		EB
Site 10B	5	74	9	1	90%		PAR
Site 4C	5	75	6	4	60		EK
Site 4A	4	76	10	0	100		EB
Site 10	5	77	8	2	80%		MD
Site 1	6	78	8	2	80%		BGK
Site 4E	2	79	9	1	90		EK
Site 6	2	80	10	0	100%		PAR
Site 5A	1	81	10	0	100%		SP
Site 10D	3	82	7	3	70%		MD
Site 5A	6	83	10	0	100%		EB
Site 4E	5	84	8	2	80%		SP
Site 10C	5	85	10	0	100%		MF
Site 1	7	86	4	6	40%		EB
Control	3	87	9	1	90%		MF
Site 10D	6	88	9	1	90%		SP
Site 4C	8	89	5	5	50%		SP
Site 1	8	90	5	5	50%		SP
Control	2	91	7	3	70%		MF
Site 10	6	92	10	0	100%		SP
Site 5	4	93	10	0	100%		PAR
Site 10	7	94	10	0	100%		SP
Site 4E	6	95	7	3	70%		MF
Site 4A	3	96	7	3	70%		SP
Site 4	6	97	9	1	90%		EK
Site 5A	2	98	6	4	60%		MD
Site 10A	6	99	7	3	70%		SP
Site 1	1	100	10	0	100%		SP
Site 4	3	101	9	~~0~~ MD 1	90%		MD
Site 4C	1	102	4	6	40%		MF
Site 4	5	103	8	2	80%		PAR
Site 5	1	104	10	0	100		MF
Site 4C	7	105	5	5	50%		EK

10-day H. azteca Pike Hill Sediment Toxicity Test

Site Name	Rep	Position	Number Alive	Number Dead	% Survival	Comments	Initials
Site 5A	4	106	10	0	100		EK
Site 6	7	107	10	0	100		SP
Site 10A	8	108	10	0	100		BGK
Site 10A	7	109	10	0	100		SP
Site 4A	1	110	7	3	70	not healthy looking	BGK
Site 10A	5	111	8	2	80		MD
Site 4A	8	112	7	3	70%		MF

Introduction:
QC:

Found Dead

10/26/07	# Dead
4C-7	3
4C-1	1
4C-5	1
4C-8	1
4C-3	1
10B-6	1
10B-3	1
10B-3	1

10/27/07	# Dead
1-5	1
4C-1	2
4C-2	2

10/28/07	# Dead
~~Control-6~~	~~1~~
4C-6	1
6-8	1
1-4	1
4E-1	1
~~MW-8~~	~~1~~

10/31/07	# Dead
4C-8	2 (+1? - BK)

site 1 has sheen on surface

4C-2	1

11/2/07	
5A-8	1

CETIS Data Worksheet

Report Date: 17 Dec-07 8:15 AM
Link: 12-0352-1470

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Start Date: 16 Oct-07 04:42 PM
Ending Date: 16 Oct-07 04:42 PM
Sample Date: 16 Oct-07 04:42 PM
Species: Hyalella azteca
Protocol: EPA/600/R-99/064 (2000)
Material: Site Sediment
Sample Code: 1007HASTC-CRT
Sample Source: Pike Hill Mine PW/SD Tox Test
Sample Station: Control

