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SAMPLING EVENT REPORT POTENTIAL SOURCE OF CONTAMINATION 37 (PSC37) EX-
POWER BARGE DOCK AREA NAS JACKSONVILLE FL
7/1/1999
HARDING LAWSON ASSOCIATES

SAMPLING EVENT REPORT
POTENTIAL SOURCE OF CONTAMINATION 37
EX-POWER BARGE DOCK AREA
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Unit Identification Code: N00207

Contract No.: N62467-89-D-0317/040

Prepared by:

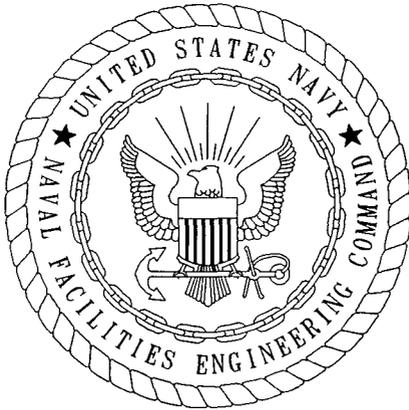
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July 1999



CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/040 are complete and accurate and comply with all requirements of this contract.

DATE: July 5, 1999

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(DFAR 252.227-7036)

TABLE OF CONTENTS

Sampling Event Report
Potential Source of Contamination 37
Ex-Power Barge Dock Area
Naval Air Station Jacksonville
Jacksonville, Florida

<u>Chapter</u>	<u>Title</u>	<u>Page No.</u>
1.0	INTRODUCTION	1-1
1.1	PURPOSE AND SCOPE	1-1
1.2	SITE DESCRIPTION AND HISTORY	1-4
2.0	SAMPLING APPROACH AND FIELD CHANGES	2-1
3.0	QUALITY ASSURANCE AND QUALITY CONTROL	3-1
4.0	ANALYTICAL RESULTS	4-1
4.1	ANALYTICAL RESULTS FOR SEDIMENT SAMPLES	4-1
4.1.1	Polynuclear Aromatic Hydrocarbons	4-1
4.1.2	Pesticides and Polychlorinated Biphenyls	4-1
4.1.3	Inorganic Parameters	4-1
4.1.4	General Chemistry Parameters	4-1
4.2	Sediment Toxicity Tests	4-1
5.0	RISK EVALUATION	5-1
5.1	HUMAN HEALTH RISK SCREENING	5-1
5.2	ECOLOGICAL RISK SCREENING	5-1
5.2.1	Exposure Pathway Analysis	5-1
5.2.2	Summary of Analytical Results	5-1
5.2.3	Toxicity Tests	5-4
5.2.4	Conclusions	5-5
6.0	REFERENCES	6-1

APPENDICES

- Appendix A: Off-site Sample Tracking Log
- Appendix B: Summary of Detections of Analytical Results
- Appendix C: Validated Analytical Data Sheets
- Appendix D: Data Validation Reports
- Appendix E: Toxicity Test Report

LIST OF FIGURES

Sampling Event Report
Potential Source of Contamination 37
Ex-Power Barge Dock Area
Naval Air Station Jacksonville
Jacksonville, Florida

<u>Figure</u>	<u>Title</u>	<u>Page No.</u>
1-1	Location of PSC 37 at NAS Jacksonville	1-2
1-2	Sampling Locations at PSC 37, Ex-Power Barge Dock Area	1-3

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page No.</u>
5-1	Summary of Analytes Detected in Sediment	5-2
5-2	Summary of Sediment Toxicity Test Results	5-4

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ABS	Aquatec Biological Sciences, Inc.
Battelle	Battelle Ocean Sciences, Inc.
BHC	benzene hexachloride
CLP	Contract Laboratory Program
EDS	Environmental Data Services
FDEP	Florida Department of Environmental Protection
HLA	Harding Lawson Associates
IAS	Initial Assessment Study
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram
NAS	Naval Air Station
NFESC	Naval Facilities Engineering Service Center
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	probable effect level
PSC	potential source of contamination
QA/QC	quality assurance and quality control
SDG	sample delivery group
SER	sampling event report
SJRWMD	St. Johns River Water Management District
SQAG	sediment quality assessment guidelines
SSW	Site Screening Workplan
TAL	target analyte list
TCL	target compound list
TEL	threshold effect level
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

Harding Lawson Associates (HLA) under contract to the Department of Navy (Contract No. N62467-89-D-0317, Task Order No. 040) is submitting this Sampling Event Report (SER) for Potential Source of Contamination (PSC) 37, the Ex-Power Barge Dock Area at Naval Air Station (NAS) Jacksonville, Jacksonville, Florida. PSC 37 is located on the St. Johns River at the southeast boundary of the station (Figures 1-1 and 1-2).

The Ex-Power Barge Dock was identified as a PSC during the initial assessment study (IAS) (Fred C. Hart Associates, Inc., 1983) based on a report that a transformer explosion occurred onshore when the barge was in operation. The IAS report explained that further investigation of the incident revealed that transformers were kept on the barge and that no explosions occurred. During an interview with HLA personnel, Mr. Tony Bavington of the Jacksonville Electric Authority confirmed that transformers for power barges may have been present on the barge instead of onshore (Bavington, 1994).

This SER summarizes the methods and the results of the field investigation and transmits the field and analytical data.

1.1 PURPOSE AND SCOPE. The purpose of the sampling event at PSC 37 was to gather sufficient information to support the next phase of the Remedial Response Decision System. The scope of the sampling event, detailed in the Site Screening Workplan ([SSW] ABB Environmental Services, Inc. [ABB-ES], 1997), at PSC 37 included the following:

- collection of up to six sediment samples from the St. Johns River along the major axis of the dock and barge area.
- laboratory analysis of the sediment samples for U.S. Environmental Protection Agency (USEPA) target compound list (TCL) polychlorinated biphenyls (PCBs).

