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NAS JACKSONVILLE  
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FINAL REPORT FOR SUB-CHRONIC TOXICITY OF SEDIMENTS FROM POTENTIAL  
SOURCE OF CONTAMINATION 17 (PSC17) MULBERRY COVE NAS JACKSONVILLE FL  
10/1/1997  
QST ENVIRONMENTAL

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**FINAL REPORT:**

**SUB-CHRONIC TOXICITY OF SEDIMENTS  
FROM PSC 17, MULBERRY COVE, NAS  
JACKSONVILLE, FLORIDA, WITH THE  
AMPHIPOD, *AMPELISCA ABDITA***

**TEST GUIDE:**

ASTM E 1367-92

**SUBMITTED TO:**

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**STUDY ID:**

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## EXECUTIVE SUMMARY

Whole sediment toxicity tests were conducted at QST Environmental with the saltwater amphipod, *Ampelisca abdita*, on samples collected from PSC 17, Mulberry Cove, Naval Air Station (NAS), Jacksonville, Florida. The effect criteria for the tests were survival and growth. A total of four site sediments, one field reference sediment, and one laboratory control sediment were used in the toxicity tests. After 10 days of exposure, survival of *Ampelisca abdita* in the laboratory control and field reference (17D01401) sediments was 94 percent and 88 percent, respectively. Survival of *Ampelisca abdita* in the site sediments ranged from 90 percent (17D00301) to 95 percent (17D00501 and 17D01001). There were no significant differences ( $P=0.05$ ) in the survival of *Ampelisca abdita* between the laboratory control sediment and the field reference sediment. Survival of *Ampelisca abdita* in the laboratory control and field reference sediments was not significantly different ( $P=0.05$ ) from survival in any of the site sediments. Growth, measured as mean dry weight, of *Ampelisca abdita* in the laboratory control and field reference sediments was 0.22 mg/organism and 0.18 mg/organism, respectively. Growth, measured as mean dry weight, of *Ampelisca abdita* in the site sediments ranged from 0.14 mg/organism (17D01001) to 0.20 mg/organism (17D00601). There were no significant differences ( $P=0.05$ ) in the growth of *Ampelisca abdita* between the laboratory control sediment, field reference sediment, and any of the site sediments. Individual metal concentrations in the site sediments ranged from a low of  $<0.04$  mg/kg-dry for mercury, to a high of 22,800 mg/kg-dry for iron. Metal concentrations in the plant tissue samples collected from PSC 17, Mulberry Cove, ranged from a low of  $<0.008$  mg/kg-wet for mercury to a high of 905 mg/kg-wet for iron.

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## **1.0 INTRODUCTION**

Whole sediment toxicity tests were conducted at QST Environmental on samples collected from PSC 17, Mulberry Cove, Naval Air Station (NAS) Jacksonville, Florida, to determine the potential toxicity of the test samples. The test organism used for the static, non-renewal sediment toxicity tests was the saltwater amphipod, *Ampelisca abdita*. The effect criteria for the sub-chronic toxicity tests were survival and growth, measured as mean dry weight.

The tests were conducted following ASTM Guideline E 1367-92 entitled *Standard Guide for Conducting 10-Day Sediment Toxicity Tests with Marine and Estuarine Amphipods* (ASTM 1995) and QST in-house protocols. All of the original raw data pertaining to this study are maintained at QST, 404 SW 140th Terrace, Newberry, Florida 32669-3000.

## **2.0 MATERIALS AND METHODS**

### **2.1 TEST SAMPLES**

Test sediments were collected on July 22 through 24, 1997 by ABB Environmental Services, Inc. (ABB-ES) personnel and were received on ice at the QST Gainesville laboratory on July 24 and 25, 1997. The test samples, identified as 17D00501, 17D01401, 17D01001, 17D00301, and 17D00601, were received in quantities of approximately 3.75 Liters (1 gallon jars) each. Sample 17D01401 was later identified as a field reference sample. Three plant tissue samples, identified as 17E00301, 17E01401 and 17E00101, were also received with the sediment samples for chemical analyses. 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 temperatures of the coolers were then measured using the temperature blanks provided in the coolers. Any observations made were recorded in the sample receipt logbook.

Laboratory control sediment was collected by a commercial test organism supplier from a marsh in Rhode Island where the test organisms were field collected. The site from which the control sediment was collected has been proven to be uncontaminated in previous tests. Prior to use in testing, the laboratory control sediment was sifted to remove any indigenous organisms present. 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 *A. abdita* tests was filtered natural seawater with a salinity of approximately 32 parts-per-thousand (ppt). The seawater was obtained from the Atlantic Ocean, near Marineland, Florida. The site was selected because it is relatively free of human activity, and has been shown to be uncontaminated in previous tests.

## 2.3 TEST ORGANISMS

The whole sediment bioassays were conducted using juvenile (second or third instar) *A. abdita* (3-5 mm in length, with no mature males or females). The test organisms were obtained from Aquatic Research Organisms, Hampton, NH. The supplier's holding conditions, such as temperature and water salinity, were similar to those of the testing conditions, therefore, organisms were held for less than 24 hours prior to test initiation.

## 2.4 TEST DESIGN

The whole sediment toxicity tests were initiated on July 28, 1997, within 3 days of receiving the last batch of samples. Prior to use in the toxicity tests, the sediment samples were allowed to equilibrate to room temperature and individually homogenized. Sediments were then hand-sorted to remove small stones and sticks, plant debris, and sieved to remove any indigenous organisms. All of the site sediments appeared dark, silty and rich in organic matter. 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 site, reference, or control sediment were introduced into the test chambers and uniformly leveled. Eight-hundred milliliters (800 mL) of overlying seawater 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 with aeration provided to maintain dissolved oxygen levels above 90 percent saturation. On day zero, the initial water quality measurements were taken and the test organisms were introduced into the test chambers. The test organisms were randomly added to the test chambers, loading one replicate at a time until loading was complete. The test vessels were examined one hour after loading to identify and replace any floaters and to ensure that the

organisms had burrowed into the sediments.

The whole sediment tests were conducted using four replicates of 20 organisms per replicate for a total of 80 *A. abdita* per sample. The test vessels were labeled with the site I.D. number and replicate number (A through D), and the test area was identified by the QST project number, test type and schedule, and the name of the project manager.

The duration of the static non-renewal whole sediment toxicity tests was 10-days during which the test organisms received no supplemental feeding. The tests were conducted in a waterbath adjusted to maintain a temperature of  $20 \pm 1$  °C under fluorescent lighting with a daily photoperiod of 24 hours continuous light (ambient laboratory illumination,  $748 \pm 11$  Lux). All test chambers were aerated at approximately 80 bubbles per minute throughout the testing period. Temperature and dissolved oxygen (DO) concentrations, were measured daily. pH, ammonia and conductivity were measured at the beginning and end of the tests. The salinity of the overlying water was measured four times during the test. Water quality measurements were taken with the following instruments: temperature--Fisher Scientific digital thermocouple; pH--SA 290A Orion pH meter equipped with an Orion 91-57 triode; dissolved oxygen--YSI, Model 57 DO meter; salinity--Aquatic Biosystems refractometer, ammonia--SA 290A electrode with Orion Model 95-12 ammonia probe, 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 mortality, entrapment at the surface of overlying water, and sediment avoidance. At test termination, the sediments were sieved through a 0.5 mm mesh Nyltex screen to collect, observe, and enumerate test organisms. *A. abdita* were considered dead if they remained immobile, possessed no pigmentation, and did not respond to a gentle stimulus. Growth, as group dry weight in milligrams, was measured by placing the surviving organisms from each replicate 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 and contents were then measured on an American Scientific S/P 180 analytical balance and the group dry weight of the organisms was determined by difference.

## **2.5 REFERENCE TOXICANT TEST**

A 96-hour reference toxicant test was conducted concurrently with the whole sediment toxicity tests to determine the general health of the test organisms. The reference toxicant used was sodium dodecyl sulfate (SDS) at concentrations of 0, 0.62, 1.25, 2.5, 5.0 and 10.0 mg/L. The reference toxicant test was conducted in complete darkness and under similar conditions of temperature and salinity as the whole sediment tests. Only 10 organisms were exposed per reference toxicant concentration without any replication.

## **2.6 CHEMICAL ANALYSES**

Chemical analyses of the five sediments used in toxicity testing and the three plant tissue samples collected from PSC 17, Mulberry Cove, NAS Jacksonville, Florida, were performed for target analyte list (TAL) metals using the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for soil/sediment and CLP SOW modified for nonstandard matrices (plant material). The plant tissue samples were analyzed in the as received condition (i.e. plants were not washed prior to digestion for chemical analyses).

## **3.0 STATISTICAL ANALYSIS**

All toxicity data were evaluated by a statistical comparison of mean survival and growth of *A. abdita* in the site samples with mean survival and growth in the reference and 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 median lethal concentration (LC<sub>50</sub>) for the reference toxicant test, the concentration of the reference toxicant causing 50 percent mortality of the test organisms under the specified conditions of exposure, was determined using the Trimmed Spearman-Kärber Statistical Method (Hamilton et. al., 1977).