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
1007HASTC-CRT	1	26	10	10	1311.08	1310.02	10		
1007HASTC-CRT	2	80	10	7	1315.69	1314.96	7		
1007HASTC-CRT	3	88	10	9	1306.28	1305.54	9		
1007HASTC-CRT	4	18	10	10	1307.61	1306.4	10		
1007HASTC-CRT	5	100	10	10	1316.5	1315.77	10		
1007HASTC-CRT	6	95	10	10	1308.9	1307.91	10		
1007HASTC-CRT	7	51	10	10	1309.89	1309.48	10		
1007HASTC-CRT	8	22	10	10	1309.7	1308.65	10		
1007HASTC5A	1	97	10	10	1313.25	1312.17	10		
1007HASTC5A	2	5	10	6	1312.94	1312.53	6		
1007HASTC5A	3	25	10	9	1302.88	1302.25	9		
1007HASTC5A	4	23	10	10	1315.04	1314	10		
1007HASTC5A	5	20	10	10	1301.37	1300.62	10		
1007HASTC5A	6	94	10	10	1314.77	1313.78	10		
1007HASTC5A	7	35	10	10	1306.82	1306.15	10		
1007HASTC5A	8	19	10	9	1314.75	1314.07	9		
1007HASTC10A	1	74	10	10	1309.83	1309.11	10		
1007HASTC10A	2	2	10	7	1310.3	1309.55	7		
1007HASTC10A	3	72	10	10	1313.43	1312.65	10		
1007HASTC10A	4	83	10	8	1304.97	1304.36	8		
1007HASTC10A	5	56	10	8	1313.29	1312.57	8		
1007HASTC10A	6	43	10	7	1310.92	1310.28	7		
1007HASTC10A	7	15	10	10	1309.67	1308.68	10		
1007HASTC10A	8	21	10	10	1311.41	1310.6	10		
1007HASTC10D	1	61	10	10	1310.28	1309.6	10		
1007HASTC10D	2	4	10	10	1320.77	1320.13	10		
1007HASTC10D	3	104	10	7	1313.17	1312.63	7		
1007HASTC10D	4	50	10	10	1306.19	1305.25	10		
1007HASTC10D	5	6	10	10	1317.3	1316.07	10		
1007HASTC10D	6	28	10	9	1309.09	1308.44	9		
1007HASTC10D	7	9	10	10	1314.25	1313.45	10		
1007HASTC10D	8	57	10	8	1301.72	1301.32	8		
1007HASTC1	1	109	10	10	1309.03	1308.31	10		
1007HASTC1	2	54	10	7	1302.03	1301.45	7		
1007HASTC1	3	11	10	9	1294.92	1294.51	9		
1007HASTC1	4	76	10	10	1309.3	1308.2	10		
1007HASTC1	5	12	10	6	1305	1304.42	6		
1007HASTC1	6	62	10	8	1315.9	1315.13	8		
1007HASTC1	7	87	10	4	1306.85	1306.5	4		
1007HASTC1	8	92	10	5	1315.32	1314.97	5		
1007HASTC4	1	99	10	10	1295.36	1294.82	10		
1007HASTC4	2	75	10	5	1309.13	1308.89	5		
1007HASTC4	3	112	10	9	1308.83	1308.44	9		
1007HASTC4	4	13	10	10	1311	1310.35	10		
1007HASTC4	5	8	10	8	1316.63	1316.18	8		
1007HASTC4	6	89	10	9	1316.16	1315.43	9		
1007HASTC4	7	27	10	10	1315.56	1314.97	10		
1007HASTC4	8	7	10	10	1312.56	1311.911	10		
1007HASTC4A	1	86	10	7	1306.89	1306.51	7		
1007HASTC4A	2	106	10	8	1308.6	1308.21	8		
1007HASTC4A	3	3	10	7	1318.53	1318.04	7		
1007HASTC4A	4	24	10	10	1308.69	1308.14	10		
1007HASTC4A	5	98	10	8	1300.13	1299.66	8		

