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FINAL TOXICITY ANALYSIS OF SEDIMENT SAMPLES FROM NORTH FUEL FARM AREA

NAS CECIL FIELD FL

1/1/1997

ENVIRONMENTAL SCIENCE AND ENGINEERING

FINAL REPORT

TOXICITY ANALYSIS OF SEDIMENT SAMPLES FROM NAS CECIL FIELD, JACKSONVILLE, FLORIDA

TEST GUIDE:

ASTM E 1383-94

SUBMITTED TO:

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EXECUTIVE SUMMARY

Whole sediment toxicity tests were conducted at Environmental Science & Engineering, Inc. (ESE) with the freshwater amphipod, *Hyalella azteca* and the midge, *Chironomus tentans*, on samples collected from the NFF site of Naval Air Station (NAS) Cecil Field, Jacksonville, Florida. The effect criteria for the tests were survival and growth. A total of 10 site sediments and one laboratory control sediment were used in the toxicity tests. After 14 days of exposure, control survivorship of *Hyalella azteca* and *Chironomus tentans* was 98 percent and 72 percent, respectively. Survival of *Hyalella azteca* in laboratory control sediment was significantly different (P=0.05) from survival in sediment from sample station POS-SD/TOX4A. Growth, measured as dry weight, of *Hyalella azteca* in the laboratory control sediment was also significantly different (P=0.05) from growth in sediment from sample station POS-SD/TOX4A. Survival of *Chironomus tentans* exposed to sediment from sample station POS-SD/TOX4A was significantly different (P=0.05) from survival in the laboratory control sediment. There were no significant differences (P=0.05) in growth, measured as dry weight of *Chironomus tentans* between the laboratory control sediment and any of the site sediments.

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1.0 INTRODUCTION

Whole sediment bioassays were conducted at Environmental Science & Engineering, Inc. (ESE) on samples collected from the NFF site, NAS Cecil Field, Jacksonville, Florida, to determine the potential toxicity of the test samples. Test organisms used for sediment toxicity tests were the freshwater amphipod, *Hyalella azteca* and the midge, *Chironomus tentans*. The effect criteria for both species were survival and growth.

The tests were conducted following ASTM E 1383-94 guidelines entitled *Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates* and ESE in-house protocols. All of the original raw data pertaining to this study are maintained at ESE, 14220 West Newberry Road, Gainesville, Florida.

2.0 MATERIALS AND METHODS

2.1 TEST SAMPLES

Test sediments were collected on December 30, 1996 by ABB-ES personnel and were received on ice at the ESE Gainesville office on December 31, 1996. The test samples, identified as ALP-SD/TOX4A, ALP-SD/TOX5A, G10-SD/TOX4A, G10-SD/TOX5A, AVD-SD/TOX4A, AVD-SD/TOX5A, POS-SD/TOX4A, POS-SD/TOX5A, G14-SD/TOX4A and G14-SD/TOX5A, were received in quantities of approximately 3.75 kilograms each. Upon receipt, the coolers were opened and the contents checked against the chain-of-custody to ensure that all the recorded samples were present. The temperature of the coolers was then measured using the temperature blanks provided in the coolers. Any observations were recorded in the sample receipt logbook. Laboratory control sediment was collected from Marineland, Florida, by ESE personnel. The site from which the control sediment was collected has been proven to be uncontaminated in previous tests. Chain-of-custody records and other traffic information pertaining to the sediment samples are presented in Appendix A. All samples were stored in a refrigerator at 4 $\pm$ 2 °C during the testing period.

2.2 OVERLYING WATER

The water used as dilution or overlying water for the *H. azteca* tests was hard freshwater with a hardness of approximately 142 mg/L as $CaCO_3$. The water was obtained from a deep well located at the test site and was diluted with deionized water to achieve the desired hardness. Overlying water for the *C. tentans* tests

was moderately hard reconstituted freshwater with a hardness of approximately 78 mg/L as $CaCO_3$. The moderately hard reconstituted water was prepared by adding reagent grade chemicals to deionized water to achieve the desired hardness and alkalinity (EPA 1993).