## **4.0 RESULTS AND DISCUSSION**

### **4.1 SEDIMENT TOXICITY TESTS**

Test conditions, including lighting, salinity, DO, conductivity, temperature, and pH levels remained at acceptable levels throughout the testing period. Test temperature remained in the range of 19.8 to 21.0 °C, pH ranged from 7.9 to 8.2 standard units, and dissolved oxygen remained above 90 percent saturation

(ranged from 6.9 to 7.3 mg/L) for the duration of the tests (Table 1). Salinity of the overlying water remained in the range of 29-32 ppt, solution conductivities ranged from 39,000 to 44,800  $\mu$ mhos/cm, and ammonia levels ranged from <0.10 to 2.61 mg/L (Table 1). There were no deviations from the test protocols in the ASTM Guideline used to conduct this test (ASTM E1367-92).

Survival and growth data of the whole sediment bioassays are presented in Table 2. After 10 days of exposure, survival of *A. abdita* in the laboratory control and field reference sediments was 94 percent and 88 percent, respectively. Survival of *A. abdita* in the Mulberry Cove sediments ranged from 90 percent (17D00301) to 95 percent (17D00501 and 17D01001). There were no significant differences ( $P=0.05$ ) in the survival of *A. abdita* between the laboratory control sediment and the field reference sediment. Survival of *A. abdita* in the laboratory control and field reference sediments was not significantly different ( $P=0.05$ ) from survival in any of the site sediments.

Growth, measured as mean dry weight in milligrams of *A. abdita*, averaged 0.22 mg/organism and 0.18 mg/organism in the laboratory control and field reference sediments, respectively (Table 2). The mean dry weight of the site sediments ranged from 0.14 mg (17D01001) to 0.20 mg (17D00601). There were no significant differences ( $P=0.05$ ) in the growth of *A. abdita* between the laboratory control sediment and the field reference sediment from sample station 17D01401. Also, there were no significant differences ( $P=0.05$ ) in the growth of *A. abdita* between the laboratory control sediment, field reference sediment, and any of the site sediments.

Indigenous organisms detected in the site sediments during the sieving and cleaning processes included worms and clams. All indigenous organisms were sieved from the sediment prior to use in testing. No adverse behavioral observations were recorded during the 10-day exposures. All of the exposed *A. abdita* were observed to burrow into the sediments and make tubes during the first hour of the test. At the end of the 10-day exposure period, all surviving *A. abdita* appeared to be normal and healthy.

#### 4.2 REFERENCE TOXICANT TESTS

The 96-hour  $LC_{50}$  of the reference toxicant for *Ampelisca abdita* was determined to be 3.08 mg SDS/L with

95 percent confidence limits of 2.20 and 4.30 mg SDS/L. The  $LC_{50}$  value falls within the normal sensitivity ranges of test species used for testing at QST. The raw data pertaining to the reference toxicant test are provided in Appendix C. A copy of the QST protocol used for the performance of the toxicity tests is provided in Appendix D.

#### 4.3 CHEMICAL ANALYSES

The results of chemical analyses of metals in the sediments used for toxicity testing and plant tissue samples collected from PSC 17, Mulberry Cove, are presented in Tables 3 and 4. Individual metal concentrations in the site sediments ranged from a low of <0.04 mg/kg-dry for mercury, to a high of 22,800 mg/kg-dry for iron (Table 3). Metal concentrations in the plant tissue samples collected from PSC 17, Mulberry Cove, ranged from a low of <0.008 mg/kg-wet for mercury to a high of 905 mg/kg-wet for iron (Table 4). A CLP data package pertaining to the chemical analyses is presented in Appendix E.

#### 5.0 CONCLUSION

The toxicity test results indicated that after 10 days of exposure to whole sediments from PSC 17, Mulberry Cove, NAS Jacksonville, Florida, survival and growth of *A. abdita* in the laboratory control sediment were not significantly different ( $P=0.05$ ) from survival and growth of *A. abdita* in the field reference sediment (17D01401). Survival and growth of *A. abdita* in the laboratory control and field reference sediments were not significantly different ( $P=0.05$ ) from survival and growth of *A. abdita* in any of the site sediments. Individual metal concentrations in the site sediments ranged from a low of <0.04 mg/kg dry for mercury, to a high of 22,800 mg/kg dry for iron. Metal concentrations in the plant tissue samples collected from Mulberry Cove ranged from a low of <0.008 mg/kg-wet for mercury to a high of 905 mg/kg-wet for iron.

## 6.0 REFERENCES

American Society for Testing and Materials. ASTM E 1367-92. *Standard Guide for Conducting 10-Day Sediment Toxicity Tests with Marine and Estuarine Amphipods*. Annual Book of ASTM Standards Vol. 11.05, 1995.

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Table 1. Water Quality Measurement Ranges<sup>a</sup> of Overlying Water During a 10-Day Toxicity Test of Whole Sediment From PSC 17, Mulberry Cove, NAS Jacksonville, Florida, With the Amphipod, *Ampelisca abdita*

Site ID	Ammonia (ppm)	Salinity (ppt)	Temp (°C)	pH (s.u.) <sup>b</sup>	DO (mg/L)	Cond <sup>c</sup> (µmhos/cm)
Control	<0.10	31 - 32	19.8 - 20.9	8.0 - 8.2	7.0 - 7.3	43,000-44,800
17D01401(Ref) <sup>d</sup>	0.17 - 0.93	30 - 31	19.9 - 20.9	8.0 - 8.0	7.0 - 7.3	41,000-42,000
17D00501	0.59 - 1.27	29 - 30	20.0 - 20.9	7.9 - 8.1	7.0 - 7.3	39,000-41,500
17D01001	2.30 - 2.61	29 - 30	20.0 - 20.9	8.0 - 8.2	7.0 - 7.3	39,500-40,000
17D00301	0.51 - 2.50	29 - 30	20.1 - 20.9	8.1 - 8.2	6.9 - 7.2	41,000-41,500
17D00601	0.44 - 0.58	29 - 30	20.1 - 21.0	8.0 - 8.1	6.9 - 7.2	38,800-41,000

<sup>a</sup>Range of 11 measurements for temperature and DO.

<sup>b</sup>pH measured in standard units (s.u.).

<sup>c</sup>Conductivity.

<sup>d</sup>Field reference sample.

Source: QST, 1997

Table 2. Survival and Growth of *Ampelisca abdita* After 10 Days of Exposure to Whole Sediments From PSC 17, Mulberry Cove, NAS Jacksonville, Florida

Sample ID	Replicate <sup>a</sup>	Survival (Percent)	Mean Dry Weight (mg) <sup>b</sup>
Control	A	20	0.25
	B	20	0.19
	C	17	0.24
	D	<u>18</u>	<u>0.21</u>
		75 (94)	0.22
17D01401 (Ref) <sup>c</sup>	A	18	0.18
	B	16	0.13
	C	19	0.22
	D	<u>17</u>	<u>0.19</u>
		70 (88)	0.18
17D00501	A	19	0.37
	B	19	0.16
	C	19	0.11
	D	<u>19</u>	<u>0.12</u>
		76 (95)	0.19
17D01001	A	19	0.15
	B	20	0.15
	C	18	0.13
	D	<u>19</u>	<u>0.14</u>
		76 (95)	0.14
17D00301	A	19	0.16
	B	17	0.16
	C	18	0.16
	D	<u>18</u>	<u>0.21</u>
		72 (90)	0.17
17D00601	A	20	0.19
	B	17	0.22
	C	18	0.19
	D	<u>19</u>	<u>0.21</u>
		74 (93)	0.20

<sup>a</sup>Twenty organisms exposed per replicate (80 organisms/sample). Percent survival in parentheses.

<sup>b</sup>Growth was measured as dry weight (at 60 °C for 24 hours) in milligrams.

<sup>c</sup>Field reference sample.

Source: QST 1997

Table 3. Chemical Analyses Results for Metals in Sediment Samples Collected from PSC 17, Mulberry Cove, NAS Jacksonville, Florida

PARAMETER	SAMPLE CONCENTRATION (mg/kg-dry)				
	17D00501	17D01401	17D01001	17D00301	17D00601
Aluminum	6,840	424	6,370	991	4,550
Antimony	<70.8	<11.1	<69.8	<11.2	<41.0
Arsenic	4.30	0.629	4.59	0.347	2.61
Barium	29.6	3.69	26.9	4.54	18.5
Beryllium	<2.83	<0.443	<2.79	<0.448	<1.64
Cadmium	5.27	<0.554	<3.49	3.98	5.72
Calcium	9,160	5,000	9,450	1,220	6,510
Chromium	39.1	1.46	31.6	8.95	38.7
Cobalt	<14.2	<2.22	<14.0	<2.24	<8.2
Copper	41.7	5.19	27.1	25.9	40.5
Iron	22,800	1,1220	20,900	986	15,700
Lead	94.2	15.2	<69.8	43.9	106
Magnesium	4,990	271	5,630	392	3,590
Manganese	150	11.7	175	14.3	91.9
Mercury -	0.447	<0.054	0.37	<0.04	0.465
Nickel	16.7	<2.22	<14.0	12.8	28.6
Potassium	1,190	<111	1,180	<112	768
Selenium	2.12	<0.335	2.41	<0.28	1.12
Silver	<3.54	<0.554	<3.49	4.35	3.29
Sodium	7,090	434	7,380	389	4,450
Thallium	<142	<22.2	<140	<22.4	<82
Vanadium	15.9	2.92	17.1	2.51	11.9
Zinc	179	18.8	131	35.6	146