CETIS Data Worksheet

Report Date: 17 Dec-07 8:15 AM
Link: 12-0352-1470

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
1007HASTC4A	6	58	10	9	1299.99	1299.63	9		
1007HASTC4A	7	67	10	7	1302.03	1301.76	7		
1007HASTC4A	8	38	10	7	1310.04	1309.6	7		
1007HASTC4C	1	82	10	4	1312.3	1312.1	4		
1007HASTC4C	2	44	10	2	1296.4	1296.27	2		
1007HASTC4C	3	42	10	6	1312.49	1312.13	6		
1007HASTC4C	4	84	10	9	1293.8	1293.43	9		
1007HASTC4C	5	63	10	6	1303.81	1303.54	6		
1007HASTC4C	6	49	10	3	1302.44	1302.32	3		
1007HASTC4C	7	78	10	5	1315.48	1315.08	5		
1007HASTC4C	8	39	10	5	1311.08	1310.9	5		
1007HASTC4E	1	29	10	8	1320	1319.67	8		
1007HASTC4E	2	33	10	9	1313.13	1312.44	9		
1007HASTC4E	3	69	10	10	1315.84	1315.29	10		
1007HASTC4E	4	64	10	9	1293.76	1293.37	9		
1007HASTC4E	5	60	10	8	1314.28	1313.98	8		
1007HASTC4E	6	52	10	7	1321.62	1320.91	7		
1007HASTC4E	7	85	10	10	1313.77	1313.36	10		
1007HASTC4E	8	91	10	10	1294.04	1293.42	10		
1007HASTC5	1	34	10	10	1314.26	1313.25	10		
1007HASTC5	2	66	10	10	1296.76	1295.8	10		
1007HASTC5	3	41	10	9	1310.13	1309.54	9		
1007HASTC5	4	70	10	10	1328.2	1322.64	10		
1007HASTC5	5	45	10	10	1314.65	1313.88	10		
1007HASTC5	6	93	10	10	1307.13	1305.94	10		
1007HASTC5	7	17	10	8	1297.04	1296.62	8		
1007HASTC5	8	31	10	10	1308.89	1308.25	10		
1007HASTC6	1	47	10	10	1299.73	1299	10		
1007HASTC6	2	68	10	10	1312.35	1311.64	10		
1007HASTC6	3	46	10	10	1308.37	1307.4	10		
1007HASTC6	4	79	10	9	1298.27	1297.72	9		
1007HASTC6	5	108	10	10	1305.77	1305	10		
1007HASTC6	6	107	10	5	1315.32	1314.98	5		
1007HASTC6	7	81	10	10	1312.81	1312.25	10		
1007HASTC6	8	103	10	10	1313.75	1313.05	10		
1007HASTC10	1	90	10	10	1293.59	1292.96	10		
1007HASTC10	2	30	10	9	1313.98	1313.35	9		
1007HASTC10	3	55	10	9	1303.56	1302.94	9		
1007HASTC10	4	10	10	6	1306.14	1305.72	6		
1007HASTC10	5	40	10	8	1311.15	1310.82	8		
1007HASTC10	6	32	10	10	1318.27	1317.69	10		
1007HASTC10	7	96	10	10	1321.98	1321.29	10		
1007HASTC10	8	110	10	10	1298.78	1297.92	10		
1007HASTC10B	1	111	10	4	1299.76	1299.55	4		
1007HASTC10B	2	53	10	9	1315.23	1314.75	9		
1007HASTC10B	3	102	10	10	1307.31	1306.92	10		
1007HASTC10B	4	59	10	10	1297.14	1296.84	10		
1007HASTC10B	5	14	10	9	1303.12	1302.23	9		
1007HASTC10B	6	71	10	5	1306.39	1305.98	5		
1007HASTC10B	7	36	10	7	1316.29	1315.77	7		
1007HASTC10B	8	48	10	9	1306.39	1305.9	9		
1007HASTC10C	1	16	10	10	1310.26	1309.68	10		
1007HASTC10C	2	37	10	10	1302.06	1301.17	10		
1007HASTC10C	3	73	10	6	1296.74	1296.27	6		
1007HASTC10C	4	65	10	9	1293.75	1293.13	9		
1007HASTC10C	5	77	10	10	1315.43	1314.57	10		
1007HASTC10C	6	1	10	8	1321.08	1320.21	8		
1007HASTC10C	7	101	10	10	1295.99	1295.32	10		

CETIS Data Worksheet

Report Date: 17 Dec-07 8:15 AM
Link: 12-0352-1470

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
1007HASTC10C	8	105	10	10	1311.12	1310.21	10		

CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	12-0352-1470	12-0352-1470	04 Dec-07 8:28 AM	CETISv1.1.1

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Dunnett's Multiple Comparison	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	6.69279	18.47531	0.46155	Equal Variances
Distribution	Shapiro-Wilk W	0.95577		0.02223	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	1.950953	0.2787076	7	6.80	0.00001	Significant Effect
Error	2.294286	0.0409694	56			
Total	4.2452395	0.3196770	63			