2.3 TEST ORGANISMS

The whole sediment bioassays were conducted using juvenile (second or third instar) *H. azteca* and second instar *C. tentans*. *H. azteca* (2-3 mm in length) were obtained from Chesapeake Cultures , Hayes, Virginia and *C. tentans* (second instar) were obtained from Aquatic BioSystems, Inc., Fort Collins, Colorado. The suppliers' breeding and holding conditions, such as temperature and water hardness, were similar to those of the testing conditions, therefore, organisms were held for less than 24 hours prior to test initiation. Test organisms were acclimated to any differences in water chemistry by diluting the receiving water with test dilution water to 50 percent of receiving water.

2.4 TEST DESIGN

The whole sediment toxicity tests were initiated on January 7 and 10, 1997 for *H. azteca* and *C. tentans*, respectively. Prior to use in the toxicity tests, sediment samples were allowed to warm to room temperature and individually homogenized. Sediments were then hand-sorted to remove small stones and sticks, plant debris or indigenous organisms. The test vessels used for the bioassays were 2 L glass jars (23 cm height and 13 cm diameter). On day minus one, approximately 200 grams of test or control sediment were introduced into the test chambers and uniformly leveled. Eight-hundred milliliters of overlying freshwater were added to each test chamber to provide a ratio of 1 part sediment to 4 parts overlying water. The test chambers were then allowed to settle overnight without aeration. On day zero, the test chambers were gently aerated at a rate of approximately 60 bubbles per minute (bpm), the initial water quality measurements were taken and the test organisms were introduced into the test chambers. The test organisms were indiscriminately added to the test chambers, loading one replicate at a time until loading was complete.

The whole sediment tests were conducted using four replicates of 20 *H. azteca* per replicate and four replicates of 15 *C. tentans* per replicate, for a total of 80 *H. azteca* and 60 *C. tentans* per sample. The test

vessels were labeled with the site sample number and replicate number (A through D), and the test area was identified by the ESE project number, test type and schedule, and the project manager.

The duration of the static-renewal whole sediment toxicity tests was 14-days, with the *H. azteca* tests being renewed three times a week and the *C. tentans* tests being renewed two times a week. During renewals, approximately 50 percent of the overlying water was siphoned off through a 0.5 mm mesh Nytex sieve. Any test organisms trapped on the sieve were pipetted back into the appropriate test chamber. New overlying water was then slowly added to the test chamber while diverting the flow onto the side of the test chamber to minimize resuspension of the sediments. *H. azteca* were fed 0.2 mL of a rabbit chow (Alachua County Feed and Seed Store, Gainesville, FL) solution per replicate, three times a week, following renewal of the overlying water. *C. tentans* were fed a 1:6 ratio (1 mg:6 mg) of Tetramin (That Fish Place, Lancaster, PA) and ground cereal leaves (Sigma Chemical Company, St. Louis, MO) per replicate following each renewal of overlying water.

The tests were conducted in a waterbath adjusted to maintain a temperature of 20 $\pm$ 2 °C under fluorescent lighting with a daily photoperiod of 16 hours light (530 Lux) and 8 hours dark. All test chambers were aerated at approximately 80 bpm throughout the testing period. Temperature, pH, and dissolved oxygen (DO) concentrations, were measured daily. On renewal days, water quality parameters (temperature, pH, DO, and conductivity) were measured prior to and immediately following renewal of overlying water. Water quality measurements were taken with the following instruments: temperature--Fisher Scientific digital thermocouple; pH--SA 290A Orion pH meter with an Orion 91-57 triode; dissolved oxygen--YSI, Model 57 DO meter; and conductivity--YSI, Model 33 SCT conductivity meter. All instruments were calibrated daily during the testing period.

The test chambers were observed daily for organism entrapment at the surface of overlying water, sediment avoidance, reproductive behavior, and organism emergence. The test organisms were indiscriminately added to the test chambers, loading one replicate at a time until loading was complete. At test termination, the overlying water was swirled and then poured through a 0.5 mm mesh Nytex screen to collect, observe, and enumerate test organisms. If all organisms were not immediately found, the remaining sediment was

poured onto a 0.50 mm mesh Nytex screen sieve or a glass pan for further observation. The effect criteria for the tests, were mortality and growth (measured as dry weight in milligrams). Growth, as group dry weight, was measured for both species by placing the organisms in pre-weighed, dried aluminum pans and drying the organisms in a Blue-M oven at 60 °C for 24 hours. After 24 hours, the pans were removed from the oven and placed in a desiccator to cool. The weights of the cooled pans were measured on an American Scientific S/P 180 analytical balance and the group weight of the organisms was determined by difference.

