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NAS JACKSONVILLE  
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FINAL SUB-CHRONIC TOXICITY OF SEDIMENTS REPORT FROM THE POTENTIAL  
SOURCE OF CONTAMINATION 44 (PSC44) DRAINAGE DITCH NAS JACKSONVILLE FL  
1/1/1998  
QST ENVIRONMENTAL

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**FINAL REPORT:**

**SUB-CHRONIC TOXICITY OF SEDIMENTS  
FROM THE PSC 44 DRAINAGE DITCH, NAS  
JACKSONVILLE, FLORIDA, WITH THE  
AMPHIPOD, *AMPELISCA ABDITA***

**TEST GUIDE:**

ASTM E 1367-92

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ABB-ES Project No: 0855548  
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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 the PSC 44 Drainage Ditch, Naval Air Station (NAS), Jacksonville, Florida. The effect criteria for the tests were survival and growth. A total of three site sediments and one laboratory control sediment were used in the toxicity tests. After 10 days of exposure, survival of *Ampelisca abdita* in the laboratory control sediment was 91 percent. Survival of *Ampelisca abdita* in the site sediments ranged from 4 percent (44D00101) to 64 percent (44D00301). Survival of *Ampelisca abdita* in the laboratory control sediment was significantly different ( $P=0.05$ ) from survival in sediments from all of the sample stations tested, 44D00101, 44D00201 and 44D00301. Growth, measured as mean length, of *Ampelisca abdita* in the laboratory control sediment was also significantly different ( $P=0.05$ ) from growth in all of the site sediments.

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## **1.0 INTRODUCTION**

Whole sediment toxicity tests were conducted at QST Environmental on samples collected from the PSC 44 Drainage Ditch, 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 length.

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). 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 December 17 and 18, 1997 by ABB Environmental Services, Inc. (ABB-ES) personnel and were received on ice at the QST Gainesville laboratory on December 19, 1997. The test samples, identified as 44D00101, 44D00201, and 44D00301, were received in quantities of approximately 3.75 Liters (1 gallon jars) 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 cooler was then measured using the temperature blank provided in the cooler. 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 Dillon Beach, California, 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. Prior to use the water was diluted to a salinity of 28 ppt with deionized water.

## 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 Brezina & Associates, Dillon Beach, CA. 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 January 5, 1998, within 17 days of receiving the test 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. 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, 700 Lux). All test chambers were aerated at approximately 80 bubbles per minute throughout the testing period. Temperature, pH and dissolved oxygen (DO) concentrations, were measured daily. Ammonia and conductivity levels were measured at the beginning of the tests. The salinity of the overlying water was measured three 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 Nytex 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 mean length in millimeters was measured with the aid of a dissecting microscope equipped with a micrometer.

## **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.

### **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 survival data were arc-sine square root transformed prior to performing the statistics. The 96-hour median lethal concentration ( $LC_{50}$ ) 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 19.9 to 21.0 °C, pH ranged from 7.8 to 8.0 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 26-30 ppt, solution conductivities ranged from 39,000 to 45,000  $\mu$ mhos/cm, and ammonia levels were all below the reporting limit of 0.10 (Table 1). There were no deviations from the test protocols in the ASTM Guidelines used to conduct this test (ASTM E1367-92; ASTM, 1995).

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 sediment was 91 percent. Survival of *A. abdita* in the PSC 44 Drainage Ditch sediments ranged from 4 percent (44D00101) to 64 percent (44D00301). Survival of *A. abdita* in the laboratory control sediment was significantly different ( $P=0.05$ ) from survival in all of the site sediments tested.

Growth, measured as mean length in millimeters of surviving *A. abdita*, averaged 3.7 mm/organism in the laboratory control sediment (Table 2). The mean length of *A. abdita* in the site sediments ranged from 3.1 mm/organism (44D00101) to 3.6 mm/organism (44D00201). Growth of *A. abdita* in the laboratory control sediment was significantly different ( $P=0.05$ ) from growth in all of the site sediments.

The recommended holding time of 14 days (ASTM, 1995) was exceeded by 3 days due to problems encountered in obtaining the test organisms. This deviation was not deemed serious enough to affect the outcome of the results. This is because different researchers have shown that sediments can be stored for up to 8 weeks or longer without any changes in their toxicity (USEPA-USCOE, 1994). No indigenous organisms were detected in the site sediments during the sieving and cleaning processes. Sample 44D00101 exhibited a strong petroleum odor. 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 loading. 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 *A. abdita* was determined to be 2.63 mg SDS/L with 95 percent confidence limits of 1.99 and 3.47 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.