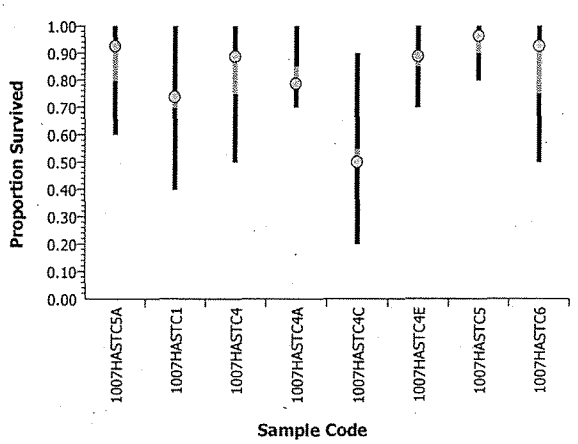
Group Comparisons

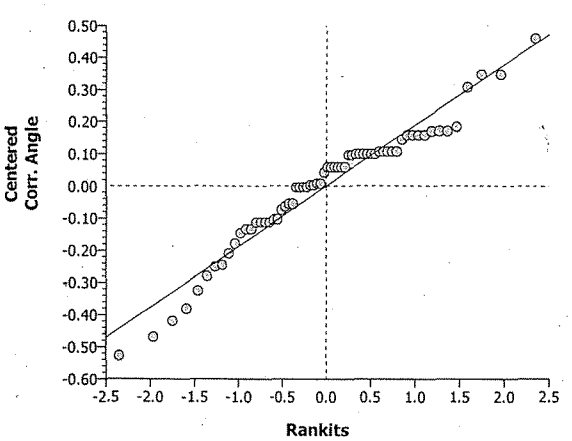
Sample	vs	Sample	Statistic	Critical	P-Value	MSD	Decision(0.05)
1007HASTC5A		1007HASTC1	2.36733	2.39945	0.0537	0.24284	Non-Significant Effect
		1007HASTC4	0.5009	2.39945	0.7062	0.24284	Non-Significant Effect
		1007HASTC4A	1.98146	2.39945	0.1176	0.24284	Non-Significant Effect
		1007HASTC4C	5.09395	2.39945	0.0000	0.24284	Significant Effect
		1007HASTC4E	0.62331	2.39945	0.6535	0.24284	Non-Significant Effect
		1007HASTC5	-0.4743	2.39945	0.9579	0.24284	Non-Significant Effect
		1007HASTC6	-0.0769	2.39945	0.8932	0.24284	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1007HASTC5A	8	0.92500	0.60000	1.00000	0.13887	1.30553	0.88608	1.41202	0.18478
1007HASTC1	8	0.73750	0.40000	1.00000	0.22638	1.06595	0.68472	1.41202	0.27691
1007HASTC4	8	0.88750	0.50000	1.00000	0.17269	1.25484	0.78540	1.41202	0.22074
1007HASTC4A	8	0.78750	0.70000	1.00000	0.11260	1.10500	0.99116	1.41202	0.15439
1007HASTC4C	8	0.50000	0.20000	0.90000	0.21381	0.79000	0.46365	1.24905	0.23636
1007HASTC4E	8	0.88750	0.70000	1.00000	0.11260	1.24245	0.99116	1.41202	0.16305
1007HASTC5	8	0.96250	0.80000	1.00000	0.07440	1.35354	1.10715	1.41202	0.11473
1007HASTC6	8	0.92500	0.50000	1.00000	0.17525	1.31332	0.78540	1.41202	0.22080

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	12-0352-1470	12-0352-1470	04 Dec-07 8:29 AM	CETISv1.1.1

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Steel Many-One Rank	C > T	Rank				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	1.33910	11.34487	0.71987	Equal Variances
Distribution	Shapiro-Wilk W	0.88201		0.00222	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.1193931	0.0397977	3	0.83	0.48867	Non-Significant Effect
Error	1.342754	0.0479555	28			
Total	1.46214762	0.0877532	31			