2.5 REFERENCE TOXICANT TEST

Ninety-six-hour reference toxicant tests were conducted concurrently with the whole sediment toxicity tests to determine the general health of the test organisms. The reference toxicant used was cadmium chloride ($CdCl_2$) at concentrations of 0, 8, 16, 32, 64 and 128 μg $CdCl_2$/L for *H. azteca* and 0, 250, 500, 1,000, 2,000 and 4,000 μg $CdCl_2$/L for *C. tentans*, respectively. The reference toxicant tests were conducted under similar conditions as the whole sediment tests. Ten organisms were exposed per concentration without replication.

3.0 STATISTICAL ANALYSIS

All toxicity data were evaluated by a statistical comparison of mean survival and growth of the site samples with mean survival and growth of the laboratory control samples using appropriate statistical procedures. Analysis of variance and Dunnett's t-test (EPA/600/4-89/001) were used to determine statistical significance. The 96-hour LC_{50} values for the reference toxicant tests, the concentration of the reference toxicant causing 50 percent mortality of the test organisms under the specified conditions of exposure, were determined using the Trimmed Spearman-Karber Statistical Method (Hamilton et.al., 1977).

4.0 RESULTS AND DISCUSSION

4.1 SEDIMENT TOXICITY TESTS

Test conditions, including lighting, hardness, alkalinity, conductivity, temperature, and pH levels remained at acceptable levels throughout the testing period. Test temperatures remained in the range of 18.4 to 21.2 °C, pH ranged from 7.4 to 8.2 standard units, and dissolved oxygen ranged from 7.8 to 9.1 mg/L as $CaCO_3$. Data for exposure water quality parameter measurements are presented in Table 1 and 2 for *H.*

azteca and *C. tentans*, respectively. Survival and growth data of the whole sediment bioassays with *H. azteca* and *C. tentans*, are presented in Tables 3 and 4, respectively. Survival of the test organisms in the laboratory control exposures was within acceptable limits for both tests (ASTM 1995). After 14 days of exposure, survival of *H. azteca* was 98 percent and survival of *C. tentans* was 72 percent in the laboratory control sediments. Growth, measured as dry weight of test organisms in the laboratory control sediments, averaged 0.33 mg per organism and 0.86 mg per organism, respectively for *H. azteca* and *C. tentans*. The relevant laboratory raw data are provided in Appendices B and C for *H. azteca* and *C. tentans*, respectively.

At the end of the exposure period, survival of *H. azteca* in the site sediments ranged from 75 percent (POS-SD/TOX4A) to 100 percent (G10-SD/TOX5A and G14-SD/TOX4A) (Table 3). Survival of *H. azteca* in the laboratory control sediment was significantly different (P=0.05) from survival in sediment from only one sample station, POS-SD/TOX4A (Table 3). At the end of the 14-day exposure, surviving *H. azteca* in sediment from sample station POS-SD/TOX4A appeared pale and weak and were smaller than the organisms in the other site samples. The remainder of the site sediments did not exhibit any acute toxicity to *H. azteca* when compared with the laboratory control. Growth, measured as dry weight of *H. azteca*, ranged from 0.23 mg/organism (POS-SD/TOX4A) to 0.43 mg/organism (G14-SD/TOX5A)(Table 3). Growth of *H. azteca* in the laboratory control sediment, was significantly different (P=0.05) from growth in sediment from sample station POS-SD/TOX4A (Table 3).

Survival of *C. tentans* in the site sediments ranged from 18 percent (POS-SD/TOX4A) to 92 percent (G14-SD/TOX5A. Survival of *C. tentans* in the laboratory control sediment was significantly different (P=0.05) from survival in sediment from sample station POS-SD/TOX4A (Table 4). No acute effects were detected for *C. tentans* exposed to sediments from the remainder of the sample stations. Growth, measured as dry weight of *C. tentans*, ranged from 0.45 mg/organism (POS-SD/TOX4A) to 1.12 mg/organism (G14-SD/TOX4A). There were no significant differences (P=0.05) in growth of *C. tentans* between the laboratory control sediment and growth in any of the site sediments (Table 4).