### 5.0 CONCLUSION

The toxicity test results indicated that after 10 days of exposure to whole sediments from the PSC 44 Drainage Ditch, NAS Jacksonville, Florida, survival of *A. abdita* in the laboratory control sediment was significantly different ( $P=0.05$ ) from survival in all of the site sediments tested. Growth of *A. abdita* in the laboratory control sediment was also significantly different ( $P=0.05$ ) from growth of *A. abdita* in all of the site sediments.

## 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.

Gulley, D., and WEST, Inc. 1994. *Toxstat Version 3.4*. Department of Zoology and Physiology, University of Wyoming.

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

U.S. Environmental Protection Agency (EPA). 1994. *Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods*. EPA/600/R-94/025. June 1994.

USEPA-USCOE (U.S. Army Corps of Engineers). 1994. Evaluation of Dredged Material Proposed for Ocean Discharge in Inland and Near Coastal Waters. EPA-000/0-93/000.

U.S. Environmental Protection Agency (EPA). 1988. *Computer Program and Users Guide for Probit and Dunnett's Analysis of Data from Acute and Short Term Chronic Toxicity Tests with Aquatic Organisms*. Prepared by Statistical Support Staff, Computer Sciences Corporation. Prepared for the Biological Methods Branch, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1988.

Table 1. Water Quality Measurement Ranges<sup>a</sup> of Overlying Water During a 10-Day Toxicity Test of Whole Sediment From the PSC 44 Drainage Ditch, 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	27 - 29	19.9 - 21.0	7.9 - 8.0	7.0 - 7.3	43,000
44D00101	<0.10	26 - 30	20.0 - 21.0	7.7 - 7.9	6.9 - 7.3	45,000
44D00201	<0.10	27 - 29	19.9 - 21.0	7.8 - 7.9	7.0 - 7.3	39,000
44D00301	<0.10	27 - 30	20.0 - 21.0	7.8 - 8.0	7.0 - 7.3	44,000

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

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

<sup>c</sup>Conductivity.

Source: QST, 1998

Table 2. Survival and Growth of *Ampelisca abdita* After 10 Days of Exposure to Whole Sediments From the PSC 44 Drainage Ditch, NAS Jacksonville, Florida

Sample ID	Replicate <sup>a</sup>	Survival (Percent)	Mean Length (mm) <sup>b</sup>
Control	A	18	3.7
	B	19	3.7
	C	19	3.6
	D	<u>17</u>	<u>3.7</u>
		73 (91)	3.7
44D00101	A	0	NM <sup>c</sup>
	B	1	3.6
	C	1	NM
	D	<u>1</u>	<u>3.5</u>
		3 (4) <sup>d</sup>	3.6 <sup>d</sup>
44D00201	A	11	3.2
	B	13	3.1
	C	13	3.0
	D	<u>12</u>	<u>3.1</u>
		49 (62) <sup>d</sup>	3.1 <sup>d</sup>
44D00301	A	12	4.4
	B	14	3.3
	C	9	3.4
	D	<u>16</u>	<u>3.4</u>
		51 (64) <sup>d</sup>	3.4 <sup>d</sup>

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

<sup>b</sup>Growth was measured as length in millimeters.

<sup>c</sup>Not measured due to 100 percent mortality.

<sup>d</sup>Significantly different (P=0.05) from the laboratory control.

Source: QST 1998

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



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

Project: 3197250-0100-3100

DAILY LOG

1/05/98 mo - The three sediment samples were stored in a refrigerator at  $4 \pm 2^\circ\text{C}$  prior to use. For each sediment, the sample was placed in a glass pan, homogenized, + sifted by hand. Samples 101 and ~~10~~<sup>no</sup> 301 contained plant debris; sample 201 was sandy with no debris. No indigenous organisms were observed. 200 mL of sediment was placed into each replicate, and 800 mL of overlying water was added. Overlying water will be aerated using Tygon tubing + glass pipette tips; aeration was set at about 80 bubbles per minute. Test vessels were placed in waterbath 8. Control sediment was washed with ~~DC~~ water prior to use. Overlying water is filtered seawater collected near Marshland, FL, diluted with deionized water to a salinity of 28 ppt.

1/06/98 CP - water quality measured. Organisms received + acclimated to test conditions. 20 organisms loaded per replicate. Organisms in normal condition. Airlines checked.

A. abdita in normal condition at test initiation. Ammonia was measured in overlying water using SA290A meter and probe 95-12 Ammonia electrode.

1/07/98 water quality measured. Observations made. Airlines checked. Tube made by organisms in all samples.

1/08/98 mo - observed + monitored test. Checked airlines.

Project: 3197250-0100-3100

DAILY LOG

1/09/98 CR Test monitored + observed. Checked airlines

1/10/98 MO Test monitored + observed. Checked airlines.

1/11/98 MO Test monitored + observed. Checked airlines.

1/12/98 MO Test monitored + observed. Checked airlines.