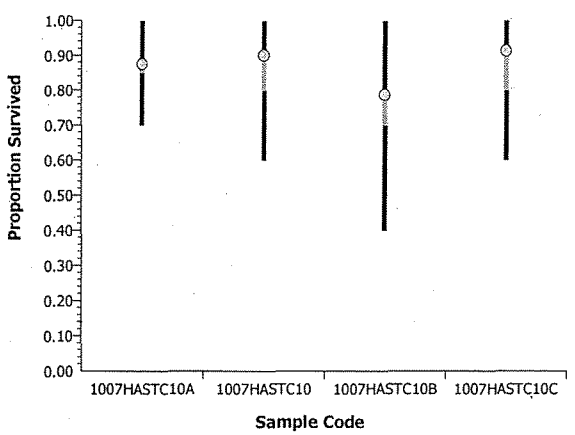
Group Comparisons

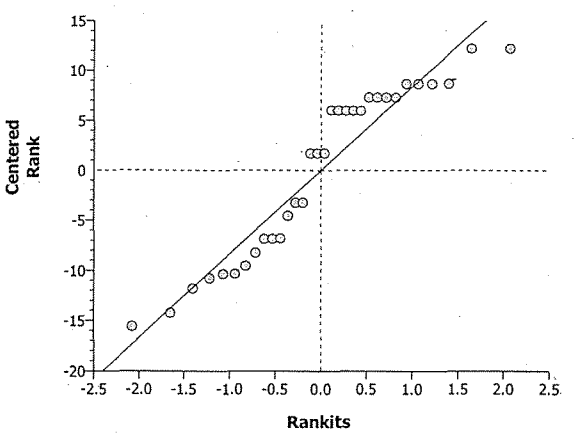
Sample	vs	Sample	Statistic	Critical	P-Value	Ties	Decision(0.05)
1007HASTC10A		1007HASTC10	71	48	0.8499	4	Non-Significant Effect
		1007HASTC10B	61	48	0.4354	4	Non-Significant Effect
		1007HASTC10C	73	48	0.8994	4	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1007HASTC10A	8	0.87500	0.70000	1.00000	0.13887	16.375	6	25	9.31493
1007HASTC10	8	0.90000	0.60000	1.00000	0.14142	17.75	3.5	25	8.47265
1007HASTC10B	8	0.78750	0.40000	1.00000	0.22952	12.8125	1	25	9.32331
1007HASTC10C	8	0.91250	0.60000	1.00000	0.14577	19.0625	3.5	25	8.70729

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	12-0352-1470	12-0352-1470	04 Dec-07 8:30 AM	CETISv1.1.1

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Steel Many-One Rank	C > T	Rank				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	1.95549	11.34487	0.58170	Equal Variances
Distribution	Shapiro-Wilk W	0.84601		0.00034	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.1511883	0.0503961	3	1.12	0.35909	Non-Significant Effect
Error	1.263864	0.045138	28			
Total	1.41505219	0.0955341	31			

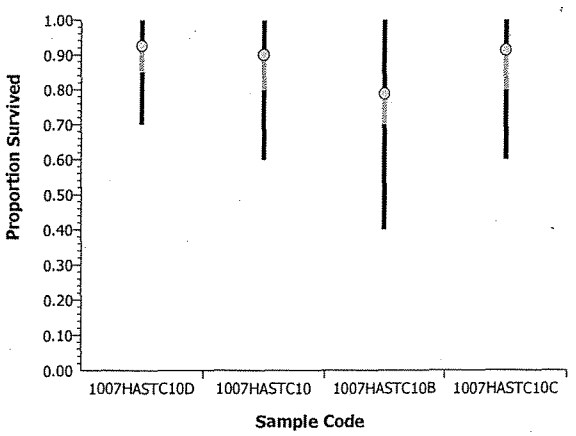
Group Comparisons

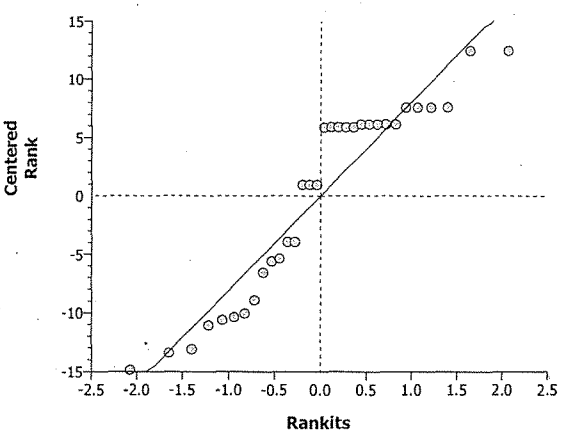
Sample	vs	Sample	Statistic	Critical	P-Value	Ties	Decision(0.05)
1007HASTC10D		1007HASTC10	64.5	48	0.6005	6	Non-Significant Effect
		1007HASTC10B	55	48	0.1918	6	Non-Significant Effect
		1007HASTC10C	67.5	48	0.7305	5	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1007HASTC10D	8	0.92500	0.70000	1.00000	0.11650	18.625	5.5	24.5	8.36126
1007HASTC10	8	0.90000	0.60000	1.00000	0.14142	16.9375	3.5	24.5	8.62073
1007HASTC10B	8	0.78750	0.40000	1.00000	0.22952	12.0625	1	24.5	9.09253
1007HASTC10C	8	0.91250	0.60000	1.00000	0.14577	18.375	3.5	24.5	8.82670

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	12-0352-1470	12-0352-1470	04 Dec-07 8:29 AM	CETISv1.1.1

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Steel Many-One Rank	C > T	Rank				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	112.61120	18.47531	0.00000	Unequal Variances
Distribution	Shapiro-Wilk W	0.47661		0.00000	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.0654161	0.0093452	7	2.39	0.03255	Significant Effect
Error	0.2187554	0.0039063	56			
Total	0.28417158	0.0132515	63			