Most of the sediment samples exhibited a slight to strong petroleum odor. No indigenous organisms were

detected in the sediments during the sorting and cleaning processes. Behavioral observations recorded during the 14-day exposures included organism emergence from the sediments and at the surface of the overlying water possibly to feed, and amplexus (reproductive behavior of *H. azteca* at test termination).

4.2 REFERENCE TOXICANT TESTS

The median lethal concentration (LC_{50}) for *Hyalella azteca* was determined to be 30.87 μg $CdCl_2$/L with 95 percent confidence limits of 21.68 and 43.95 μg $CdCl_2$/L. The reference toxicant LC_{50} for *Chironomus tentans* was determined to be 2,830 μg $CdCl_2$/L with 95 percent confidence limits of 1,980 and 4,030 μg $CdCl_2$/L. Both LC_{50} values fall within the normal sensitivity ranges of test species used for testing at ESE.

5.0 CONCLUSION

The toxicity test results indicated that after 14 days of exposure to whole sediments from the NFF site of NAS Cecil Field, survival and growth of *H. azteca* in the laboratory control sediment were significantly different (P=0.05) from survival and growth in sediment from only one sample station, POS-SD/TOX4A. Survival of *C. tentans* in the laboratory control sediment was significantly different (P=0.05) from survival in sediment from sample station POS-SD/TOX4A. There were no significant differences (P=0.05) in growth of *C. tentans* between the laboratory control sediment and growth in any of the site sediments.

6.0 REFERENCES

American Society for Testing and Materials. ASTM E 1383-94. *Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates*. Annual Book of ASTM Standards Vol. 11.05, 1995.

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Hamilton, M.A., R.C. Russo, and R.V. Thurston. 1977. *Trimmed Spearman-Karber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays*. Environmental Science and Technology. 11(7):714-719; Correction 12(4):417 (1978).

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Table 1. Water Quality Measurement Ranges[a] of Overlying Water During a 14-Day Toxicity Test of Whole Sediment From the NFF Site, NAS Cecil Field, Jacksonville, Florida, With the Amphipod, *Hyalella azteca*

Sample ID	Temp (°C)	pH (s.u.)[b]	DO (mg/L)	Cond[c] (μmhos/cm)
CONTROL	18.5 - 21.2	7.5 - 8.2	7.8 - 9.0	230 - 270
ALP-SD/TOX4A	18.5 - 21.2	7.4 - 8.1	8.1 - 9.0	215 - 250
ALP-SD/TOX5A	18.6 - 21.2	7.5 - 8.2	8.2 - 9.0	235 - 270
G10-SD/TOX4A	18.6 - 21.2	7.5 - 8.1	8.2 - 8.9	250 - 280
G10-SD/TOX5A	18.6 - 21.1	7.7 - 8.2	8.2 - 8.9	235 - 280
AVD-SD/TOX4A	18.6 - 21.0	7.6 - 8.1	8.3 - 8.9	200 - 245
AVD-SD/TOX5A	18.7 - 21.0	7.5 - 7.9	8.3 - 8.9	190 - 230
POS-SD/TOX4A	18.7 - 21.2	7.6 - 8.1	8.2 - 9.0	230 - 260
POS-SD/TOX5A	18.7 - 21.0	7.7 - 8.1	8.0 - 9.0	220 - 270
G14-SD/TOX4A	18.6 - 21.0	7.6 - 8.1	7.9 - 9.0	220 - 265
G14-SD/TOX5A	18.6 - 21.2	7.5 - 8.2	8.0 - 9.0	225 - 280

[a]Range of 19 measurements for temperature, pH and DO, and 9 measurements for conductivity.
[b]pH measured in standard units (s.u.).
[c]Conductivity.