Table 4. Chemical Analyses Results for Metals in Plant Tissue Samples Collected from PSC 17, Mulberry Cove, NAS Jacksonville, Florida

PARAMETER	SAMPLE CONCENTRATION (mg/kg wet)		
	17E01401	17E00301	17E00101
Aluminum	298	301	210
Antimony	<0.017	<0.017	<0.02
Arsenic	0.139	0.226	0.358
Barium	19.3	5.11	3.0
Beryllium	0.011	0.018	0.013
Cadmium	0.127	0.409	0.272
Calcium	430	807	594
Chromium	0.618	1.24	0.442
Cobalt	0.087	0.199	0.116
Copper	0.885	2.41	1.28
Iron	467	674	905
Lead	1.86	6.81	2.55
Magnesium	137	229	174
Manganese	30.5	49.9	39.7
Mercury	<0.007	0.016	<0.008
Nickel	0.255	1.48	0.254
Potassium	671	554	649
Selenium	0.079	0.101	0.092
Silver	0.06	0.26	0.04
Sodium	148	201	211
Thallium	0.005	0.007	0.004
Vanadium	0.68	1.33	1.09
Zinc	5.8	11.5	13.4

## **Appendix A: Chain-of-Custody and Traffic Information**



## **Appendix B: *Ampelisca abdita* Sediment Test Raw Data**

Project No: 3197237-0100-3100 Client: APB

Test Species: *A. abdita*

DAILY LOG

7/28/97 - JY Sample 601 - Dark not much debris, foul smell

Nice smooth sediment.

- 301 - Sandy Lot of dead worms, foul smell, big clam

- 1001 Dark not much debris Clam shells + nice smooth sediment

- 1401 Sandy, clam shells

- 501 Dark, not much debris, smooth sediment

All sediments sieved and approximately 200g of each put in a 1.5 L glass jar. Four (4) replicates of each sample set up. Aeration was provided after 800ml of natural seawater had been added to each jar. Remainder of the samples stored at 4±2°C for chemical analysis.

7/29/97 MS - checked aeration (aeration provided through Tygon tubing + glass pipettes) - aeration B set at ~150 bubbles per minute to maintain D.O. above 90% saturation.

*A. abdita* were received, checked-in, and acclimated for ~3 hours to test temperature. *A. abdita* were in normal condition and were loaded into the test chambers in lots of 10 until all of the test vessels contained 20 *A. abdita*.

*A. abdita* were observed carefully during loading to insure that they appeared healthy + the proper size (3-5mm). DO in all of the test vessels was ≥ 7.2 mg/L (> 90% saturation). The sediments have settled out of the overlying water pretty well.

Project No: 3197237-0100

Client: ABB-ES

Test Species: *A. abdita*

### DAILY LOG

7/29/97 MO - The control sediment was collected at the site where the *A. abdita* were collected on Rhode Island.

CTM-6 set up to monitor temperature in water bath

8. Fluorescent lighting set for 24-hour light photoperiod. Light intensity over the test area is 740 lux.

7/30/97 MO - Observed + monitored test. Checked airlines + aeration. CTM-6 reads 20°C. The tubes of the *A. abdita* were observed in all of the test vessels;  $\geq 18$  tubes were counted in all of the replicates. No organisms were above the sediment surface, so the organisms are not avoiding any of the sediments.

Note: Ammonia measured using SA290A meter with Orion model 95-12 Ammonia probe.

7/31/97 MO - Observed + monitored test. Checked airlines + aeration. CTM-6 reads 21°C.

8/1/97 MO - Observed + monitored test. Checked airlines + aeration. CTM-6 reads 20°C.

8/02/97 MO - Observed + monitored test. Checked airlines + aeration. CTM-6 reads 21°C. One dead *A. abdita* found floating on water surface in 17D01001, rep. B.

Note: on further observation, *A. abdita* is still alive + was placed back into water column - it is on the sediment surface but appears weak.

8/03/97 MO - Observed + monitored test. Checked airlines. CTM-6 reads 21°C.

Project No: 3197237-0100

Client: ABB-ES

Test Species: *A. abdita*

DAILY LOG

8/01/97 MO - Observed + monitored test. Checked airlines + aeration. CSM-6 reads 21°C.

8/05/97 MO - Observed + monitored test. Checked airlines + aeration. CSM-6 reads 20°C.

8/06/97 MO - Observed + monitored test. Checked airlines + aeration. There are still tubes (of *A. abdita*) in all of the replicates. CSM-6 reads 20°C.

8/07/97 MO - Observed + monitored test. Checked airlines + aeration. CSM-6 reads 21°C.

8/08/97 MO - Test terminated - *A. abdita* recovered from sediment, enumerated, rinsed with DI water, + placed in weigh pans. Weigh pans placed in oven at 60°C to dry. Pooled water from 4 reps of each sample for ammonia measurements. CSM-6 reads 21°C.

All of the *A. abdita* appeared normal in appearance + behavior.

Light intensity over test area = 755 lux (LX-1)

SUBJECT: TOXICITY TEST DATA SHEET

Client: <u>ABB</u>			Project Number: <u>3197237-0100-3100</u>									
Test Material			Test Conditions									
See Page <u>189</u> of Sample Receipt Log Test Material Information			<input type="checkbox"/> Preliminary <input type="checkbox"/> Definitive <input checked="" type="checkbox"/> Screening		<input checked="" type="checkbox"/> Static <input type="checkbox"/> Flow-through Duration: <u>10 Days</u>							
Test Animal History			Dilution Water: <u>Natural, Filtered Seawater</u>									
Species : <u>Ampelisca abdita</u> Batch Number : <u>97-55</u> Age / Life Stage : <u>3-5 mm (juvenile)</u> Date Acclimation / Maintenance Began : <u>7/29/97</u> See Page <u>186</u> of <u>Invertebrate Holding</u> Log for raw data. Mortality (%) 48 Hrs prior to testing: <u>&lt; 1</u> %			Lighting : <input checked="" type="checkbox"/> Fluorescent <input type="checkbox"/> Incandescent Photoperiod : <u>24</u> hr Light : <u>—</u> hr Dark									
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:20%;">Test Area Used</td> <td style="width:20%;">Temperature (C)</td> <td style="width:60%;">Salinity (ppt)</td> </tr> <tr> <td><u>Waterbath 8</u></td> <td><u>20 +/- 1</u></td> <td><u>31 +/- 2</u></td> </tr> </table>			Test Area Used	Temperature (C)	Salinity (ppt)	<u>Waterbath 8</u>	<u>20 +/- 1</u>	<u>31 +/- 2</u>	Test Container Dimensions <sup>(cm)</sup> : <u>10.5</u> L x <u>—</u> W x <u>23.5</u> H Test Solution Height : <u>~11.0</u> cm Test Containers : <input checked="" type="checkbox"/> Open <input type="checkbox"/> Covered Test Container Volume : <u>1.6</u> Liters Diluent Volume : <u>0.8</u> Liters			
Test Area Used	Temperature (C)	Salinity (ppt)										
<u>Waterbath 8</u>	<u>20 +/- 1</u>	<u>31 +/- 2</u>										
			Reps / Concentration : <u>4</u> Animals / Replicate : <u>20</u>									
Protocol Followed:												
Concentrations Based on: <input type="checkbox"/> A.I. <input checked="" type="checkbox"/> W.M.			Container Composition: <input checked="" type="checkbox"/> Glass <input type="checkbox"/> Plastic									
Test Concentrations: (Units = % ):			Control	D01401	D00501	D01001	D00301	D00601				
Amount Reference <sup>OVERLYING WATER</sup> Soil Added (mL): <sub>no filter</sub>			800	800	800	800	800	800				
Amount Test <sup>SEDIMENT</sup> Soil Added (mL): <sub>no filter</sub>			200 N/A	200	200	200	200	200				

Additional Observations: \_\_\_\_\_

Data By: MO      Date: 7/29/97

SUBJECT: SEDIMENT TOXICITY DATA SHEET - WATER QUALITY

SPONSOR: ABB ENVIRONMENTAL				PROJECT NUMBER: 3197237-0100-3100						
SAMPLE ID: CONTROL				TEST SPECIES: <i>Ampelisca abdita</i>						
DATE-DAY	REP	TEMP (°C)	SALINITY HARD/ALK	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME	
7/29/97	0	A	20.4	31 pt	<0.1	8.0	7.2	43,000	—	MO 1515
7/30/97	1	B	20.6	—	—	—	7.0	—	—	MO 1445
7/31/97	2	C	20.7	31	—	—	7.1	—	—	MO 1130
8/01/97	3	D	20.9	—	—	—	7.1	—	—	MO 1045
8/02/97	4	A	20.8	—	—	—	7.1	—	—	MO 1130
8/03/97	5	B	20.9	—	—	—	7.1	—	—	MO 1145
8/04/97	6	C	20.2	—	—	—	7.3	—	—	MO 1500
8/05/97	7	D	19.9	31	—	—	7.3	—	—	MO 1330
8/06/97	8	A	19.8	—	—	—	7.3	—	—	MO 1330
8/07/97	9	B	20.0	—	—	—	7.2	—	—	MO 1130
8/08/97	10	C	20.5	32	<0.1	8.2	7.2	44,800	—	MO 0830