1/13/98 CR Test monitored + observed. Checked airlines

1/14/98 CR Test monitored + observed. Checked airlines

1/15/98 CR Test monitored + observed. Airlines checked

1/16/98 CR Test monitored. Test ended by pouring aerating water + sediment into sieve; rinsing + displacing the sediment in sieve by placing in a sorting pan. Organisms enumerated + preserved with 10% formalin to await measurement. Strong petroleum odor in Sample 101

**SUBJECT: TOXICITY TEST DATA SHEET**

Client: ABB-ES Project Number: 3197250-0100-3100

Test Material	Test Conditions
See Page <u>216</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>A. abdita</u> Batch Number : <u>98-01</u> Age / Life Stage : <u>Adults</u> Date Acclimation / Maintenance Began : <u>1/06/98</u> See Page <u>204</u> of <u>Invertebrate Holding</u> Log for raw data. Mortality (%) 48 Hrs prior to testing: <u>0</u> %	Lighting : <input checked="" type="checkbox"/> Fluorescent <input type="checkbox"/> Incandescent Photoperiod : <u>24</u> hr Light : <u>80</u> hr Dark <small style="margin-left: 20px;"><u>12/16/98</u> <u>12/16/98</u></small>
	Test Container Dimensions: <u>23</u> <sup>10.5</sup> L x <u>    </u> W x <u>12.3</u> <sup>10.5</sup> H Test Solution Height : <u>    </u> cm Test Containers : <input checked="" type="checkbox"/> Open <input type="checkbox"/> Covered Test Container Volume : <u>2.0</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>28 +/- 2</u>	Repls / Concentration : <u>4</u> Animals / Replicate : <u>20</u>

Protocol Followed: \_\_\_\_\_

Concentrations Based on:  A.I.  W.M. Container Composition:  Glass  Plastic

Test Concentrations: (Units = % ):	Control	44D00101	44D00201	44D00301			
Amount Reference <sup>overlying water</sup> Soil Added (mL):	800	800	800	800			
Amount Test <sup>Sediment</sup> Soil Added (mL):	<u>200 N/A</u>	200	200	200			

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

Data By: mo Date: 1/06/98

**SUBJECT: SEDIMENT TOXICITY DATA SHEET**

SPONSOR: ABB ENVIRONMENTAL SERVICES				PROJECT NUMBER: 3197250-1011-3100					
SAMPLE ID: CONTROL				TEST SPECIES: <i>Ampelisca abdita</i>					
DATE-DAY	REP	TEMP (°C)	SALIN	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME
1-6-98	0 A	20.8	27	0.1	8.0	7.3	43000	NONE	CR 1500
1-7-98	1 B	21.0	—	—	7.9	7.2	—	—	CR 0800
1-8-98	2 C	20.9	—	—	7.9	7.3	—	—	MO 1100
1-9-98	3 D	20.9	—	—	7.9	7.3	—	—	CR 0900
1-10-98	4 A	20.7	—	—	7.9	7.1	—	—	MO 1145
1-11-98	5 B	19.9	27	—	7.9	7.3	—	—	MO 1015
1-12-98	6 C	20.5	—	—	8.0	7.2	—	—	MO 1600
1-13-98	7 D	21.0	—	—	7.9	7.0	—	—	CR 0915
1-14-98	8 A	21.0	—	—	7.9	7.1	—	—	CR 0915
1-15-98	9 B	20.9	—	—	7.9	7.2	—	—	CR 1600
1-16-98	10 C	20.9	29	—	7.9	7.1	—	—	CR 1500

OBSERV	REPLICATE				
	A	B	C	D	Initial
1-6-98 0	ZOA	ZOA	ZOA	ZOA	CR
1-7-98 1	∩	∩	∩	∩	CR
1-8-98 2	N	N	N	N	MO
1-9-98 3	∩	∩	∩	∩	CR
1-10-98 4	N	N	N	N	MO
1-11-98 5	N	N	N	N	MO
1-12-98 6	N	N	N	N	MO
1-13-98 7	∩	∩	∩	∩	CR
1-14-98 8	∩	AS	∩	∩	CR
1-15-98 9	∩	∩	∩	∩	CR
1-16-98 10	18A 2UF	19A INF	19A INF	17A 3NF	CR