Source: ESE, 1997

Table 2. Water Quality Measurement Ranges[a] of Overlying Water During a 14-Day Toxicity Test of Whole Sediment From the NFF Site, NAS Cecil Field, Jacksonville, Florida, With the Midge, *Chironomus tentans*

Sample	Temp (°C)	pH (s.u.)[b]	DO (mg/L)	Cond[c] (μmhos/cm)
CONTROL	18.4 - 21.0	7.5 - 8.1	8.5 - 9.1	250 - 270
ALP-SD/TOX4A	18.5 - 20.9	7.5 - 8.0	8.5 - 9.1	230 - 260
ALP-SD/TOX5A	18.5 - 20.9	7.5 - 8.0	8.4 - 9.1	260 - 300
G10-SD/TOX4A	18.5 - 21.0	7.5 - 8.0	8.5 - 9.0	285 - 310
G10-SD/TOX5A	18.5 - 20.9	7.5 - 8.0	8.4 - 9.0	280 - 300
AVD-SD/TOX4A	18.5 - 21.0	7.4 - 7.9	8.5 - 9.1	220 - 260
AVD-SD/TOX5A	18.6 - 21.0	7.4 - 7.9	8.4 - 9.1	230 - 260
POS-SD/TOX4A	18.6 - 21.0	7.5 - 7.9	8.4 - 9.1	250 - 280
POS-SD/TOX5A	18.6 - 21.0	7.5 - 8.0	8.5 - 8.9	280 - 290
G14-SD/TOX4A	18.6 - 21.0	7.5 - 7.9	8.5 - 9.0	250 - 270
G14-SD/TOX5A	18.6 - 21.0	7.5 - 7.9	8.5 - 9.0	295 - 315

[a]Range of 18 measurements for temperature, pH and DO, and 9 measurements for conductivity
[b]pH measured in standard units (s.u.)
[c]Conductivity

Source: ESE, 1997

Table 3. Survival and Growth of *Hyalella azteca* After 14 Days of Exposure to Whole Sediments From the NFF Site, NAS Cecil Field, Jacksonville, Florida (Page 1 of 2)

Sample ID	Replicate	Survival[a] (Percent)	Growth[b] (mg)
CONTROL	A	18	0.37
	B	20	0.33
	C	20	0.33
	D	20	0.28
		78 (98)	0.33
ALP-SD/TOX4A	A	19	0.39
	B	20	0.32
	C	20	0.38
	D	18	0.36
		77 (96)	0.36
ALP-SD/TOX5A	A	20	0.31
	B	20	0.31
	C	16	0.33
	D	20	0.32
		76 (95)	0.32
G10-SD/TOX4A	A	19	0.32
	B	18	0.28
	C	20	0.32
	D	20	0.31
		77 (96)	0.31
G10-SD/TOX5A	A	20	0.30
	B	20	0.35
	C	20	0.33
	D	20	0.30
		80 (100)	0.32
AVD-SD/TOX4A	A	20	0.20
	B	20	0.46
	C	19	0.35
	D	20	0.29
		79 (99)	0.33
AVD-SD/TOX5A	A	19	0.35
	B	20	0.38
	C	19	0.37
	D	20	0.38
		78 (98)	0.37

Table 3. Survival and Growth of *Hyalella azteca* After 14 Days of Exposure to Whole Sediments From the NFF Site, NAS Cecil Field, Jacksonville, Florida (Page 2 of 2)

Sample ID	Replicate	Survival[a] (Percent)	Growth[b] (mg)
POS-SD/TOX4A	A	13	0.28
	B	16	0.20
	C	15	0.21
	D	16	0.24
		60 (75)[c]	0.23[c]
POS-SD/TOX5A	A	20	0.29
	B	20	0.30
	C	17	0.36
	D	19	0.27
		76 (95)	0.31
G14-SD/TOX4A	A	20	0.35
	B	20	0.41
	C	20	0.40
	D	20	0.47
		80 (100)	0.41
G14-SD/TOX5A	A	19	0.39
	B	19	0.40
	C	18	0.47
	D	19	0.44
		75 (94)	0.43

[a]Twenty organisms exposed per replicate (80 organisms/sample). Percent survival values in parentheses.
[b]Growth was measured by drying organisms at 60 °C for 24 hours.
[c]Significantly different (P=0.05) from control.