OBSERV	REPLICATE									
	DATE-DAY	A	B	C	D	E	F	G	H	Initial
7/29/97	0	20A	20A	20A	20A	—	—	—	—	MO 1700
7/30/97	1	N	N	N	N	—	—	—	—	MO 1500
7/31/97	2	N	N	N	N	—	—	—	—	MO 1130
8/01/97	3	N	N	N	N	—	—	—	—	MO 1100
8/02/97	4	N	N	N	N	—	—	—	—	MO 1145
8/03/97	5	N	N	N	N	—	—	—	—	MO 1200
8/04/97	6	N	N	N	N	—	—	—	—	MO 1500
8/05/97	7	N	N	N	N	—	—	—	—	MO 1330
8/06/97	8	N	N	N	N	—	—	—	—	MO 1345
8/07/97	9	N	N	N	N	—	—	—	—	MO 1130
8/08/97	10	20A	20A	17A 3NF	18A 2NF	—	—	—	—	MO 0900

Comments:

KEY: AS = AT SURFACE N = NONE EMR = EMERGENCE A = ALIVE D = DEAD NF = NOT FOUND  
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 TEMP = TEMPERATURE HARD = HARDNESS YTC = YEAST/ TROUT CHOW/CEROPHYLL

SUBJECT: SEDIMENT TOXICITY DATA SHEET - WATER QUALITY

SPONSOR: ABB ENVIRONMEATAL  
SAMPLE ID: 17D01401

PROJECT NUMBER: 3197237-0100-3100  
TEST SPECIES: *Ampelisca abdita*

DATE-DAY	REP	TEMP (°C)	SALINITY HARD/ALK (%)	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME	
7/29/97	0	A	20.4	30	0.17	8.0	7.2	41,000	—	MO 1515
7/30/97	1	B	20.6	—	—	—	7.0	—	—	MO 1445
7/31/97	2	C	20.7	30	—	—	7.0	—	—	MO 1130
8/01/97	3	D	20.9	—	—	—	7.1	—	—	MO 1045
8/02/97	4	A	20.8	—	—	—	7.1	—	—	MO 1130
8/03/97	5	B	20.9	—	—	—	7.0	—	—	MO 1145
8/04/97	6	C	20.2	—	—	—	7.2	—	—	MO 1500
8/05/97	7	D	19.9	31	—	—	7.3	—	—	MO 1330
8/06/97	8	A	19.9	—	—	—	7.3	—	—	MO 1330
8/07/97	9	B	20.1	—	—	—	7.2	—	—	MO 1130
8/08/97	10	C	20.6	31	0.93	8.0	7.2	42,000	—	MO 0830

OBSERV	REPLICATE								Initial
	A	B	C	D	E	F	G	H	
7/29/97 0	20A	20A	20A	20A	—	—	—	—	MO 1700
7/30/97 1	N	N	N	N	—	—	—	—	MO 1500
7/31/97 2	N	N	N	N	—	—	—	—	MO 1130
8/01/97 3	N	N	N	N	—	—	—	—	MO 1100
8/02/97 4	N	N	N	N	—	—	—	—	MO 1145
8/03/97 5	N	N	N	N	—	—	—	—	MO 1200
8/04/97 6	N	N	N	N	—	—	—	—	MO 1500
8/05/97 7	N	N	N	N	—	—	—	—	MO 1330
8/06/97 8	N	N	N	N	—	—	—	—	MO 1345
8/07/97 9	N	N	N	N	—	—	—	—	MO 1130
8/08/97 10	18A 2NF	16A 4NF	19A 1NF	17A 3NF	—	—	—	—	MO 0930

Comments:

KEY: AS = AT SURFACE N = NONE EMR = EMERGENCE A = ALIVE D = DEAD NF = NOT FOUND  
 REP = REPLICATE COND = CONDUCTIVITY ALK = ALKALINITY AMP = AMPLEXUS  
 TEMP = TEMPERATURE HARD = HARDNESS YTC = YEAST/ TROUT CHOW/CEROPHYLL

SUBJECT: SEDIMENT TOXICITY DATA SHEET - WATER QUALITY

SPONSOR: ABB ENVIRONMEATAL SAMPLE ID: 17D00501				PROJECT NUMBER: 3197237-0100-3100 TEST SPECIES: <i>Ampelisca abdita</i>						
DATE-DAY	REP	TEMP (°C)	SALINITY HARD/ALK (%)	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME	
7/29/97	0	A	20.5	29	1.27	8.1	7.2	39,000	—	MO 1515
7/30/97	1	B	20.7	—	—	—	7.0	—	—	MO 1445
7/31/97	2	C	20.7	29	—	—	7.0	—	—	MO 1130
8/01/97	3	D	20.9	—	—	—	7.1	—	—	MO 1045
8/02/97	4	A	20.8	—	—	—	7.1	—	—	MO 1130
8/03/97	5	B	20.9	—	—	—	7.0	—	—	MO 1145
8/04/97	6	C	20.3	—	—	—	7.2	—	—	MO 1500
8/05/97	7	D	20.0	29	—	—	7.3	—	—	MO 1330
8/06/97	8	A	20.0	—	—	—	7.2	—	—	MO 1330
8/07/97	9	B	20.2	—	—	—	7.1	—	—	MO 1130
8/08/97	10	C	20.6	30	0.59	7.9	7.1	41,500	—	MO 0830

OBSERV	REPLICATE								Initial	
	DATE-DAY	A	B	C	D	E	F	G		H
7/29/97	0	20A	20A	20A	20A	—	—	—	—	MO 1700
7/30/97	1	N	N	N	N	—	—	—	—	MO 1500
7/31/97	2	N	N	N	N	—	—	—	—	MO 1130
8/01/97	3	N	N	N	N	—	—	—	—	MO 1100
8/02/97	4	N	N	N	N	—	—	—	—	MO 1145
8/03/97	5	N	N	N	N	—	—	—	—	MO 1200
8/04/97	6	1AS	N	N	N	—	—	—	—	MO 1500
8/05/97	7	N	N	N	N	—	—	—	—	MO 1330
8/06/97	8	N	N	N	N	—	—	—	—	MO 1345
8/07/97	9	N	N	N	N	—	—	—	—	MO 1130
8/08/97	10	19A 1NF	19A, 1NF	19A, 1NF	19A, 1NF	—	—	—	—	MO 1000

Comments:

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 TEMP = TEMPERATURE HARD = HARDNESS YTC = YEAST/ TROUT CHOW/CEROPHYLL

SUBJECT: SEDIMENT TOXICITY DATA SHEET - WATER QUALITY

SPONSOR: ABB ENVIRONMEATAL SAMPLE ID: 17D01001				PROJECT NUMBER: 3197237-0100-3100 TEST SPECIES: <i>Ampelisca abdita</i>						
DATE-DAY	REP	TEMP (°C)	SALINITY HARD/ALK (%)	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME	
7/29/97	0	A	20.6	29	2.61	8.2	7.3	39,500	—	MO 1515
7/30/97	1	B	20.7	—	—	—	7.0	—	—	MO 1445
7/31/97	2	C	20.8	29	—	—	7.0	—	—	MO 1120
8/01/97	3	D	20.9	—	—	—	7.0	—	—	MO 1045
8/02/97	4	A	20.9	—	—	—	7.1	—	—	MO 1130
8/03/97	5	B	20.9	—	—	—	7.1	—	—	MO 1145
8/04/97	6	C	20.3	—	—	—	7.2	—	—	MO 1500
8/05/97	7	D	20.0	29	—	—	7.2	—	—	MO 1330
8/06/97	8	A	20.1	—	—	—	7.2	—	—	MO 1330
8/07/97	9	B	20.2	—	—	—	7.1	—	—	MO 1130
8/08/97	10	C	20.7	30	2.3	8.0	7.0	49000	—	MO 0830

OBSERV	REPLICATE								Initial	
	A	B	C	D	E	F	G	H		
7/29/97	0	20A	20A	20A	20A	—	—	—	—	MO 1700
7/30/97	1	N	N	N	N	—	—	—	—	MO 1500
7/31/97	2	N	N	N	N	—	—	—	—	MO 1120
8/01/97	3	N	N	N	N	—	—	—	—	MO 1100
8/02/97	4	N	1AS 100%	N	N	—	—	—	—	MO 1145
8/03/97	5	N	N	N	N	—	—	—	—	MO 1200
8/04/97	6	N	N	N	N	—	—	—	—	MO 1500
8/05/97	7	N	N	N	N	—	—	—	—	MO 1330
8/06/97	8	N	N	N	N	—	—	—	—	MO 1345
8/07/97	9	N	N	N	N	—	—	—	—	MO 1120
8/08/97	10	19A, 1NF	20A	18A, 2NF	19A, 1NF	—	—	—	—	MO 1030

Comments: @ MO 8/2/97 - *A. abdita* was still alive & placed back into water column.