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**

SPONSOR: ABB ENVIRONMENTAL SERVICES  
SAMPLE ID: 44D00101

PROJECT NUMBER: 3197250-1011-3100  
TEST SPECIES: *Ampleisca abdita*

DATE-DAY	REP	TEMP (°C)	SALIN	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME
1-6-98 0	A	20.9	27	0.1	7.8	7.3	45000	NONE	CR 1500
1-7-98 1	B	21.0	—	—	7.8	7.1	—	—	CR 0800
1-8-98 2	C	20.8	—	—	7.7	6.9	—	—	MO 1100
1-9-98 3	D	20.9	—	—	7.9	7.2	—	—	CR 0900
1-10-98 4	A	20.7	—	—	7.8	7.1	—	—	MO 1145
1-11-98 5	B	20.0	26	—	7.9	7.2	—	—	MO 1045
1-12-98 6	C	20.6	—	—	7.8	7.1	—	—	MO 1600
1-13-98 7	D	21.0	—	—	7.9	7.2	—	—	CR 0915
1-14-98 8	A	20.9	—	—	7.8	7.0	—	—	CR 0915
1-15-98 9	B	21.0	—	—	7.7	7.1	—	—	CR 1000
1-16-98 10	C	21.0	30	—	7.8	7.1	—	—	CR 1500

OBSERV	REPLICATE				Initial
	A	B	C	D	
1-6-98 0	20 A	20 A	20 A	20 A	CR
1-7-98 1	U	U	U	U	CR
1-8-98 2	N	N	N	N	MO
1-9-98 3	U	U	U	U	MO
1-10-98 4	N	N	N	N	MO
1-11-98 5	N	N	N	N	MO
1-12-98 6	N	N	N	N	MO
1-13-98 7	U	U	U	U	CR
1-14-98 8	U	U	U	U	CR
1-15-98 9	U	U	U	U	CR
1-16-98 10	20 NF	1A 19 NF	1A 19 NF	1A 19 NF	CR

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**

SPONSOR: ABB ENVIRONMENTAL SERVICES SAMPLE ID: 44D00201				PROJECT NUMBER: 3197250-1011-3100 TEST SPECIES: <i>Ampleisca abdita</i>						
DATE-DAY	REP	TEMP (°C)	SALIN	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME	
1-6-98	0	A	20.9	27	40.1	7.8	7.3	39000	NONE	CR 1500
1-7-98	1	B	21.0	—	—	7.8	7.0	—	—	CR 20800
1-8-98	2	C	20.8	—	—	7.9	7.1	—	—	MO 1100
1-9-98	3	D	20.8	—	—	7.9	7.2	—	—	CR 0900
1-10-98	4	A	20.6	—	—	7.8	7.2	—	—	MO 1148
1-11-98	5	B	19.9	27	—	7.8	7.1	—	—	MO 1015
1-12-98	6	C	20.6	—	—	7.9	7.0	—	—	MO 1600
1-13-98	7	D	20.9	—	—	7.9	7.0	—	—	CR 0915
1-14-98	8	A	21.0	—	—	7.9	7.0	—	—	CR 0915
1-15-98	9	B	21.0	—	—	7.9	7.1	—	—	CR 1000
1-16-98	10	C	21.0	29	—	7.8	7.1	—	—	CR 1500

OBSERV	REPLICATE				
	A	B	C	D	Initial
1-6-98	20A	20A	20A	20A	CR
1-7-98	∩	∩	∩	∩	CR
1-8-98	2	2	2	2	MO
1-9-98	∩	∩	∩	∩	CR
1-10-98	2	2	2	2	MO
1-11-98	2	2	2	2	MO
1-12-98	∩	∩	∩	∩	MO
1-13-98	∩	∩	∩	∩	CR
1-14-98	1 DEAD	∩	2 DEAD	1 DEAD	CR
1-15-98	∩	∩	∩	∩	CR
1-16-98	11A, 8NF	13A, 7NF	13A, 5NF	12A, 7NF	

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**

SPONSOR: ABB ENVIRONMENTAL SERVICES  
SAMPLE ID: 44D00301

PROJECT NUMBER: 3197250-1011-3100  
TEST SPECIES: *Ampleisca abdita*

LF  
CR  
1-7-98

DATE-DAY	REP	TEMP (°C)	SALIN	NH <sub>3</sub> (ppm)	pH (s.u.)	DO (mg/L)	COND (µmhos/cm)	FEEDING	INITIAL/TIME
1-6-98 <sup>0</sup>	A	20.8	27	<0.1	7.8	7.3	44000	NONE	CR 1500
1-7-98 <sup>1</sup>	B	21.0	—	—	7.9	7.0	—	—	CR 0800
1-8-98 <sup>2</sup>	C	20.9	—	—	7.9	7.0	—	—	NO 1100
1-9-98 <sup>3</sup>	D	20.8	—	—	8.0	7.2	—	—	CR 0900
1-10-98 <sup>4</sup>	A	20.6	—	—	7.9	7.2	—	—	NO 1145
1-11-98 <sup>5</sup>	B	20.0	27	—	7.9	7.2	—	—	NO 1015
1-12-98 <sup>6</sup>	C	20.7	—	—	7.9	7.1	—	—	NO 1600
1-13-98 <sup>7</sup>	D	20.9	—	—	7.9	7.0	—	—	CR 0915
1-14-98 <sup>8</sup>	A	20.9	—	—	7.9	7.1	—	—	CR 0915
1-15-98 <sup>9</sup>	B	21.0	—	—	7.9	7.2	—	—	CR 1000
1-16-98 <sup>10</sup>	C	21.0	30	—	7.9	7.1	—	—	CR 1500