Source: ESE 1997

Table 4. Survival and Growth of *Chironomus tentans* After 14 Days of Exposure to Whole Sediments From the NFF Site, NAS Cecil Field, Jacksonville, Florida (Page 1 of 2)

Sample ID	Replicate	Survival[a] (Percent)	Growth[b] (mg)
CONTROL	A	6	1.48
	B	10	0.74
	C	12	0.75
	D	15	0.48
		43 (72)	0.86
ALP-SD/TOX4A	A	10	1.35
	B	9	1.32
	C	13	0.74
	D	10	0.78
		42 (70)	1.05
ALP-SD/TOX5A	A	13	0.73
	B	12	0.63
	C	11	1.35
	D	13	0.80
		49 (82)	0.88
G10-SD/TOX4A	A	14	0.71
	B	12	0.87
	C	13	0.69
	D	12	0.88
		51 (85)	0.79
G10-SD/TOX5A	A	12	1.20
	B	11	1.16
	C	12	1.11
	D	15	0.67
		50 (83)	1.04
AVD-SD/TOX4A	A	13	0.85
	B	10	1.05
	C	14	0.67
	D	11	0.72
		48 (80)	0.82
AVD-SD/TOX5A	A	14	1.10
	B	14	0.91
	C	12	1.43
	D	14	0.59
		54 (90)	1.01

Table 4. Survival and Growth of *Chironomus tentans* After 14 Days of Exposure to Whole Sediments From the NFF Site, NAS Cecil Field, Jacksonville, Florida (Page 2 of 2)

Sample ID	Replicate	Survival[a] (Percent)	Growth[b] (mg)
POS-SD/TOX4A	A	2	0.15
	B	3	0.67
	C	3	0.33
	D	3	0.63
		11 (18)[c]	0.45
POS-SD/TOX5A	A	12	1.07
	B	11	0.85
	C	11	0.85
	D	14	0.53
		48 (80)	0.83
G14-SD/TOX4A	A	12	1.29
	B	14	1.27
	C	11	1.15
	D	11	0.77
		48 (80)	1.12
G14-SD/TOX5A	A	14	1.41
	B	15	1.01
	C	14	0.89
	D	12	1.02
		55 (92)	1.08

[a]Fifteen organisms exposed per replicate (60 organisms/sample). Percent survival values in parentheses.
[b]Growth was measured by drying organisms at 60 °C for 24 hours.
[c]Significantly different (P=0.05) from control.

Source: ESE 1997

Appendix A: Chain-of-Custody and Traffic Information

Chain of Custody Record

Quanterra Environmental Services

QUA-4124-1

Client	Project Manager	Date	Chain Of Custody Number
ABB-ES	Rao Angara	12/30/96	70353

Address	Telephone Number (Area Code)/Fax Number	Lab ~~Number~~ Name	Page
2590 EXECUTIVE CTR CIR EAST	904-856-1293 / 904-877-0742	ES&E	1 of 1

City	State	Zip Code	Site Contact	Lab Contact
Tallahassee	FL	32301		Dr. ONUSU-Yaw

Project Name	Carrier/Waybill Number
NASCF - NFF	2655922430

Contract/Purchase Order/Quote No.: 852092

Analysis (Attach list if more space is needed)

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Matrix: Sed.	Matrix: Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Toxicity Analysis	Special Instructions/ Conditions of Receipt
ALP-SD/TOX4A	12/30/96	0840		✓		✓						1	TOXICITY ANALYSIS
ALP-SD/TOX5A		0805		✓		✓						1	for Growth and
G10-SD/TOX5A		0920		✓		✓						1	survival using midg
G10-SD/TOX4A		0925		✓		✓						1	& Survival for amphipod
AVD-SD/TOX4A		1045		✓		✓						1	Each sample is in
AVD-SD/TOX5A		1055		✓		✓						1	a 1 gallon plastic
POS-SD/TOX4A		1240		✓		✓						1	container.
POS-SD/TOX5A		1250		✓		✓						1	
G14-SD/TOX4A		1500		✓		✓						1	[Hyalella azteca &
G14-SD/TOX5A		1450		✓		✓						1	Chironomus tentans]

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☑ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other _____

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/30/96	1830	1. Received By: Fed Ex		
2. Relinquished By: Fed Ex 2655922430	12/31/96		2. Received By: Max Overman ESE	12-31-96	1130
3. Relinquished By			3. Received By		

Comments: (*) Samples are Packed in 2 coolers.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Appendix B: *Hyalella azteca* Sediment Test Raw Data

Appendix C: *Chironomus tentans* Sediment Test Raw Data

Appendix D: Reference Toxicant Test Raw Data