The original objective of the site screening process was to determine if PCBs were present in the St. Johns River surrounding PSC 37, as a result of reported transformer explosions. However, in June 1997, as part of a larger sampling event in the river, the St. Johns River Water Management District (SJRWMD) through its contractor, Battelle Ocean Sciences (Battelle) collected samples near the former dock (Figure 1-2). They collected two discrete grab samples and two split samples which were composited from four locations along the former dock area. These four samples were analyzed for the full suite of TCL and target analyte list (TAL) constituents. In addition to PCBs, detected concentrations of six polynuclear aromatic hydrocarbons (PAHs), three pesticides and seven inorganic analytes in the sediment exceeded the Florida Sediment Quality Assessment Guidelines (SQAG) Threshold Effects Levels (TELs). Of these exceedances, only one PAH, acenaphthene, exceeded the Probable Effects Level (PEL). Based on results of the Battelle sampling, it was recommended that three additional sediment samples, rather than the six samples proposed in the SSW, be collected and analyzed for TAL inorganics, PAHs, TCL pesticides, TCL PCBs, and total organic carbon (TOC). A sediment toxicity test using the organism *Leptocheirus plumulosus* and grain size analysis were also conducted on the sediment samples.

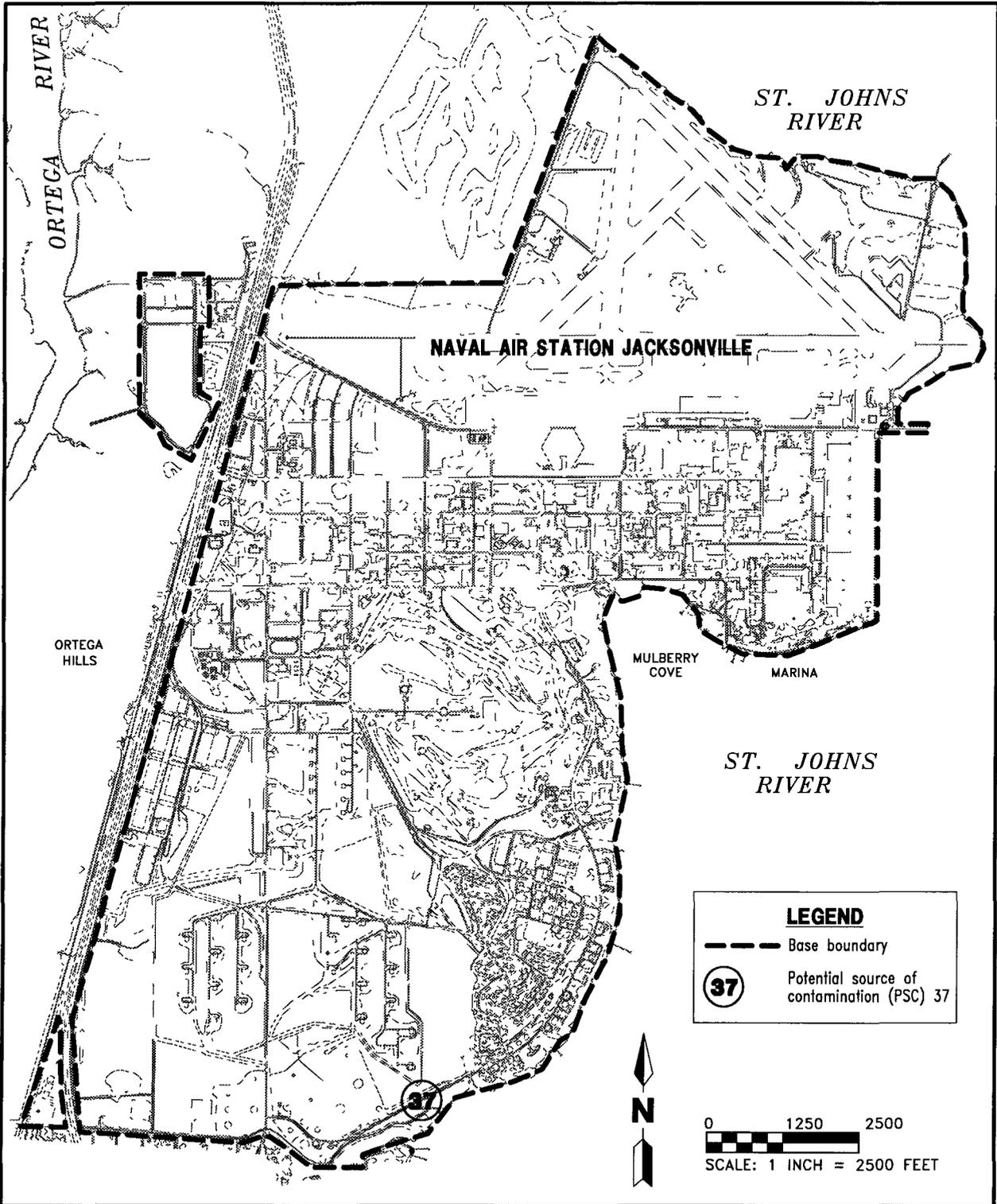
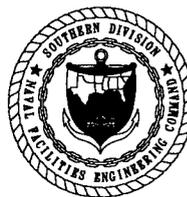