OBSERV	REPLICATE				
	A	B	C	D	Initial
1-6-98 <sup>0</sup>	20 A	20 A	20 A	20 A	CR
1-7-98 <sup>1</sup>	U	U	U	U	CR
1-8-98 <sup>2</sup>	N	N	N	N	NO
1-9-98 <sup>3</sup>	U	U	U	U	CR
1-10-98 <sup>4</sup>	N	N	N	N	NO
1-11-98 <sup>5</sup>	N	N	N	N	NO
1-12-98 <sup>6</sup>	N	N	N	N	NO
1-13-98 <sup>7</sup>	U	U	U	U	CR
1-14-98 <sup>8</sup>	1 DEAD	U	U	U	CR
1-15-98 <sup>9</sup>	U	U	U	U	CR
1-16-98 <sup>10</sup>	12A, 7NF	14A, 6NF	9A, 11NF	16A, 4NF	

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: TEST ORGANISM GROWTH											
SPONSOR: ABB ENVIRONMENTAL						SAMPLE ID: CONTROL					
PROJECT NUMBER:						TEST SPECIES: <i>Ampelisca abdita</i>					
Boat	REP	Length (mm)	Boat	REP	Length (mm)	Boat	REP	Length (mm)	Boat	REP	Length (mm)
1	A	3.1	2	B	4.0	3	C	3.3	4	D	3.3
		4.4			3.7			3.5			3.2
		3.2			3.3			3.3			3.9
		4.3			3.4			4.1			3.8
		4.2			3.3			3.8			3.9
		3.2			3.6			3.2			3.4
		3.3			3.8			3.6			3.7
		4.0			3.9			3.5			3.3
		3.8			3.6			3.3			3.2
		3.9			4.1			4.1			4.1
		4.0			3.4			4.2			3.8
		3.4			3.7			3.4			4.3
		3.5			3.6			3.5			4.0
		3.3			3.6			3.5			3.8
		3.8			4.0			3.8			3.9
		4.0			3.7			3.6			3.2
		3.9			3.5			3.2			3.4
		3.6			3.2			3.9			
					4.0			3.8			
AVERAGE		3.7	AVERAGE		3.7	AVERAGE		3.6	AVERAGE		3.7
STD. DEV.		0.40	STD. DEV.		0.27	STD. DEV.		0.31	STD. DEV.		0.35
RANGE		3.1-4.4	RANGE		3.2-4.4	RANGE		3.2-4.2	RANGE		3.2-4.3
NET WT (g)			NET WT (g)			NET WT (g)			NET WT (g)		
GROSS WT (g)			GROSS WT (g)			GROSS WT (g)			GROSS WT (g)		
MEAN (mg)			MEAN (mg)			MEAN (mg)			MEAN (mg)		
Measuring Device: <i>micrometer slide</i>						Calculator: <i>RS-SAE</i>					
Data By: <i>MAD</i>		Date: <i>1/23/98</i>				Reviewed By: <i>JV</i>		Date: <i>1/23/98</i>			





SUBJECT: TEST ORGANISM GROWTH											
SPONSOR: ABB ENVIRONMENTAL						SAMPLE ID: 44D00301					
PROJECT NUMBER:						TEST SPECIES: <i>Ampelisca abdita</i>					
Boat	REP	Length (mm)	Boat	REP	Length (mm)	Boat	REP	Length (mm)	Boat	REP	Length (mm)
7	A	3.1	8	B	3.0	9	C	3.2	10	D	3.5
		3.8			3.2			3.2			3.6
		3.2			3.2			3.5			3.5
		3.7			3.4			3.4			3.7
		3.5			3.3			3.3			3.2
		3.5			3.7			3.7			3.4
		3.2			3.7			3.2			3.5
		3.3			3.1			3.3			3.1
		3.4			3.2			3.5			3.6
		3.5			3.5						3.5
		3.1			3.3						3.4
		3.0			3.4						3.7
					3.3						3.2
					3.2						3.3
											3.1
											3.3
AVERAGE		3.4	AVERAGE		3.3	AVERAGE		3.4	AVERAGE		3.4
STD. DEV.		0.26	STD. DEV.		0.20	STD. DEV.		0.17	STD. DEV.		0.20
RANGE		3.0-3.8	RANGE		3.0-3.7	RANGE		3.2-3.7	RANGE		3.1-3.7
NET WT (g)			NET WT (g)			NET WT (g)			NET WT (g)		
GROSS WT (g)			GROSS WT (g)			GROSS WT (g)			GROSS WT (g)		
MEAN (mg)			MEAN (mg)			MEAN (mg)			MEAN (mg)		
Measuring Device: <u>micrometer</u>						Calculator: <u>TJ-60</u>					
Data By: <u>MAO</u>			Date: <u>1/27/98</u>			Reviewed By: <u>JUY</u>			Date: <u>1/23/90</u>		