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SUBJECT: SEDIMENT TOXICITY DATA SHEET - WATER QUALITY

SPONSOR: ABB ENVIRONMENTAL  
SAMPLE ID: 17D00301

PROJECT NUMBER: 3197237-0100-3100  
TEST SPECIES: *Ampelisca abdita*

DATE-DAY	REP	TEMP (°C)	SALINITY HARD/ALK(‰)	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME	
7/29/97	0	A	20.7	30	0.51	8.1	7.2	41,000	—	MO 1575 7/29/97
7/30/97	1	B	20.8	—	—	—	7.0	—	—	MO 1445
7/31/97	2	C	20.9	29	—	—	6.9	—	—	MO 1130
8/01/97	3	D	20.8	—	—	—	7.0	—	—	MO 1045
8/02/97	4	A	20.9	—	—	—	7.0	—	—	MO 1130
8/03/97	5	B	20.9	—	—	—	7.0	—	—	MO 1145
8/04/97	6	C	20.3	—	—	—	7.2	—	—	MO 1500
8/05/97	7	D	20.1	30	—	—	7.2	—	—	MO 1330
8/06/97	8	A	20.1	—	—	—	7.2	—	—	MO 1330
8/07/97	9	B	20.3	—	—	—	7.1	—	—	MO 1130
8/08/97	10	C	20.8	29.30	2.5	8.2	7.0	41,500	—	MO 0820

no data (WTF)

OBSERV	REPLICATE									
	DATE-DAY	A	B	C	D	E	F	G	H	Initial
7/29/97	0	20A	20A	20A	20A	—	—	—	—	MO 1700
7/30/97	1	N	N	N	N	—	—	—	—	MO 1500
7/31/97	2	N	N	N	N	—	—	—	—	MO 1130
8/01/97	3	N	N	N	N	—	—	—	—	MO 1100
8/02/97	4	N	N	N	N	—	—	—	—	MO 1145
8/03/97	5	N	1AS	N	N	—	—	—	—	MO 1200
8/04/97	6	N	N	N	N	—	—	—	—	MO 1500
8/05/97	7	N	N	N	N	—	—	—	—	MO 1330
8/06/97	8	N	N	N	N	—	—	—	—	MO 1345
8/07/97	9	N	N	N	N	—	—	—	—	MO 1130
8/08/97	10	19A, 1NF	17A, 3NF	18A, 1NF, 1DEAD	18A, 2NF	—	—	—	—	MO 1100

Comments:

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 TEMP = TEMPERATURE HARD = HARDNESS YTC = YEAST/ TROUT CHOW/CEROPHYLL

SUBJECT: SEDIMENT TOXICITY DATA SHEET - WATER QUALITY

SPONSOR: ABB ENVIRONMEATAL SAMPLE ID: 17D00601				PROJECT NUMBER: 3197237-0100-3100 TEST SPECIES: <i>Ampelisca abdita</i>					
DATE-DAY	REP	TEMP (°C)	SALINITY HARD/ ALK(‰)	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME
7/29/97	0 A	20.8	29	0.44	8.1	7.2	39,800	—	MO 1515
7/30/97	1 B	20.9	—	—	—	7.0	—	—	MO 1445
7/31/97	2 C	21.0	29	—	—	6.9	—	—	MO 1130
8/01/97	3 D	20.8	—	—	—	7.1	—	—	MO 1045
8/02/97	4 A	21.0	—	—	—	7.0	—	—	MO 1130
8/03/97	5 B	21.0	—	—	—	7.0	—	—	MO 1145
8/04/97	6 C	20.4	—	—	—	7.2	—	—	MO 1500
8/05/97	7 D	20.1	30	—	—	7.2	—	—	MO 1330
8/06/97	8 A	20.2	—	—	—	7.2	—	—	MO 1330
8/07/97	9 B	20.4	—	—	—	7.1	—	—	MO 1130
8/08/97	10 C	20.9	30	0.58	8.0	7.1	41,000	—	MO 0820

OBSERV	REPLICATE									
	DATE-DAY	A	B	C	D	E	F	G	H	Initial
7/29/97	0	20A	20A	20A	20A	—	—	—	—	MO 1700
7/30/97	1	N	N	N	N	—	—	—	—	MO 1500
7/31/97	2	N	N	N	N	—	—	—	—	MO 1130
8/01/97	3	N	N	N	N	—	—	—	—	MO 1100
8/02/97	4	N	N	N	N	—	—	—	—	MO 1145
8/03/97	5	N	N	N	N	—	—	—	—	MO 1200
8/04/97	6	N	N	N	N	—	—	—	—	MO 1500
8/05/97	7	N	N	N	N	—	—	—	—	MO 1330
8/06/97	8	N	N	N	N	—	—	—	—	MO 1345
8/07/97	9	N	N	N	N	—	—	—	—	MO 1130
8/08/97	10	20A	17A, 1D, 2NF	18A, 2NF	19A, 1NF	—	—	—	—	MO 1130

Comments:

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 TEMP = TEMPERATURE HARD = HARDNESS YTC = YEAST/ TROUT CHOW/CEROPHYLL

SUBJECT: TEST ORGANISM SURVIVAL AND WEIGHTS							
SPONSOR: ABB ENVIRONMENTAL				SPECIES: <i>Ampelisca abdita</i>			
Sample ID	Boat	Rep	No. Alive	Tare Wt (g)	Gross Wt (g)	Net Wt (mg)	Average
CONTROL	1	A	20	0.9333	0.9383	5.0/0.25	0.22
	2	B	20	0.9355	0.9393	3.8/0.19	
	3	C	17	0.9288	0.9329	4.1/0.24	
	4	D	18	0.9274	0.9311	3.7/0.21	
	-	E	-	-	-	-	
	-	F	-	-	-	-	
	-	G	-	-	-	-	
	-	H	-	-	-	-	
17D00501 17D09401 JNY 8/10/97	9	A	18	0.9217	0.9240	2.3/0.18	0.18
	10	B	16	0.9246	0.9267	2.1/0.13	
	11	C	19	0.9313	0.9355	4.2/0.22	
	12	D	17	0.9293	0.9325	3.2/0.19	
	-	E	-	-	-	-	
	-	F	-	-	-	-	
	-	G	-	-	-	-	
	-	H	-	-	-	-	
17D01401 17D00501 JNY 8/10/97	5	A	19	0.9248	0.9318	7.0/0.37	0.19
	6	B	19	0.9252	0.9283	3.1/0.16	
	7	C	19	0.9271	0.9292	2.1/0.11	
	8	D	19	0.9284	0.9306	2.2/0.12	
	-	E	-	-	-	-	
	-	F	-	-	-	-	
	-	G	-	-	-	-	
	-	H	-	-	-	-	

Balance Used: SP180 Calculator Used: TI-30 By: JNY Date: 8/10/97

SUBJECT: TEST ORGANISM SURVIVAL AND WEIGHTS							
SPONSOR: ABB ENVIRONMENTAL				SPECIES: <i>Ampelisca abdita</i>			
Sample ID	Boat	Rep	No. Alive	Tare Wt (g)	Gross Wt (g)	Net Wt (mg)	Average
17D01001	13	A	19	0.9272	0.9301	2.9 / 0.15	0.14
	14	B	20	0.9251	0.9281	3.0 / 0.15	
	15	C	18	0.9238	0.9261	2.3 / 0.13	
	16	D	19	0.9271	0.92957	2.6 / 0.14	
	-	E	-	-	-	-	
	-	F	-	-	-	-	
	-	G	-	-	-	-	
	-	H	-	-	-	-	
17D00301	17	A	19	0.9322	0.9353	3.1 / 0.16	0.17
	18	B	17	0.9328	0.9356	2.8 / 0.16	
	19	C	18	0.9332	0.9360	2.8 / 0.16	
	20	D	18	0.9340	0.9378	3.8 / 0.21	
	-	E	-	-	-	-	
	-	F	-	-	-	-	
	-	G	-	-	-	-	
	-	H	-	-	-	-	
17D00601	21	A	20	0.9386	0.9424	3.8 / 0.19	0.20
	22	B	17	0.9377	0.9415	3.8 / 0.22	
	23	C	18	0.9274	0.9308	3.4 / 0.19	
	24	D	19	0.9165	0.9204	3.9 / 0.21	
	-	E	-	-	-	-	
	-	F	-	-	-	-	
	-	G	-	-	-	-	
	-	H	-	-	-	-	

Balance Used: SP-180 Calculator Used: TI-30 By: JAV Date: 8/16/97

Jay July 97

RRDS NAS JAX TOXICITY TESTS-Ampelisca Weights  
File: a:rrds.wts Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.015	0.003	0.995
Within (Error)	18	0.054	0.003	
Total	23	0.069		

Critical F value = 2.77 (0.05,5,18)  
Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ : All equal

RRDS NAS JAX TOXICITY TESTS-Ampelisca Weights  
 File: a:rrds.wts Transform: NO TRANSFORM

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.223	0.223		
2	01401	0.180	0.180	1.098	
3	00501	0.190	0.190	0.840	
4	01001	0.143	0.143	2.068	
5	00301	0.173	0.173	1.292	
6	00601	0.203	0.203	0.517	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

RRDS NAS JAX TOXICITY TESTS-Ampelisca Weights  
 File: a:rrds.wts Transform: NO TRANSFORM

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	01401	4	0.093	41.9	0.042
3	00501	4	0.093	41.9	0.033
4	01001	4	0.093	41.9	0.080
5	00301	4	0.093	41.9	0.050
6	00601	4	0.093	41.9	0.020

4171251-0100-3100

Jay 8/11/97

RRDS NAS JAX TOXICITY TESTS-Ampelisca  
File: a:rrds.sur Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	7.208	1.442	1.251
Within (Error)	18	20.750	1.153	
Total	23	27.958		

Critical F value = 2.77 (0.05,5,18)  
Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ : All equal

RRDS NAS JAX TOXICITY TESTS-Ampelisca  
 File: a:rrds.sur Transform: NO TRANSFORM