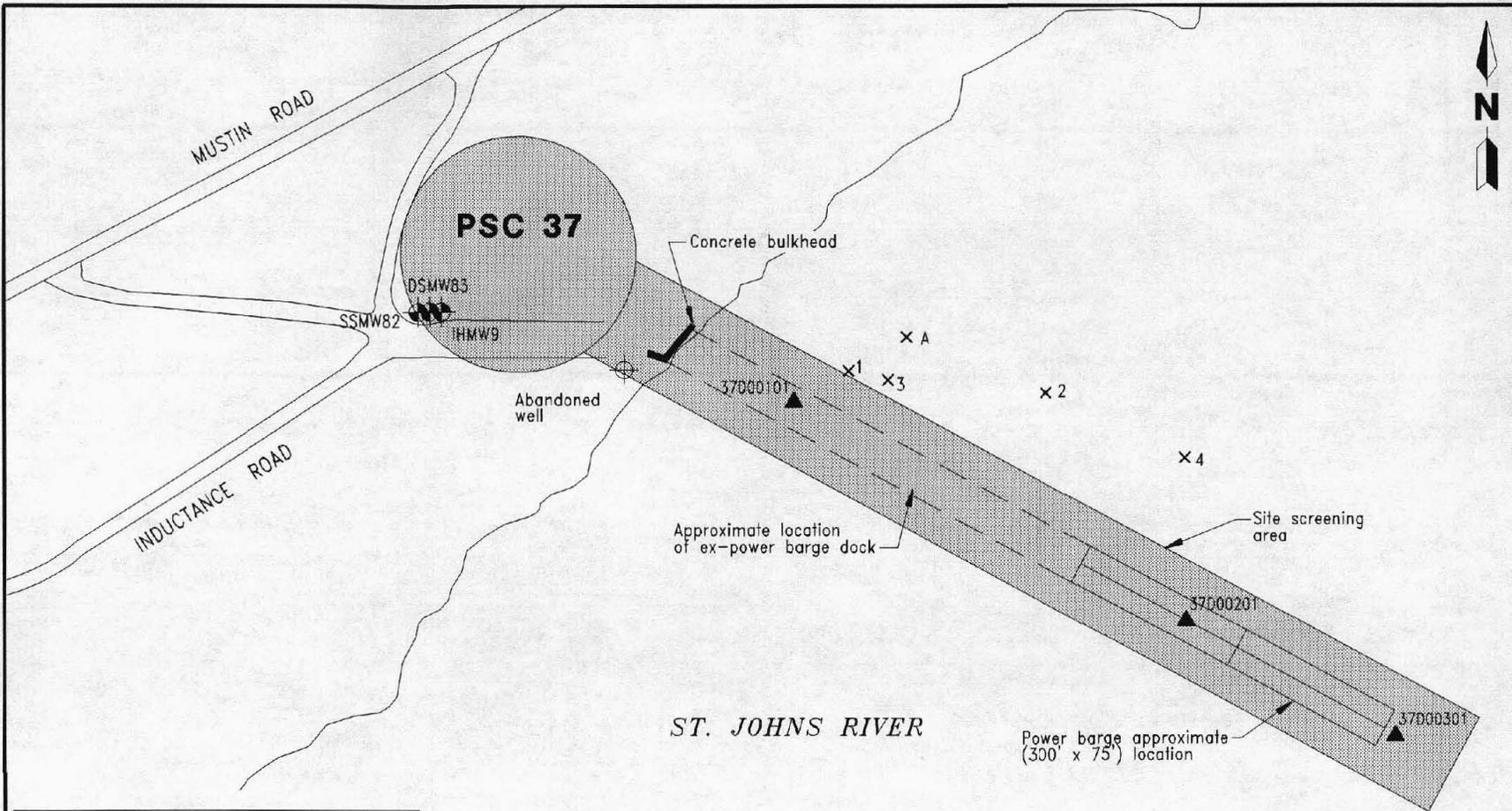
FIGURE 1-1
LOCATION OF PSC 37 AT
NAVAL AIR STATION JACKSONVILLE



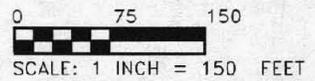
SAMPLING EVENT REPORT
PSC 37

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

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LEGEND	
	Existing monitoring well location and designation (ABB-ES, 1993)
	Abandoned well location
	Sediment sample location and designation (HLA, 1999)
	Sediment sample location (Battelle, 1997)
	PSC Potential source of contamination



**FIGURE 1-2
SAMPLING LOCATIONS AT PSC 37
EX-POWER BARGE DOCK AREA**



**SAMPLING EVENT REPORT
PSC 37**

**NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA**

Field work for this sampling event was completed on March 29, 1999. The locations of the sediment samples are shown on Figure 1-2. A sample tracking log which includes sample and sample delivery group (SDG) identifiers, relevant dates, sample depths, and parameters analyzed is included in Appendix A.

1.2 SITE DESCRIPTION AND HISTORY. PSC 37 is located on the St. Johns River at the southeast boundary of the station (Figure 1-1). The PSC is accessible by roads on the south side of Mustin Road. The wood dock, once used by the power barge, was about 400 feet long and is no longer present; only a concrete bulkhead remains on the shoreline (Figure 1-2). An abandoned water supply well is located approximately 50 feet from the bulkhead. A monitoring well triplet (well identifiers DSMW83, SSMW82 and IHMW9), installed by HLA in 1993 for basewide background water quality and flow modeling purposes, is located adjacent to the PSC.

The Ex-Power Barge Dock was identified as a PSC during the IAS (Fred C. Hart Associates, Inc., 1983) based on a report that a transformer explosion occurred onshore when the barge was in operation. The IAS report explained that further investigation of the incident revealed that transformers were kept on the barge and that no explosions occurred. During an interview with HLA personnel, Mr. Tony Bavington of the Jacksonville Electric Authority confirmed that transformers for power barges may have been present on the barge instead of onshore (Bavington, 1994).

The exact period the barge operated was not determined. Mr. Bavington and Mr. J. Michael Wadel, Project Manager at the Base Construction Department (Wadel, 1994), indicated that the barge was in operation no later than the 1960s. Examination of aerial photography from 1943 to 1988 support this assessment. The dock was not present in the 1943 or 1953 photographs. In the 1959 and 1961 aerial photographs, the dock is present and the barge is in operation. The barge is absent in the 1969 photograph, however, and the dock was apparently removed some time in the mid- to late 1980s.

The IAS report did not recommend a confirmation study at PSC 37 because the transformers were located on the barge and there was no evidence that explosions occurred there. Volume 1 of the Naval Installation Restoration Plan (Geraghty & Miller, Inc., 1991) also recommended no further action. However, during subsequent review, Florida Department of Environmental Protection regulatory personnel did not concur with the no further action recommendation and requested that sediment samples be collected from the area of the former dock and power barge anchorage and analyzed for PCBs.