NAS JAX Toxicity Tests-Ampelisca Survival  
File: a:amp2 Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	3	0.745	0.248	66.222
Within (Error)	12	0.045	0.004	
Total	15	0.790		

Critical F value = 3.49 (0.05,3,12)  
Since  $F > \text{Critical } F$  REJECT  $H_0$ : All equal

NAS JAX Toxicity Tests-Ampelisca Survival  
 File: a:amp2 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	3.675	3.675		
2	001	3.550	3.550	2.887	*
3	002	3.100	3.100	13.279	*
4	003	3.375	3.375	6.928	*

Dunnett table value = 2.29 (1 Tailed Value, P=0.05, df=12,3)

NAS JAX Toxicity Tests-Ampelisca Survival  
 File: a:amp2 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	001	4	0.099	2.7	0.125
3	002	4	0.099	2.7	0.575
4	003	4	0.099	2.7	0.300

NAS JAX Toxicity Tests-Ampelisca Survival  
File: a:amp1 Transform: NO TRANSFORMATION

ANOVA TABLE

---

SOURCE	DF	SS	MS	F
Between	3	2.450	0.817	103.882
Within (Error)	12	0.094	0.008	
Total	15	2.544		

---

Critical F value = 3.49 (0.05,3,12)  
Since  $F > \text{Critical } F$  REJECT  $H_0$ : All equal

NAS JAX Toxicity Tests-Ampelisca Survival  
 File: a:amp1 Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	1.278	1.278		
2	001	0.198	0.198	17.234	*
3	002	0.899	0.899	6.041	*
4	003	0.915	0.915	5.794	*

Dunnett table value = 2.29 (1 Tailed Value, P=0.05, df=12,3)

NAS JAX Toxicity Tests-Ampelisca Survival  
 File: a:amp1 Transform: NO TRANSFORMATION

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	001	4	0.144	11.2	1.081
3	002	4	0.144	11.2	0.379
4	003	4	0.144	11.2	0.363

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

TRIMMED SPEARMAN-KARBER METHOD. VERSION 1.5

DATE: 1/26/98  
TOXICANT : SDS  
SPECIES: A. abdita

TEST NUMBER: 1

DURATION: 96 h

RAW DATA:	Concentration (mg/L)	Number Exposed	Mortalities
---	.00	10	0
----	.62	10	1
	1.25	10	1
	2.50	10	4
	5.00	10	10
	10.00	10	10

SPEARMAN-KARBER TRIM: 10.00%

SPEARMAN-KARBER ESTIMATES: LC50: 2.63  
95% LOWER CONFIDENCE: 1.99  
95% UPPER CONFIDENCE: 3.47

---

REFERENCE TOXICANT TEST DATA SHEET							
Client: <u>MISC.</u>				Project Number: <u>Ref TOX</u>			
Test Material				Test Conditions			
Amount of <u>SDS</u> : <u>0.1001</u> (g)				<input checked="" type="checkbox"/> Definitive		<input checked="" type="checkbox"/> Static	
Volume of Milli-Q Water: <u>100</u> (mL)				<input type="checkbox"/> Screening		Duration: <u>96</u> Hours	
Date Prepared: <u>1/06/98</u>							
Test Organism History				Dilution Water: <u>natural filtered seawater</u>			
Species: <u>A. abdita</u>				Lighting: <input checked="" type="checkbox"/> Fluorescent <input type="checkbox"/> Incandescent			
Batch Number: <u>98-01</u>				Photoperiod: <u>0</u> Hr Light <u>24</u> Hr Dark			
Age/Life Stage: <u>Adult</u>				Test Vessel Dimensions: <u>100</u> L X <u>—</u> W <u>50</u> H			
Date of Acclimation/Maintenance: <u>1/06/98</u>				Test Solution Height: <u>4</u> (cm)			
See Page <u>204</u> of <u>Insect Holding Log</u>				Test Vessel Volume: <u>0.34</u> (L)			
Mortality 48 hours prior to test: <u>0</u> (%)				Test Solution Volume: <u>0.20</u> (L)			
Replicates/Concentration: <u>1</u>				Test Temperature: <u>20</u> ± <u>1</u> °C			
No. Of Organisms/Replicate: <u>10</u>				Test Salinity: <u>28</u> ± <u>2</u> ppt			
Test Area Used: <u>waterbath 9</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>SAR A-004</u>			
Test Concentrations: (Units: mg/L )		Control	0.62	1.25	2.5	5	10
Amount Dilution Water Added (mL)		<u>200</u>	199.875	199.75	199.5	199	198
Amount of Reftox Stock Added (mL)		<u>—</u>	0.125	0.25	0.5	1	2