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	18.750	18.750		
2	01401	17.500	17.500	1.646	
3	00501	19.000	19.000	-0.329	
4	01001	19.000	19.000	-0.329	
5	00301	18.000	18.000	0.988	
6	00601	18.500	18.500	0.329	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

RRDS NAS JAX TOXICITY TESTS-Ampelisca  
 File: a:rrds.sur Transform: NO TRANSFORM

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	01401	4	1.830	9.8	1.250
3	00501	4	1.830	9.8	-0.250
4	01001	4	1.830	9.8	-0.250
5	00301	4	1.830	9.8	0.750
6	00601	4	1.830	9.8	0.250

## **Appendix C: Reference Toxicant Test Raw Data**

REFERENCE TOXICANT TEST DATA SHEET								
Client: <u>GENERAL/ABB</u>				Project Number: <u>3147237</u>				
Test Material				Test Conditions				
Amount of <u>SBS</u> : <u>0.1002</u> (g)				<input checked="" type="checkbox"/> Definitive <input type="checkbox"/> Static				
Volume of Milli-Q Water: <u>100</u> (mL)				<input type="checkbox"/> Screening      Duration: <u>96</u> Hours				
Date Prepared: <u>7-31-97</u>								
Test Organism History				Dilution Water:				
Species: <u>Ameliscia abdita</u>				Lighting: <input type="checkbox"/> Fluorescent <input type="checkbox"/> Incandescent				
Batch Number: <u>97-55</u>				Photoperiod: <u>—</u> Hr Light <u>24</u> Hr Dark				
Age/Life Stage: <u>3-5mm juvenile</u>				Test Vessel Dimensions: <u>100</u> L X <u>—</u> W <u>50</u> H				
Date of Acclimation/Maintenance: <u>7/21/97</u>				Test Solution Height: _____ (cm)				
See Page <u>186</u> of <u>Invert holding Log</u>				Test Vessel Volume: <u>0.34</u> (L)				
Mortality 48 hours prior to test: <u>&lt;1</u> (%)				Test Solution Volume: <u>0.20</u> (L)				
Replicates/Concentration: <u>1</u>				Test Temperature: <u>20 ± 1</u> °C				
No. Of Organisms/Replicate: <u>10</u>				Test Salinity: <u>31 ± 2</u> ppt				
Test Area Used: <u>Waterbath 7</u>				Test Vessel Composition: <input checked="" type="checkbox"/> Glass <input type="checkbox"/> Plastic				
Test Concentrations Based on: <input checked="" type="checkbox"/> Whole Material <input type="checkbox"/> Active Ingredient				Test Protocol/Guideline Followed: <u>ASTM/EPA</u>				
Test Concentrations: (Units: mg/L)		Control	0.62	1.25	2.5	5.5	10.0	20.0
Amount Dilution Water Added (mL)		200	199.875	199.75	199.5	199	198	196
Amount of Reftox Stock Added (mL)		0	0.125	0.25	0.5	1.0	2	4

Additional Observations: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Data By: Joy \_\_\_\_\_

Date: 7/31/97 \_\_\_\_\_



**REFERENCE TOXICANT TEST DATA: DAY 3 AND 4**

Client: \_\_\_\_\_ Project Number: \_\_\_\_\_ Species: \_\_\_\_\_

**DAY 3**

Nominal Concentration	Date:		Time:		Analyst:	
	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control						

DAY 4 Date: 8/4/97 Time: 1500 Analyst: \_\_\_\_\_

Nominal mg/L Concentration	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control	10	N	20.7	31	7.2	8.0
0.62	10	N	↓	↓	↓	↓
1.25	10	N	↓	↓	↓	↓
2.5	10	N	↓	↓	↓	↓
5	2	8D	↓	↓	↓	↓
10 / 20	0 / 0	10D / 10D	↓	↓	↓	↓

**SUMMARY**

**COMMENTS:**

Nominal Concentration	Number Dead
Control	0
0.62	0
1.25	0
2.5	0
5.0	8
10 / 20	10 / 10

Forgot to check tests on Saturday and Sunday, 8/8/97

Joe Omeru-Jaw 8/5/97

TRIMMED SPEARMAN-KARBER METHOD. VERSION 1.5

DATE: 8-3-97 TEST NUMBER: 1 DURATION: 96 h  
TOXICANT : SDS  
SPECIES: Ampelisca abdita

RAW DATA:	Concentration	Number	Mortalities
---	(mg/L)	Exposed	
	.00	10	0
	.62	10	0
	1.25	10	0
	2.50	10	0
	5.00	10	8
	10.00	10	10
	20.00	10	10

SPEARMAN-KARBER TRIM: .00%

SPEARMAN-KARBER ESTIMATES: LC50: 4.06  
95% LOWER CONFIDENCE: 3.41  
95% UPPER CONFIDENCE: 4.84

---

SUBJECT: REFERENCE TOXICANT TEST DATA SHEET

Client: <u>Misc.</u>		Project Number: <u>Ref TOX</u>					
Test Material			Test Conditions				
Amount SDS: <u>0.1002</u> g	Volume of Milli-Q Water: <u>100</u> mL		<input checked="" type="checkbox"/> Definitive	<input checked="" type="checkbox"/> Static			
Date Prepared: <u>7/31/97</u>			<input type="checkbox"/> Screening	Duration: <u>96 Hours</u>			
Test Animal History			Dilution Water: <u>Natural, Filtered Seawater</u>				
Species : <u>Amphibia abdita</u>	Batch Number : <u>97-55</u>		Lighting : <input type="checkbox"/> Fluorescent	<input type="checkbox"/> Incandescent			
Age / Life Stage : <u>3-5 mm (juvenile)</u>	Date Acclimation / Maintenance Began : <u>7/29/97</u>		Photoperiod : <u>—</u> hr Light : <u>24</u> hr Dark				
See Page <u>186</u> of <u>Invertebrate Holding</u> Log for raw data.	Mortality (%) 48 Hrs prior to testing: <u>&lt;</u> %		Test Container Dimensions: <u>100</u> L x <u>—</u> W x <u>50</u> H	Test Solution Height : <u>4</u> cm			
Test Area Used	Temperature (C)	Salinity (ppt)	Test Containers	Test Container Volume : <u>0.34</u> Liters			
<u>waterbath 7</u>	<u>20 +/- 1</u>	<u>31 +/- 2</u>	Diluent Volume	Diluent Volume : <u>0.20</u> Liters			
Protocol Followed: <u>SOP-A-004</u>			Reps / Concentration	Animals / Replicate			
Concentrations Based on: <input type="checkbox"/> A.I. <input checked="" type="checkbox"/> W.M.			Container Composition: <input checked="" type="checkbox"/> Glass <input type="checkbox"/> Plastic				
Test Concentrations: (Units = mg/L):	Control	0.62	1.25	2.5	5	10	
Amount Dilution Water Added (mL):	200	199.875	199.75	199.5	199	198	
Amount SDS Stock Added (mL):	N/A	0.125	0.25	0.5	1	2	

Additional Observations: \_\_\_\_\_

Data By: MO Date: 7/31/97

REFERENCE TOXICANT TEST DATA: DAY 0 and 1

Client: MRC		Project Number: Ref Tox			Species: A. abdita		
Nominal Concentration (mg/L)	Date: 7/31/97				Day: 0		
	Time: 1200				Analyst: MD		
	# Alive	Obs.	Temp. (C)	Sal. (ppt)	D.O. (mg/L)	pH	
Control	10	2	20.7	31	7.4	8.0	
0.62	10	2	-	-	-	-	
1.25	10	2	-	-	-	-	
2.5	10	2	-	-	-	-	
5	10	2	-	-	-	-	
10	10	2	-	-	-	-	
Nominal Concentration (mg/L)	Date: 8/01/97				Day: 1		
	Time: 1145				Analyst: MD		
	# Alive	Obs.	Temp. (C)	Sal. (ppt)	D.O. (mg/L)	pH	
Control	10	2	20.6	31	7.2	8.0	
0.62	10	2	-	-	-	-	
1.25	8	2 Dead	-	-	-	-	
2.5	8	2 Dead	-	-	-	-	
5	9	1 Dead	-	-	-	-	
10	3	7 Dead	-	-	7.0	7.9	

REFERENCE TOXICANT TEST DATA: DAY 0 and 1

Client: MRC      Project Number: Ref. Tox      Species: A. abdita

Nominal Concentration (mg/L)	Date: 8/02/97		Day: 02			
	Time: 1145		Analyst: MO			
	# Alive	Obs.	Temp. (C)	Sal. (ppt)	D.O. (mg/L)	pH
Control	10	2	20.9	31	7.1	8.0
0.62	10	2	-	-	-	-
1.25	8	2	-	-	-	-
2.5	7	1 Dead	-	-	-	-
5	6	3 Dead	-	-	-	-
10	0	3 Dead	-	-	6.9	7.9

Nominal Concentration (mg/L)	Date: 8/03/97		Day: 03			
	Time: 1200		Analyst: MO			
	# Alive	Obs.	Temp. (C)	Sal. (ppt)	D.O. (mg/L)	pH
Control	10	2	20.5	31	7.0	8.0
0.62	10	2	-	-	-	-
1.25	8	2	-	-	-	-
2.5	7	2	-	-	-	-
5	4	2 Dead	-	-	6.8	7.9
10	-	-	-	-	-	-

REFERENCE TOXICANT TEST DATA: FINAL DAY

Client: MISC,		Project Number: Ref Tox			Species: A. abdita	
Nominal Concentration (mg/L)	Date: 8/04/97			Day: 4		
	Time: 1315			Analyst: MO		
	# Alive	Obs.	Temp. (C)	Sal. (ppt)	D.O. (mg/L)	pH
Control	10	2	20.7	31	7.0	8.0
0.62	10	2	-	-	-	-
1.25	8	2	-	-	-	-
2.5	7	2	-	-	-	-
5	3	1 Dead	-	-	6.7	8.0
10	-	-	-	-	-	-

FINAL RESULTS

Nominal Concentration (mg/L)	Number Dead
Control	0
0.62	0
1.25	2
2.5	3
5	7
10	10

MO 8/05/97.