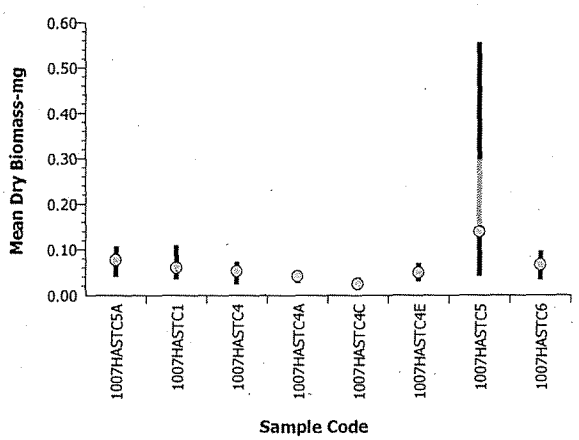
Group Comparisons

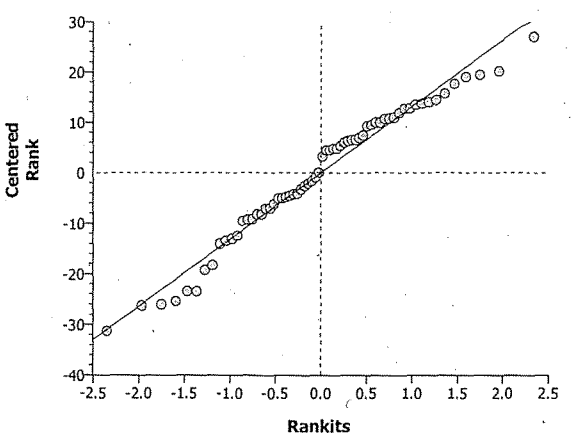
Sample	vs	Sample	Statistic	Critical	P-Value	Ties	Decision(0.05)
1007HASTC5A		1007HASTC1	56	45	0.3546	0	Non-Significant Effect
		1007HASTC4	47	45	0.0684	0	Non-Significant Effect
		1007HASTC4A	40	45	0.0098	0	Significant Effect
		1007HASTC4C	36	45	0.0025	0	Significant Effect
		1007HASTC4E	47	45	0.0684	0	Non-Significant Effect
		1007HASTC5	72	45	0.9521	0	Non-Significant Effect
		1007HASTC6	60	45	0.5520	0	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1007HASTC5A	8	0.07812	0.04099	0.10800	0.02343	47.25	21	61	13.4987
1007HASTC1	8	0.06075	0.03500	0.11001	0.02549	34.9375	11.5	62	19.0777
1007HASTC4	8	0.05299	0.02400	0.07300	0.01614	31.0625	5	50.5	14.6931
1007HASTC4A	8	0.04187	0.02700	0.05499	0.00872	20.5625	6.5	30.5	8.36847
1007HASTC4C	8	0.02538	0.01200	0.04000	0.01121	8.125	1	20	7.08494
1007HASTC4E	8	0.05000	0.03000	0.07100	0.01631	27.3125	8	47.5	15.4132
1007HASTC5	8	0.13925	0.04200	0.55599	0.17023	49.5	24	64	14.4815
1007HASTC6	8	0.06662	0.03400	0.09700	0.01857	41.25	10	57	15.5288

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	12-0352-1470	12-0352-1470	04 Dec-07 8:30 AM	CETISv1.1.1

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	1.89810	11.34487	0.59382	Equal Variances
Distribution	Shapiro-Wilk W	0.97278		0.57953	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.0044278	0.0014759	3	5.41	0.00461	Significant Effect
Error	0.0076443	0.0002730	28			
Total	0.01207209	0.0017489	31			