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

Data By: MO

Date: 1/06/98

REFERENCE TOXICANT TEST DATA: DAY 0 - 2

Client: *MBC* Project Number: *Ref Tox* Species: *A. abdita*

DAY 0

Nominal Concentration (mg/L)	Date: <i>1/06/98</i>		Time: <i>1430</i>		Analyst: <i>MO</i>	
	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control	<i>10</i>	<i>2</i>	<i>20.1</i>	<i>27</i>	<i>7.4</i>	<i>8.0</i>
<i>0.62</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>1.25</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>2.5</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>5</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>10</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>

DAY 1

Nominal Concentration	Date: <i>1/07/98</i>		Time: <i>1700</i>		Analyst: <i>MO</i>	
	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control	<i>10</i>	<i>2</i>	<i>20.9</i>	<i>27</i>	<i>7.3</i>	<i>8.0</i>
<i>0.62</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>1.25</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>2.5</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>5</i>	<i>6</i>	<i>4 dead</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>10</i>	<i>0</i>	<i>10 dead</i>	<i>-</i>	<i>-</i>	<i>7.0</i>	<i>8.0</i>

DAY 2

Nominal Concentration	Date: <i>1/08/98</i>		Time: <i>1100</i>		Analyst: <i>MO</i>	
	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control	<i>10</i>	<i>2</i>	<i>20.8</i>	<i>27</i>	<i>7.2</i>	<i>8.0</i>
<i>0.62</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>1.25</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>2.5</i>	<i>10</i>	<i>2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>5</i>	<i>2</i>	<i>4 dead</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>10</i>	<i>0</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>

REFERENCE TOXICANT TEST DATA: DAY 3 AND 4						
Client: MISC		Project Number:			Species: A. abd. l.	
DAY 3						
Nominal Concentration	Date: 1-9-98		Time: 0900		Analyst: MD	
	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control	10	0	21.8	27	7.2	8.6
0.62	10	0	—	—	—	—
1.25	10	0	—	—	—	—
2.5	8	2 DEAD	—	—	—	—
5	0	2 DEAD	21.7	27	7.1	7.9
DAY 4						
Nominal Concentration	Date: 1-10-98		Time: 1200		Analyst: MD	
	# Alive	Observ.	Temp. (°C)	Sal (ppt)	DO (mg/L)	pH
Control	10	0	20.9	26	7.1	7.9
0.62	9	1 Dead	—	—	—	—
1.25	9	1 Dead	—	—	—	—
2.5	6	2 Dead	—	—	—	—
5	—	—	—	—	—	—
—	—	—	—	—	—	—

SUMMARY

COMMENTS:

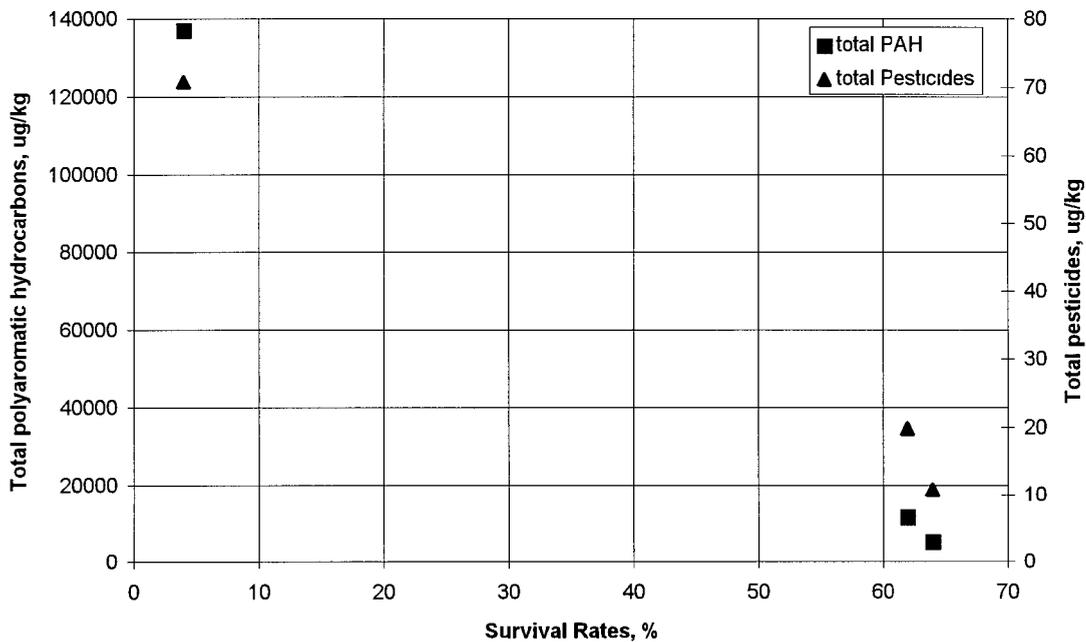
Nominal Concentration	Number Dead
Control	0
0.62	1
1.25	1
2.5	4
5	10
10	10