DATE: 7/31/97

TEST NUMBER: ref tox

DURATION: 96 hours

TOXICANT : SDS

SPECIES: A. abdita

RAW DATA:	Concentration	Number	Mortalities
---	(mg/L)	Exposed	
	.00	10	0
	.62	10	0
	1.25	10	2
	2.50	10	3
	5.00	10	7
	10.00	10	10

SPEARMAN-KARBER TRIM: .00%

SPEARMAN-KARBER ESTIMATES: LC50: 3.08  
95% LOWER CONFIDENCE: 2.20  
95% UPPER CONFIDENCE: 4.30

---

## **Appendix D: QST Protocol For Sediment Tests**

QST Environmental  
Toxicology Laboratory  
Gainesville, Florida

Title: **STANDARD OPERATING PROCEDURE FOR PERFORMING WHOLE SEDIMENT  
AND ELUTRIATE BIOASSAYS**

---

Effective Date: \_\_\_\_\_

Prepared by: Toxicology Laboratory: \_\_\_\_\_

Approved by: Quality Assurance Unit: \_\_\_\_\_

## CONTENTS

- 1.0 Purpose
- 2.0 Scope
- 3.0 Guidelines
  - 3.1 Sediment Sample Holding
  - 3.2 Sediment Processing
  - 3.3 Control and Reference Sediments
  - 3.4 Sediment Elutriate Bioassays
  - 3.5 Whole Sediment Bioassays
- 4.0 Statistical Analysis
- 5.0 Health and Safety
- 6.0 References
- 7.0 Summary of Test Conditions

## 7.0 Appendices

### Elutriate Bioassays

*Ceriodaphnia dubia*  
*Daphnia magna*  
*Daphnia pulex*  
*Pimephales promelas*  
*Mysidopsis bahia*  
*Menidia beryllina*  
*Cyprinodon variegatus*

### Whole Sediment Bioassays

*Daphnia magna*  
*Daphnia pulex*  
*Hyalella azteca*  
*Chironomus tentans*  
*Chironomus riparius*  
*Mysidopsis bahia*  
*Lumbriculus variegatus*  
*Ampelisca abdita*  
*Leptocheirus plumulosus*  
*Eohaustorius estuarius*  
*Rhepoxynius abronius*  
*Macoma nasuta & Nereis virens*

Title: **STANDARD OPERATING PROCEDURE FOR PERFORMING WHOLE SEDIMENT AND ELUTRIATE BIOASSAYS**

**1.0 Purpose**

The purpose of this document is to provide a consistent method for the preparation for and the performance of whole sediment and elutriate bioassays.

**2.0 Scope**

These procedures described in this standard operating procedure (SOP) are applicable to the processing and preparation of sediment samples used for toxicity testing in the Toxicology Laboratory. Laboratory personnel with documented training and/or experience are responsible for the performance of this SOP.

**3.0 Guidelines**

**3.1 Sediment Sample Holding**

- 3.1.1 Receipt and disposal of sediment samples shall follow SOP-S-008. Sediment samples shall be stored in the laboratory test sample refrigerator at  $4 \pm 2$  °C.
- 3.1.2 Sediment samples shall be used for testing within 14 days of sample collection, or sooner based the sponsor's requirements. Sediments may be used for testing for up to 6 weeks at the request of the test sponsor, and depending on the data requirements.

**3.2 Sediment Processing**

- 3.2.1 Prior to use in testing, sediment samples shall be homogenized by manual manipulation, using stainless steel or Teflon utensils.
- 3.2.2 Large particles and indigenous benthic organisms shall be removed from the sediment samples before testing, using one of 3 methods. The method of choice will be dependent on test specific requirements, requirements of the test sponsor, and the nature of the sediment (e.g. grain size). If indigenous organisms are a concern the sediment shall be to press-sieve the sediment through uncontaminated 0.5, 1, or 2 mm mesh screen (mesh size will depend on test organism size and prior knowledge of indigenous organism presence). Alternatively, sediments may be sorted by hand in large dissecting pans or placed under anoxic conditions (e.g. N<sub>2</sub>) for approximately 6 hours to kill indigenous organisms.

3.2.3 Any matter or organisms removed from sediment samples will be documented in the test file.

3.2.4 Sediment samples for biological testing will never be frozen or dried.

### 3.3 Negative and Positive Control and Reference Sediments

3.3.1 Negative and positive controls will be included with each test. The controls and reference (if provided) sediments will be held, processed, and tested in the same manner as sediment samples. A laboratory control sediment and positive reference toxicant (in water only) will be tested concurrently with each batch of sediment samples.

3.3.2 The test sponsor or the Toxicology Laboratory will provide a non-toxic, natural control sediment (i.e. test organisms will exhibit the minimum survival required for a valid test).

3.3.3 If a reference sediment is provided by the test sponsor, it will be tested concurrently with the laboratory control, positive control and the test samples.

### 3.4 Sediment Elutriate Bioassay Preparation

3.4.1 Sediment for elutriate preparation will be prepared using water provided by the test sponsor or laboratory dilution water.

3.4.2 After sifting and homogenization, sediment and dilution water will be mixed in a 1:4 ratio (1 part sediment to 4 parts dilution water).

3.4.3 The mixture will be stirred vigorously for 30 minutes, alternating by hand (stainless steel or Teflon utensil) and magnetic stirrer.

3.4.4 The mixture will be allowed to settle for a minimum of 1 hour.

3.4.5 The elutriate is the supernatant of the mixture and represents the 100% liquid plus suspended particulate phase. The elutriate will be collected by siphoning with minimal disturbance of the settled sediment. With very fine grained sediment samples, the elutriate may have to be centrifuged to provide a solution clear enough to allow observation of the test organisms.

3.4.6 The elutriate will be used for testing within 1 hour after preparation.

3.4.7 The elutriate may be volumetrically diluted with dilution water to prepare additional test concentrations.

- 3.4.8 Elutriate tests do not require aeration, unless DO drops below 40% saturation.
- 3.4.9 Organisms are added randomly in lots of five until each test chamber contains the appropriate number of test organisms (See SOP-T-014). After 1 hour, any test organisms that appear abnormal shall be replaced.
- 3.4.10 At a minimum, the following water quality parameters will be measured daily: temperature, pH, and dissolved oxygen (salinity for marine species).
- 3.4.11 The test endpoint is mortality.
- 3.4.12 See Appendix for more specific test conditions and feeding regimes.

### 3.5 Whole Sediment Bioassay Preparation

- 3.5.1 After the sediments are sifted and homogenized, approximately 200 g (100 g for EPA procedure) of sediment are placed in the appropriate test chamber (see Appendices).
- 3.5.2 Cover the sediment with the appropriate dilution water (sediment to water ratio is 1:4 or 1:1.75 for EPA procedure), aerate and allow to settle at least 24 hours. For the EPA freshwater invertebrate procedure, no aeration is required.
- 3.5.3 All test chambers will be aerated throughout the test duration. A glass tip shall be placed on the airline and suspended in the overlying water, so as not to disturb the sediment. The rate of aeration will be between 50 and 80 bubbles per minute. For the EPA freshwater invertebrate procedure, no aeration is required since solutions will be renewed daily.
- 3.5.4 Organisms are added indiscriminately in lots of five until each test chamber contains the appropriate number of test organisms (See SOP-T-014). After 1 hour, any test organisms that appear abnormal shall be replaced. See appropriate Appendix for feeding regimes.
- 3.5.5 Overlying water renewal may be necessary. Refer to the appropriate Appendix for further renewal information.
- 3.5.6 Test chambers shall be covered to reduce evaporation.
- 3.5.7 At a minimum, the following water quality parameters will be measured daily: temperature, dissolved oxygen (salinity for marine species). Ammonia and conductivity shall be measured at the beginning and end of the test.

- 3.5.8 At test termination, the test organisms will be removed from the sediments. This process may be facilitated with the use of screens or if needed, a dye/formalin mixture.
- 3.5.9 Mortality is a test point for all organisms. Additional endpoints may be included at the request of the sponsor. Additional endpoints may include the following:
- A) reburial
  - B) growth (group dry weight and/or length, head capsule width)
  - C) reproduction (number of neonates)
- 3.5.10 If test organisms need to be shipped for chemical analysis, organisms from each replicate are placed in a Ziploc® bag. The project name, sample ID, replicate ID and "QST" is written on the outside of the bag with a black permanent marker and also on a card placed inside the bag. Samples are stored frozen at  $-10 \pm 2$  °C until ready for shipment. Samples will be shipped in a cooler with dry ice.