HLA obtained additional information during a PSC reconnaissance on April 21, 1994. During the PSC reconnaissance, there was no evidence that a transformer had been onshore, such as a concrete pad or old power lines. In addition, no evidence of contamination, such as stressed vegetation, stained soil, or odor, was noted. The vicinity of PSC 37 is mostly wooded. Shallow groundwater flow at PSC 37 is to the east toward the St. Johns River.

As discussed previously in Section 1.1, the SJRWMD through its contractor, Battelle, collected samples near the former dock in June 1997 (Figure 1-2). In addition to PCBs, detected concentrations of six PAHs, three pesticides and seven inorganic analytes in the sediment exceeded the Florida SQAG TELs. Of these exceedances, only one PAH, acenaphthene, exceeded the PEL.

2.0 SAMPLING APPROACH AND FIELD CHANGES

The work described herein was performed in general accordance with the recommendation presented in the SSW (ABB-ES, 1997). The proposed sample frequency and analyses were modified based on analytical results of sampling performed for SJWRMD by Battelle, as described in this section.

Sediment samples were collected from the St. Johns River at PSC 37 by Battelle in 1997 (Figure 1-2). Analytical results from this study identified PAHs, PCBs, and metals in the sediment at the former barge dock area. The results of a screening-level ecological risk assessment indicated the detected concentrations of PCBs, PAHs, and several inorganic analytes in the sediment exceeded the Florida SQAG TELs, indicating possible adverse effects to aquatic receptors. One PAH compound was detected at a concentration above its respective PEL, which represents a concentration that is usually or always associated with adverse biological effects. Based on results of the Battelle sampling, it was recommended that a field investigation be conducted to evaluate potential ecological risks to benthic macroinvertebrates associated with contaminants in the St. Johns River sediment at PSC 37.

Three sediment samples, rather than the six samples proposed in the SSW, were collected on March 29, 1999, from locations shown on Figure 1-2. The sediment samples identified as 37D00101, 37D00201, and 37D00301 were analyzed for TAL inorganics, PAHs, TCL pesticides, TCL PCBs, and TOC. In addition, grain size analysis and sediment toxicity tests using the marine amphipod *Leptocheirus plumulosus* were performed on the three sediment samples. The amphipod was evaluated for 10-day acute mortality and reburial rates.

The sediment samples collected for laboratory analysis were sent by overnight carrier to the subcontract laboratory, Quanterra, Inc., North Canton, Ohio. Toxicity test and grain size analysis for the sediment samples were performed by Aquatec Biological Sciences, Inc. (ABS) of South Burlington, Vermont.

Following the laboratory analysis, all analytical data were validated in accordance with the Naval Facilities Engineering Service Center (NFESC) Level D protocol. A summary of the detections in the sediment analytical results are presented in Appendix B. The validated analytical results are included in Appendix C.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

Field samples and an associated quality assurance and quality control (QA/QC) sample (rinsate blank) were collected and analyzed according to USEPA Contract Laboratory Program (CLP) and NFESC requirements by an NFESC-certified laboratory, Quanterra, Inc. (North Canton, OH), following CLP analytical and deliverable requirements (for TAL metals, TCL pesticides, and PCB analysis). PAH analysis was performed using USEPA SW846 Method 8310 and TOC analysis by the Walkley-Black oxidation procedure. Toxicity tests were performed based on methods described in Method 600/R-94/025 (USEPA, 1994c).

The analytical data packages, submitted by SDGs, were independently validated by a subcontract data validation company, Environmental Data Services (EDS, Concord, NH), in accordance with validation requirements contained in NFESC document *Navy Installation Restoration Laboratory Quality Assurance Guide*, February 1996. Other documents utilized in the data validation and review include the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, February 1994 (USEPA, 1994a) and the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, February 1994 (USEPA, 1994b).

A detailed QA/QC evaluation can be found in the EDS validation reports dated May 1999 and included in Appendix D. The generated analytical data were found to be acceptable according to NFESC requirements, with less than five percent of the data requiring qualification as estimated concentration (J qualifier), mostly related to inorganic detections between the instrument detection limit and the contract required detection limit.

4.0 ANALYTICAL RESULTS

4.1 ANALYTICAL RESULTS FOR SEDIMENT SAMPLES Appendix B presents a summary of the parameters detected in sediment samples collected at PSC 37. The complete validated analytical data are included in Appendix C.

4.1.1 Polynuclear Aromatic Hydrocarbons Two PAHs, fluoranthene and pyrene, were detected in the sediment samples. Fluoranthene was detected in sample 37D00101 at 33 micrograms per kilogram ($\mu\text{g}/\text{kg}$). Pyrene was detected in sample 37D00101 and 37D00301 at 33 $\mu\text{g}/\text{kg}$ and 53 $\mu\text{g}/\text{kg}$, respectively. Both compounds were also detected at concentrations up to 10 $\mu\text{g}/\text{kg}$ in reference sediment samples collected for the Operable Unit 3 remedial investigation (HLA, 1999).

4.1.2 Pesticides and Polychlorinated Biphenyls Seven pesticides and one PCB compound were identified in sediment samples analyzed. Each sediment sample had at least one pesticide detection at concentrations ranging from 0.21 to 1.8 $\mu\text{g}/\text{kg}$. Each pesticide was detected in one of three samples analyzed, except for gamma-Chlordane, which was detected at locations 37D00201 and 37D00301.

One PCB, Aroclor-1260, was detected at 43 $\mu\text{g}/\text{kg}$ only in one sample (37D00101), indicating that sediments underlying the former barge dock area were not significantly impacted by possible PCB leakage from transformers kept on the barge instead of onshore.

4.1.3 Inorganic Parameters Twenty inorganic analytes were identified in sediment samples analyzed. Except for cobalt, mercury, selenium, silver, and thallium, all inorganics were detected in all three samples analyzed.

4.1.4 General Chemistry Parameters TOC was measured at the three sediment sample locations at 55,000 (37D00101), 140,000 (37D00201) and 160,000 (37D00301) milligrams per kilogram (mg/kg).