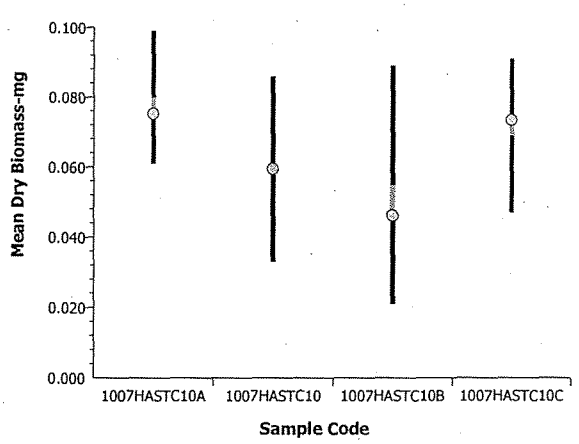
Group Comparisons

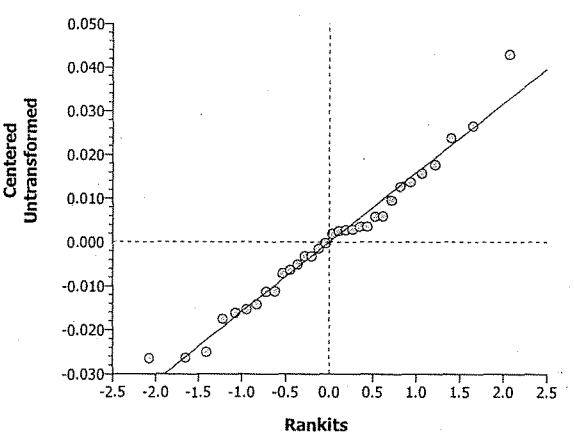
Sample	vs	Sample	Statistic	Critical	P-Value	MSD	Decision(0.05)
1007HASTC10A		1007HASTC10	1.90626	2.15364	0.0808	0.01779	Non-Significant Effect
		1007HASTC10B	3.52549	2.15364	0.0021	0.01779	Significant Effect
		1007HASTC10C	0.22699	2.15364	0.6617	0.01779	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1007HASTC10A	8	0.07525	0.06100	0.09900	0.01168				
1007HASTC10	8	0.05950	0.03301	0.08600	0.01618				
1007HASTC10B	8	0.04613	0.02100	0.08900	0.02019				
1007HASTC10C	8	0.07338	0.04700	0.09100	0.01691				

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	12-0352-1470	12-0352-1470	04 Dec-07 8:30 AM	CETISv1.1.1

Method	Alt H	Data Transform	Zeta	NOEL	LOEL	Toxic Units	ChV	PMSD
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	1.82526	11.34487	0.60945	Equal Variances
Distribution	Shapiro-Wilk W	0.96720		0.42602	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	0.0041191	0.0013730	3	3.40	0.03130	Significant Effect
Error	0.0112972	0.0004035	28			
Total	0.01541632	0.0017765	31			

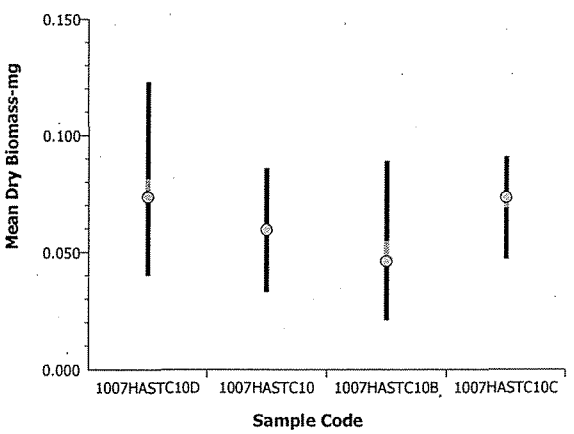
Group Comparisons

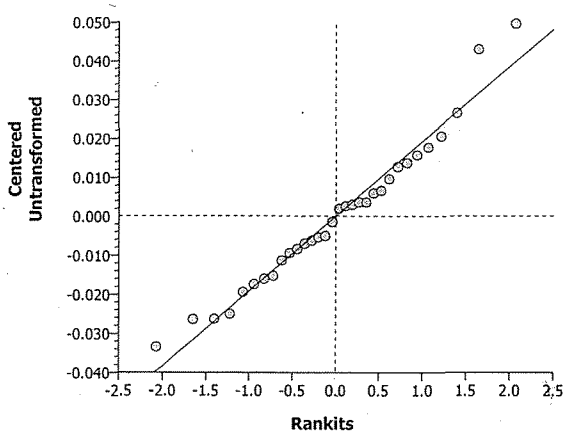
Sample	vs	Sample	Statistic	Critical	P-Value	MSD	Decision(0.05)
1007HASTC10D		1007HASTC10	1.39396	2.15364	0.1920	0.02163	Non-Significant Effect
		1007HASTC10B	2.72593	2.15364	0.0145	0.02163	Significant Effect
		1007HASTC10C	0.01261	2.15364	0.7454	0.02163	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1007HASTC10D	8	0.07350	0.04000	0.12301	0.02566				
1007HASTC10	8	0.05950	0.03301	0.08600	0.01618				
1007HASTC10B	8	0.04613	0.02100	0.08900	0.02019				
1007HASTC10C	8	0.07338	0.04700	0.09100	0.01691				