### 3.6 Contingency Plan for Unacceptable Control Mortality

Separate control sediment exposures will be assigned each phase of testing. If test organism control mortality exceeds acceptable criteria, QST will evaluate possible causes of excess mortality prior to proceeding with any further testing options. Following the evaluation, QST will offer the following options:

1. If the unacceptable control organism mortality is due to high mortality in only one replicate of the control exposure, this exposure will be discarded and statistical tests will compare test sediment exposures to the remaining control exposures. Alternate results from a replicate sediment may be used, if available.
2. If control mortality is only slightly above criteria but within 10 percent, control sediments results from concurrently run batches of test sediments will be pooled and;
3. If enough test sediment is remaining to repeat the test of a batch of sediments, the tests will be repeated.

#### 4.0 Statistical Analyses

Statistical analysis of the test data (survival, growth and/or reproduction) will be performed following EPA guidelines and the test sponsor's requirements, if applicable. Results will be maintained in the study file and included in the final report.

#### 5.0 Health and Safety

All samples shall be handled according to the procedures described in the laboratory safety manual. Appropriate safety precautions should be taken at all times when working in the laboratory.

#### 6.0 References

*Evaluation of Dredged Material Proposed for Ocean Dumping (Green Book)*. EPA-503/8-91/001. February 1991.

ASTM. 1995. *Standard Guide for Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods*, E 1367-92. Annual Book of Standards. American Society for Testing and Materials. Philadelphia, PA.

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ASTM. 1995. *Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing*, E 1391-90. Annual Book of Standards. American Society for Testing and Materials. Philadelphia, PA.

EPA. 1994. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates*. EPA/600/R-94/024. Office of Research and Development. Washington, DC.

EPA. 1994. *Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods*. EPA/600/R-94/025. Office of Research and Development. Washington, DC.

Greene, J.C., C.L. Bartels, W.J. Warren-Hicks, B.R. Parkhurst, G.L. Linder, S.A. Peterson, and W.E. Miller. 1988. *Protocols for Short-Term Screen of Hazardous Waste Sites*. EPA/600/3-88/029. Office of Research and Development. Corvallis, OR.

## 7.0 Summary of Test Conditions

**WHOLE SEDIMENT**  
*Ampelisca abdita/Leptocheirus plumulosus*

Test type:	Static 10-28 days
Temperature:	20 ± 2 °C (25 ± 2 °C)
Salinity:	28 ppt Ampelisca (0 - 33 ppt Leptocheirus)
Light intensity	540-1080 lux (ambient lab levels)
Photoperiod:	24 h light, 0 h dark
Test chamber size:	1 L
Sediment volume:	200 mL
Test solution volume:	800 mL
Age of test organisms:	Ampelisca 2-4 mm, Leptocheirus 3-5 mm (no mature males or females)
Number of organisms per test chamber:	20
Number of replicates per sample/dilution:	4
Feeding regime:	None for 10-day test (feed diatom/algae - 28-day test)
Aeration:	Aerate overnight before test and during test to maintain DO ≥90% saturation
Dilution water:	Natural filtered seawater
Test concentrations:	control, reference, samples
Reference Toxicant Test:	96 hour (Ampelisca 10 mg SDS/L; Leptocheirus 4000 mg CdCl <sub>2</sub> /L) in darkness, dilute 0.5X for testing
Water quality:	daily temp, pH, DO
Observations:	Mortality
Control validity:	≤ 10 % mortality
Acclimation:	≤ 24 hours
Sediment requirements:	Sieve to remove any indigenous organisms
Source(s) of organisms:	Brezina & Associates/Chesapeake Cultures
Other information:	measure ammonia/conductivity beginning and end of test

Source: QST, 1997.

## **Appendix E: Chemical Analyses Raw Data**

CLIENT SAMPLE ID'S:	17E00101	17E00301	17E01401
ESE FIELD GROUP:	QBCFP1	QBCFP1	QBCFP1
ESE SEQUENCE #:	1	2	3
DATE COLLECTED:	07/24/97	07/22/97	07/24/97
TIME COLLECTED:	10:45	10:00	11:15

PARAMETERS	UNITS	METHOD			
-----					
ALUMINUM, TISS	UG/G-WET	EPA 6010	210	304	298
ANTIMONY, TISS	UG/G-WET	EPA 6020M	<0.020	<0.014	<0.017
ARSENIC, TISS	UG/G-WET	EPA 6020M	0.358	0.226	0.139
BARIUM, TISS	UG/G-WET	EPA 6020M	3.00	5.11	19.3
BERYLLIUM, TISS	UG/G-WET	EPA 6020M	0.013	0.018	0.011
CADMIUM, TISS	UG/G-WET	EPA 6020M	0.272	0.409	0.127
CALCIUM, TISS	UG/G-WET	EPA 6010	594	807	430
CHROMIUM, TISS	UG/G-WET	EPA 6020M	0.442	1.24	0.618
COBALT, TISS	UG/G-WET	EPA 6020M	0.116	0.199	0.087
COPPER, TISS	UG/G-WET	EPA 6020M	1.28	2.41	0.885
IRON, TISS	UG/G-WET	EPA 6010	905	674	467
LEAD, TISS	UG/G-WET	EPA 6020M	2.55	6.81	1.86
MAGNESIUM, TISS	UG/G-WET	EPA 6010	174	229	137
MANGANESE, TISS	UG/G-WET	EPA 6020M	NA	NA	NA
MANGANESE, TISS	MG/KG-WET	EPA 6010	39.7	49.9	30.5
MERCURY, TISS	UG/G-WET	EPA 6020M	<0.008	0.016	<0.007
NICKEL, TISS	UG/G-WET	EPA 6020M	0.254	1.48	0.255
POTASSIUM, TISS	UG/G-WET	EPA 6010	649	554	671
SELENIUM, TISS	UG/G-WET	EPA 7740	0.092	0.101	0.079
SILVER, TISS	UG/G-WET	EPA 6020M	0.04	0.26	0.06
SODIUM, TISS	UG/G-WET	EPA 6010	211	201	148
THALLIUM, TISS	UG/G-WET	EPA 6020M	0.004	0.007	0.005
VANADIUM, TISS	UG/G-WET	EPA 6020M	1.09	1.33	0.680
ZINC, TISS	UG/G-WET	EPA 6020M	13.4	11.5	5.80

CLIENT SAMPLE ID'S:	17D01001	17D00601	17D00501	17D00301	17D01401
ESE FIELD GROUP:	QBCFS1	QBCFS1	QBCFS1	QBCFS1	QBCFS1
ESE SEQUENCE #:	1	2	3	4	5
DATE COLLECTED:	07/24/97	07/22/97	07/24/97	07/22/97	07/24/97
TIME COLLECTED:	14:30	13:15	09:50	10:00	11:15

PARAMETERS	UNITS	METHOD					
MOISTURE	%WET WT	ASTM D2216	87.1	81.1	86.8	20.9	29.5
ALUMINUM	MG/KG-DRY	EPA 6010	6370	4550	6840	991	424
ANTIMONY	MG/KG-DRY	EPA 6010	<69.8	<41.0	<70.8	<11.2	<11.1
ARSENIC	MG/KG-DRY	EPA 7060	4.59	2.61	4.30	0.347	0.629
BARIUM	MG/KG-DRY	EPA 6010	26.9	18.5	29.6	4.54	3.69
BERYLLIUM	MG/KG-DRY	EPA 6010	<2.79	<1.64	<2.83	<0.448	<0.443
CADMIUM	MG/KG-DRY	EPA 6010	<3.49	5.72	5.27	3.98	<0.554
CALCIUM	MG/KG-DRY	EPA 6010	9450	6510	9160	1220	5000
CHROMIUM	MG/KG-DRY	EPA 6010	31.6	38.7	39.1	8.95	1.46
COBALT	MG/KG-DRY	EPA 6010	<14.0	<8.20	<14.2	<2.24	<2.22
COPPER	MG/KG-DRY	EPA 6010	27.1	40.5	41.7	25.9	5.19
IRON	MG/KG-DRY	EPA 6010	20900	15700	22800	986	1120
LEAD	MG/KG-DRY	EPA 6010	<69.8	106	94.2	43.9	15.2
MAGNESIUM	MG/KG-DRY	EPA 6010	5630	3590	4990	392	271
MANGANESE	MG/KG-DRY	EPA 6010	175	91.9	150	14.3	11.7
MERCURY	MG/KG-DRY	7471 MOD	0.370	0.465	0.447	<0.040	<0.054
NICKEL	MG/KG-DRY	EPA 6010	<14.0	28.6	16.7	12.8	<2.22
POTASSIUM	MG/KG-DRY	EPA 6010	1180	768	1190	<112	<111
SELENIUM	MG/KG-DRY	EPA 7740	2.41	1.12	2.12	<0.280	<0.335
SILVER	MG/KG-DRY	EPA 6010	<3.49	3.29	<3.54	4.34	<0.554
SODIUM	MG/KG-DRY	EPA 6010	7380	4450	7090	389	434
THALLIUM	MG/KG-DRY	EPA 6010	<140	<82.0	<142	<22.4	<22.2
VANADIUM	MG/KG-DRY	EPA 6010	17.1	11.9	15.9	2.51	2.92
ZINC	MG/KG-DRY	EPA 6010	131	146	179	35.6	18.8

**APPENDIX B-2**

**FOOD CHAIN MODELING METHODOLOGY**