4.2 Sediment Toxicity Tests Three bulk sediment samples were collected and submitted to ABS for grain size analysis and 10-day whole sediment survival and reburial toxicity test using the estuarine amphipod *Leptocheirus plumulosus*.

The toxicity test report, including the grain size analysis results, is included in Appendix E and discussed in Chapter 5.0.

5.0 RISK EVALUATION

The purpose of performing risk screening as part of the site screening evaluation is to assist in determining whether or not the existing risk at PSC 37 (1) supports a no further action decision, (2) indicates the need for an interim remedial action, or (3) requires additional investigation to make a decision.

5.1 HUMAN HEALTH RISK SCREENING. The current human exposure pathways are recreational fishing and dermal contact with and incidental ingestion of the surface water of the St. Johns River. Human health risk screening was not conducted because no surface water analytical data were collected at PSC 37. There is little potential for human exposure to contaminated sediments under the recreational or wading scenario because the area is currently off-limits to human activities.

5.2 ECOLOGICAL RISK SCREENING. This screening-level evaluation is intended to provide an assessment of potential ecological risks associated with sediment at PSC 37. The evaluation consists of an exposure pathway analysis (Subsection 5.2.1), a summary of the analytical results and comparison to applicable sediment toxicological benchmarks (Subsection 5.2.2), an evaluation of the sediment toxicity testing data (Subsection 5.2.3), and conclusions and recommendations (Subsection 5.2.4). The results of the chemical analyses and toxicity tests were used to determine if chemical concentrations in sediment at PSC 37 are associated with adverse effects to benthic invertebrates in the St. Johns River.

5.2.1 Exposure Pathway Analysis Because sediment is the media of concern, the exposure pathway most likely to occur is direct contact and indirect ingestion of contaminants in the sediment of the St. Johns River adjacent to PSC 37 by aquatic receptors. The aquatic receptors of concern include bottom-dwelling macroinvertebrates and larval stage aquatic species that may come into contact with contaminants in the sediment. Although fish ingestion of contaminated food and incidental ingestion of contaminated sediment are also potential exposure pathways, these routes of exposure were not evaluated in the screening-level evaluation due to the localized nature of potential sediment contamination adjacent to PSC 37. Population-level impacts to fish are not anticipated because the area surrounding PSC 37 is small relative to the wide range of fish foraging habitat in the St. Johns River.

5.2.2 Summary of Analytical Results Sediment data are summarized in Table 5-1. Information provided in these tables includes frequency of detection, range of detected concentrations, maximum detected concentration, and the applicable sediment quality guidelines from USEPA Region IV (USEPA, 1995) and the Florida Department of Environmental Protection (FDEP) (MacDonald, 1994).

Two PAH compounds, one PCB (Aroclor-1260), seven pesticides, and twenty inorganic analytes were detected at various concentrations in sediment collected from the 3 locations shown in Figure 1-2 (37D00101, 37D00201, and 37D00301). Maximum detected concentrations of these compounds and analytes were generally at or below both the USEPA Region IV and FDEP sediment quality TEL and PEL values.

Table 5-1
Summary of Analytes Detected in Sediment

Sampling Event Report
Potential Source of Contamination 37
Ex-Power Barge Dock Area
Naval Air Station Jacksonville
Jacksonville, Florida

Chemical Name	Frequency of Detections ¹	Range of Detects	Maximum Detected Concentration	Background Concentrations ²	USEPA Region IV Sediment Screening Values ³	FDEP Sediment TEL/PEL Guidelines ⁴	Exceeds TEL and/or PEL?
Semivolatile Organic Compounds (µg/kg)							
Fluoranthene	1/3	33 to 33	33	NA	330	113/1,494	
Pyrene	2/3	33 to 53	53	NA	330	153/1,398	
Pesticides and PCBs (µg/kg)							
4,4'-DDE	1/3	1.8 to 1.8	1.8	NA	3.3	2.07/3.74	
alpha-BHC	1/3	1.6 to 1.6	1.6	NA	3.3	NA/NA	
Aroclor-1260	1/3	43 to 43	43	NA	33	21.6/189	TEL
beta-BHC	1/3	1.6 to 1.6	1.6	NA	3.3	NA/NA	
delta-BHC	1/3	0.98 to 0.98	0.98	NA	⁵ 3.3	⁵ 0.32/ ⁵ 0.99	TEL
Dieldrin	1/3	0.58 to 0.58	0.58	NA	3.3	0.715/4.3	
gamma-BHC (Lindane)	1/3	1.3 to 1.3	1.3	NA	3.3	0.32/0.99	TEL/PEL
gamma-Chlordane	2/3	0.21 to 0.61	0.61	NA	1.7	2.26/4.79	
Inorganic Analytes (mg/kg)							
Aluminum	3/3	4,680 to 13,500	13,500	1,167	NA	NA/NA	
Arsenic	3/3	2.8 to 11.2	11.2	ND	7.24	7.24/41.6	TEL
Barium	3/3	15.5 to 49	49	4.8	NA	NA/NA	
Calcium	3/3	3,820 to 12,700	12,700	1,914	NA	NA/NA	
Chromium	3/3	13 to 43.4	43.4	4.4	52.3	52.3/160	
Cobalt	2/3	4.2 to 4.5	4.5	0.6	NA	NA/NA	
Copper	3/3	8.2 to 29	29	1.8	18.7	18.7/108	TEL
Iron	3/3	7,090 to 24,800	24,800	1,530	NA	NA/NA	
See notes at end of table							

**Table 5-1 (Continued)
Summary of Analytes Detected in Sediment**

Sampling Event Report
Potential Source of Contamination 37
Ex-Power Barge Dock Area
Naval Air Station Jacksonville
Jacksonville, Florida