Graphics

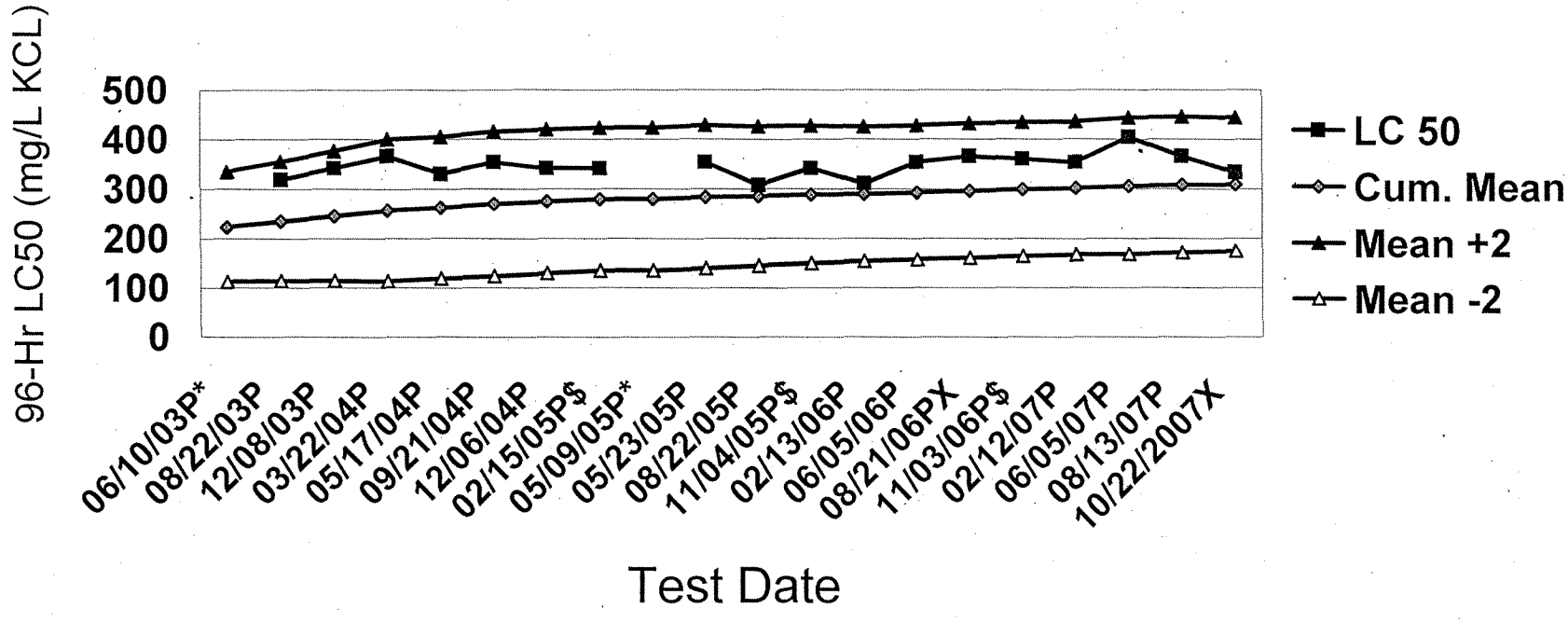




Appendix E

Control Charts for *H. azteca*

H. azteca 96-Hour LC50 Ref. Tox. Control Chart



NOTES:

Historical data are available for tests performed prior to April 2002.

P=tests were performed at the Chelmsford facility using laboratory process water.

No test was performed in January, February, or March 2003 because ESAT was learning how to sieve the cultures to produce known-age test organisms.

*=test failed because it did not meet the test acceptability criteria (TAC).

No site-specific tests were performed in June 2003.

Two tests were performed in May of 2005. The first test (05/09/05) failed due to low control survival. The test was successfully repeated on 05/23/05.

$ indicates that the test was performed concurrently with a site-specific sediment toxicity test.

X indicates that the test was performed concurrently with a site-specific acute pore water toxicity test.

REVISION DATE: 10/29/07