Summary of Detections in Sediment Analytical Results  
TAL Metals and TCL Organics  
PSC 44

Naval Air Station, Jacksonville  
Jacksonville, FL

Identifier	FDEP Sediment Quality Guidelines	44D00101	44D00201	44D00301
Sampling Date		12/17/97	12/17/97	12/17/97
Potassium	ND	59 B	19 B	40.4 B
Sodium	ND	227 B	172 B	203 B
Vanadium	ND	7.6 B	3.1 B	8.5 B
Zinc	300	137 N	38.6 N	159 N
<b>Toxicity test survival rates, %</b>				
		4	62	64
<b>Total concentration, PAHs, ug/kg</b>				
		137082	11512	5060
<b>Total concentration, pesticides, ug/kg</b>				
		70.75	19.77	10.76

**Survival Rates of *Ampelisca abdita* Versus Chemical Concentrations**



Summary of Detections in Sediment Analytical Results  
TAL Metals and TCL Organics  
PSC 44

Naval Air Station, Jacksonville  
Jacksonville, FL

Identifier	FDEP Sediment Quality Guidelines	44D00101		44D00201		44D00301	
		12/17/97		12/17/97		12/17/97	
Sampling Date							
<b>Semivolatile Organics, ug/kg</b>							
2-Methylnaphthalene	ND	600					
Acenaphthene	450	<del>1500</del>		86 J			
Acenaphthylene	ND	82 J					
Anthracene	740	<del>2400</del>		140 J			
Benzo(a)anthracene	1300	<del>10000</del> D		890		390 J	
Benzo(a)pyrene	1700	<del>8500</del> D		1100		460 J	
Benzo(b)fluoranthene	ND	14000 DX		1800		930	
Benzo(g,h,i)perylene	ND	2400		460		290 J	
Benzo(k)fluoranthene	ND	16000 DX		650		330 J	
bis(2-Ethylhexyl)phthalate	ND	1900		570		560	
Butylbenzylphthalate	ND	350 J		73 J		72 J	
Carbazole	ND	5300 DJ		140 J			
Chrysene	1700	<del>11000</del> D		960		640	
Dibenzofuran		1400					
Fluoranthene	3200	<del>21000</del> D		2100		890	
Fluorene	460	<del>1800</del>		66 J			
Indeno(1,2,3-cd)pyrene	ND	2800		580		300 J	
Naphthalene	1100	<del>1300</del>					
Phenanthrene	1200	<del>17000</del> D		940		180 J	
Pyrene	1900	<del>20000</del> D		1600		650	
<b>Pesticides, ug/kg</b>							
4,4'-DDE	130	7 P		4 6 JP		1 9 JP	
4,4'-DDT	270	22 P		1 2 JP			
Aldrin	ND	5 6 P				0 26 JP	
alpha-BHC	ND	0 55 JP				0 3 JP	
alpha-Chlordane	ND	1 JP		3 8		2 4 JP	
delta-BHC	ND	1 6 JP					
Endosulfan II	ND			1 5 JP		1 2 JP	
Endosulfan sulfate				0 87 JP		1 4 JP	
Endrin	ND	23 P					
Endrin ketone	ND			5 4 P			
gamma-Chlordane	ND			1 1 JP		3 3	
Heptachlor epoxide	ND			1 3 JP			
Methoxychlor	ND	10 JP					
<b>Inorganics, mg/kg</b>							
Aluminum	ND	1100		525		1700	
Arsenic	64	1 7 B				0 73 B	
Barium	ND	25 6 B		7 3 B		21 5 B	
Beryllium	ND	0 11 B				0 1 B	
Cadmium	7 5	6 2 *		1 9 *		2 2 *	
Calcium	ND	4240		805 B		16000	
Chromium	240	33 3		7 4		9	
Cobalt	ND	2 B		1 3 B		0 81 B	
Copper	170	17 5		5 8 B		13	
Iron	ND	2280 *		1330 *		6090 *	
Lead	160	130 N		42 N		46 6 N	
Magnesium	ND	639 B		148 B		701 B	
Manganese	ND	18 8		5 9		34	
Mercury	1 4	0 12 B		0 11 B		0 13 B	
Nickel	ND	3 3 B		1 4 B		3 3 B	