Chemical Name	Frequency of Detections ¹	Range of Detects	Maximum Detected Concentration	Background Concentrations ³	USEPA Region IV Sediment Screening Values ⁴	FDEP Sediment TEL/PEL Guidelines ⁵	Exceeds TEL and/or PEL
<u>Inorganic Analytes (mg/kg) (continued)</u>							
Lead	3/3	16.8 to 53.8	53.8	6.1	30.2	30.2/112	TEL
Magnesium	3/3	1,390 to 6,440	6,440	353.8	NA	NA/NA	
Manganese	3/3	59.1 to 378	378	21.3	NA	NA/NA	
Mercury	2/3	0.34 to 0.35	0.35	ND	0.13	0.13/0.696	TEL
Nickel	3/3	4.4 to 15.5	15.5	ND	15.9	15.9/42.8	
Potassium	3/3	214 to 1110	1,110	122.8	NA	NA/NA	
Selenium	1/3	8.2 to 8.2	8.2	1.48	NA	NA/NA	
Silver	1/3	1.9 to 1.9	1.9	ND	2	0.733/1.77	TEL/PEL
Sodium	3/3	937 to 4,530	4,530	ND	NA	NA/NA	
Thallium	1/3	6.3 to 6.3	6.3	ND	NA	NA/NA	
Vanadium	3/3	9.7 to 32.3	32.3	3.65	NA	NA/NA	
Zinc	3/3	56.6 to 125	125	ND	124	124/271	TEL
<u>General Chemistry (mg/kg)</u>							
Organic Carbon	3/3	55,000 to 160,000	160,000	NA	NA	NA/NA	

¹ Frequency of detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed (excluding rejected data).

² The background concentration is twice the average of detected concentrations for inorganic analytes in four background samples collected from the St. Johns River upgradient of OU 3 (HLA, 1999).

³ USEPA Region IV, Waste Management Division, *Sediment Screening Values for Hazardous Waste Sites* (USEPA, 1995)

⁴ TEL and PEL Sediment Quality Assessment Guidelines (MacDonald, 1994).

⁵ Value for gamma-BHC used as a surrogate.

Notes USEPA = U.S. Environmental Protection Agency.
FDEP = Florida Department of Environmental Protection.
TEL = threshold effects limit.
PEL = probable effects limit
µg/kg = micrograms per kilogram
NA = not applicable (background) or not available.

PCB = polychlorinated biphenyl.
DDE = dichlorodiphenyldichloroethene
BHC = benzene hexachloride.
mg/kg = milligrams per kilogram.
mg/kg = milligrams per kilogram.
ND = not detected.

The TEL value represents concentrations of sediment-associated contaminants that when below that value are not considered to represent significant hazards to aquatic organisms. Within the range of concentrations between the TEL and PEL, adverse biological effects are possible; above the PEL range, concentrations of sediment-associated contaminants are considered to represent significant hazards to aquatic organisms.

Analytes detected at concentrations exceeding their respective TELs but not their PELs include Aroclor-1260, delta-benzene hexachloride (BHC), arsenic, copper, lead, mercury, and zinc. In addition, gamma-BHC (Lindane) and silver were detected at concentrations exceeding their respective PEL values. Gamma-BHC was detected at a concentration of 1.3 µg/kg in only one of the three samples at location 37D00201. Although this value slightly exceeds the Florida PEL value of 0.99 µg/kg, it is less than the USEPA Region IV sediment screening value of 3.3 µg/kg. Silver was also only detected in one of three samples at location 37D00201 at a concentration of 1.9 mg/kg. This concentration slightly exceeds the Florida PEL value of 1.77 mg/kg.

5.2.3 Toxicity Tests Three bulk sediment toxicity test samples were collected from sampling locations 37D00101, 37D00201, and 37D00301 (Figure 1-2) and were submitted to ABS for toxicity tests using the marine amphipod *Leptocheirus plumulosus*. The test species, *L. plumulosus*, was chosen as the representative infaunal test species for the toxicity test because of its tolerance to a wide range of salinities from 0 to 33 parts per thousand as well as its tolerance to both coarse texture and fine grain sediment. The amphipod was evaluated for 10-day acute mortality and reburial rates. The results of the sediment toxicity tests are summarized in Table 5-2; the full laboratory report is presented in Appendix E.

**Table 5-2
Summary of Sediment Toxicity Test Results**

Sampling Event Report Potential Source of Contamination 37 Ex-Power Barge Dock Area Naval Air Station Jacksonville Jacksonville, Florida		
Sample Location	Mean Survival (Percent)	Mean Reburial (Percent)
Laboratory Control	94	94
37D00101	95	95
37D00201	95	95
37D00301	96	96

Note. No significant differences in site-related samples versus laboratory control (p=0.05).

After 10 days of exposure, mean survival and mean reburial rates of *L. plumulosus* in the laboratory control sediment sample were both 94 percent. Mean survival and reburial rates of *L. plumulosus* exposed to the PSC 37 sediment ranged from 95 to 96 percent. There were no significant differences (P = 0.05) in mean survival and reburial rates between the lab control and the site-related sediment samples. These results suggest that although concentrations of some analytes slightly exceeded FDEP SQAG guidelines, benthic macroinvertebrates are not adversely affected from exposure to sediment at PSC 37.

5.2.4 Conclusions Based on the results of the ecological screening for PSC 37 sediment, there appears to be no significant impact resulting from exposure of aquatic receptors to contaminants in sediment at PSC 37; therefore, it is recommended that this site be proposed for no further action.

6.0 REFERENCES

- ABB Environmental Services, Inc. 1997. *Naval Installation Restoration Program Plan, Naval Air Station, Jacksonville, Florida, Volume 3, Site Screening Workplan*. Prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOC), North Charleston, South Carolina.
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APPENDIX A

OFF-SITE SAMPLE TRACKING LOG

Appendix A

PSC 37
 OFFSITE SAMPLE TRACKING LOG
 SITE SCREENING, NAS JACKSONVILLE

SDG	SAMPLE ID	SAMP DATE	MATRIX	TAL MET	PAH/8310	TCL PESTPCB	TOC	TOX	DRFL	TAT	DSTV	DRFV
JAX05	37D00101	3/29/99	sediment	X	X	X	X	X	5/3/99	35	5/5/99	5/14/99
JAX05	37D00201	3/29/99	sediment	X	X	X	X	X	5/3/99	35	5/5/99	5/14/99
JAX05	37D00301	3/29/99	sediment	X	X	X	X	X	5/3/99	35	5/5/99	5/14/99

NOTES:

SDG	Sample Delivery Group (group of 20 samples or less collected not more than 14 days of each other)
SAMPLE ID	Sample Identifier
SAMP DATE	Date of Sample Collection
MATRIX	Media Sampled
TAL_MET	Target Analyte List Metals
PAH/8310	Polynuclear Aromatic Hydrocarbons, Method SW8310
PESTPCB	Target Compound List Pesticides and Polychlorinated Biphenyls
TOC	Total Organic Carbon
TOX	Toxicity test
DRFL	Date Package Received from Laboratory
TAT	Turnaround Time (days)
DSTV	Date Package Sent to Validators
DRFV	Date Package Received from Validators

APPENDIX B

SUMMARY OF DETECTIONS OF ANALYTICAL RESULTS

Appendix B

**Summary of Detections in Sediment Analytical Results,
PAHs, TCL Pesticides/PCBs, TAL Metals, and TOC
PSC 37**

Sampling Event Report
Naval Air Station, Jacksonville
Jacksonville, FL

Identifier	37D00101	37D00201	37D00301
Sampling Date	3/29/99	3/29/99	3/29/99
Polyaromatic Hydrocarbons, ug/kg			
Fluoranthene	33		
Pyrene	33 J		53 J
Pesticides/PCBs, ug/kg			
4,4'-DDE	1 8 J		
alpha-BHC		1 6 J	
Aroclor-1260	43 J		
beta-BHC		1 6 J	
delta-BHC		0 98 J	
Dieldrin	0 58 J		
gamma-BHC(Lindane)		1 3 J	
gamma-Chlordane		0 61 J	0 21 J
Inorganics, mg/kg			
Aluminum	4680	13500	14000
Arsenic	2 8 J	11 2 J	8 1 J
Barium	15 5 J	49 J	46 3 J
Calcium	3820	12700	12500
Chromium	13	41 8	43 4
Cobalt		4 5 J	4 2 J
Copper	8 2 J	29 J	27 5 J
Iron	7090	24300	24800
Lead	16 8	53 8	53 5
Magnesium	1390 J	6210 J	6440 J
Manganese	59 1	378	365
Mercury	0 34 J		0 35 J
Nickel	4 4 J	15 5 J	14 5 J
Potassium	214 J	1110 J	1110 J
Selenium		8 2	
Silver		1 9 J	
Sodium	937 J	3720 J	4530 J
Thallium		6 3 J	
Vanadium	9 7 J	31 8 J	32 3 J
Zinc	56 6	125	115
General Chemistry, mg/kg			
Total Organic Carbon	55000	140000	160000
NOTES:			
PAH = Polynuclear aromatic hydrocarbons			
TCL = Target compound list		TAL = Target analyte list	
PCB = polychlorinated biphenyl		TOC = Total organic carbon	
mg/kg = milligrams per kilogram		PSC = Potential source of contamination	
ug/kg = micrograms per liter			
J = Reported concentration is an estimated quantity			
Blank space indicates analyte/compound was not detected at the reporting limit			

APPENDIX C
VALIDATED ANALYTICAL DATA SHEETS

Appendix C

Analytical Results for Sediment
PAHs, TCL Pesticides/PCBs, TAL Metals, and TOC
PSC 37

Sampling Event Report
Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	37D00101	37D00201	37D00301
Lab ID	A9D010139001	A9D010139002	A9D010139003
Sampling Date	3/29/99	3/29/99	3/29/99
Polyaromatic Hydrocarbons, ug/kg			
1-Methylnaphthalene	120 U	270 U	250 U
2-Methylnaphthalene	120 U	270 U	250 U
Acenaphthene	120 U	270 U	250 U
Acenaphthylene	120 U	270 U	250 U
Anthracene	18 U	41 U	38 U
Benzo(a)anthracene	18 U	41 U	38 U
Benzo(a)pyrene	18 U	41 U	38 U
Benzo(b)fluoranthene	18 U	41 U	38 U
Benzo(ghi)perylene	18 U	41 U	38 U
Benzo(k)fluoranthene	18 U	41 U	38 U
Chrysene	18 U	41 U	38 U
Dibenzo(a,h)anthracene	18 U	41 U	38 U
Fluoranthene	33	41 U	38 U
Fluorene	18 UJ	41 UJ	38 UJ
Indeno(1,2,3-cd)pyrene	18 U	41 U	38 U
Naphthalene	120 U	270 U	250 U
Phenanthrene	18 U	41 U	38 U
Pyrene	33 J	41 UJ	53 J
Pesticides/PCBs, ug/kg			
4,4'-DDD	12 U	27 U	25 U
4,4'-DDE	18 J	27 U	25 U
4,4'-DDT	12 U	27 U	25 U
Aldrin	6.1 U	13 U	12 U
alpha-BHC	6.1 U	1.6 J	12 U
alpha-Chlordane	6.1 U	13 U	12 U
Aroclor-1016	120 U	270 U	250 U
Aroclor-1221	240 U	540 U	500 U
Aroclor-1232	120 U	270 U	250 U
Aroclor-1242	120 U	270 U	250 U
Aroclor-1248	120 U	270 U	250 U
Aroclor-1254	120 U	270 U	250 U
Aroclor-1260	43 J	270 U	250 U

Appendix C

Analytical Results for Sediment
PAHs, TCL Pesticides/PCBs, TAL Metals, and TOC
PSC 37

Sampling Event Report
Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	37D00101	37D00201	37D00301
Lab ID	A9D010139001	A9D010139002	A9D010139003
Sampling Date	3/29/99	3/29/99	3/29/99
Aroclor-1262	120 U	270 U	250 U
Aroclor-1268	120 U	270 U	250 U
beta-BHC	6.1 U	1.6 J	12 U
delta-BHC	6.1 U	0.98 J	12 U
Dieldrin	0.58 J	27 U	25 U
Endosulfan I	6.1 U	13 U	12 U
Endosulfan II	12 U	27 U	25 U
Endosulfan sulfate	12 U	27 U	25 U
Endrin	12 U	27 U	25 U
Endrin aldehyde	12 U	27 U	25 U
Endrin ketone	12 U	27 U	25 U
gamma-BHC(Lindane)	6.1 U	1.3 J	12 U
gamma-Chlordane	6.1 U	0.61 J	0.21 J
Heptachlor	6.1 U	13 U	12 U
Heptachlor epoxide	6.1 U	13 U	12 U
Methoxychlor	61 U	130 U	120 U
Toxaphene	610 U	1300 U	1200 U
Inorganics, mg/kg			
Aluminum	4680	13500	14000
Antimony	1.6 U	3.6 U	3.3 U
Arsenic	2.8 J	11.2 J	8.1 J
Barium	15.5 J	49 J	46.3 J
Beryllium	0.07 U	0.2 U	0.16 U
Cadmium	0.21 U	0.33 U	0.3 U
Calcium	3820	12700	12500
Chromium	13	41.8	43.4
Cobalt	1.2 U	4.5 J	4.2 J
Copper	8.2 J	29 J	27.5 J
Iron	7090	24300	24800
Lead	16.8	53.8	53.5
Magnesium	1390 J	6210 J	6440 J
Manganese	59.1	378	365
Mercury	0.34 J	0.28 UJ	0.35 J

Appendix C

Analytical Results for Sediment
PAHs, TCL Pesticides/PCBs, TAL Metals, and TOC
PSC 37

Sampling Event Report
Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	37D00101	37D00201	37D00301
Lab ID	A9D010139001	A9D010139002	A9D010139003
Sampling Date	3/29/99	3/29/99	3/29/99
Nickel	4.4 J	15.5 J	14.5 J
Potassium	214 J	1110 J	1110 J
Selenium	2.3 U	8.2	4.7 U
Silver	0.53 U	1.9 J	1.3 U
Sodium	937 J	3720 J	4530 J
Thallium	2.6 U	6.3 J	5.3 U
Vanadium	9.7 J	31.8 J	32.3 J
Zinc	56.6	125	115
General Chemistry			
Total Organic Carbon, mg/kg	55000	140000	160000

Appendix C

Notes to Sediment Analytical Results Table PSC 37

Sampling Event Report
Naval Air Station, Jacksonville
Jacksonville, FL

TAL = Target Analyte List	
Sample ID = Sample Identifier	
Lab ID = Laboratory Identifier	
Units	
mg/kg	milligram per kilogram
ug/kg	microgram per kilogram
The following standard validation qualifiers have the following definitions	
U	The analyte/compound was analyzed for but was not detected above the reported sample quantitation limit The number preceding the U qualifier is the reported sample quantitation limit
J	The analyte/compound was positively identified and the associated numerical value is an estimated concentration of the analyte/compound in the sample For most detected analytes and compounds, the J qualifier is also used to indicate that the reported concentration is below the contract required detection or quantitation limit
UJ	The analyte/compound was not detected above the reported sample quantitation limit The reported quantitation limit, however, is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte/compound in the sample

APPENDIX D
DATA VALIDATION REPORTS

Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) NFESC LEVEL D

Site: NAS Jacksonville - Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 14, 1999

Laboratory: Quanterra, North Canton, Ohio Reviewer: Nancy Weaver

Client Sample ID	Laboratory Sample ID	Matrix
37D00101	A9D010139-001	Soil
37D00201	A9D010139-002	Soil
37D00301	A9D010139-003	Soil
09S00102	A9D010139-004	Soil
09SBK101	A9D010139-005	Soil
40D00301	A9D010139-008	Soil
40D00101	A9D010139-009	Soil
JXR93740	A9D010139-010	Water

Holding Times - All samples were extracted within 7 days for water samples and 14 days for soil samples and analyzed within 40 days for all samples. No qualifications were required.

Initial Calibration - The initial calibration analyzed on 4/19/99 exhibited a high %RSD value for fluorene of 48.5%. Fluorene has been qualified (UJ) in all samples since all results are non-detect.

Continuing Calibration - The continuing calibration analyzed on 4/22/99 (1704) exhibited high %D values for pyrene and fluorene of 33.5% and 84.0%, respectively. Pyrene has been qualified (J) for positive results and (UJ) for non-detects in sample 37D00101. Fluorene has already been qualified due to the initial calibration and no further qualifications were required.

The continuing calibration analyzed on 4/22/99 (2352) exhibited high %D values for pyrene and fluorene of 32.3% and 84.0%, respectively. Pyrene has been qualified (J) for positive results and (UJ) for non-detects in samples 37D00201, 37D00301, 09S00102, 09SBK101, 40D00301, 40D00101, and JXR93740. Fluorene has already been qualified due to the initial calibration and no further qualifications were required.

Surrogates - Sample JXR93740 exhibited a low %R for S1-benzo(e)pyrene. All results for this sample have been qualified (UJ) since all results are non-detect.

MS/MSD - MS/MSD sample "LAB" exhibited acceptable %R and RPD values and no qualifications were required.

Laboratory Control Samples - LCS sample CT9JH102 exhibited acceptable %R values. No qualifications were required.

LCS/LCSD sample CT8FV102/CT8FV103 exhibited acceptable %R and RPD values. No qualifications were required.

Method Blank - Method blanks CT8FV101 (4/2/99) and CT9JH101 (4/5/99) were free of contamination. No qualifications were required.

Field, equipment blank - Rinsate blank JXR93740 was free of contamination. No qualifications were required.

Field Duplicates - Field duplicate samples were not analyzed with this data package. No action was taken on this basis.

Compound Quantitation - The laboratory flagged several results with a (P) indicating that the % difference between the original and confirmation analyses was >25%. The reviewer further qualified these results as estimated (J).

Comments - The analyses of environmental samples and quality control samples are valid within the constraints identified with the data quality flags as presented in the initial calibration, continuing calibration, surrogates, and compound quantitation sections of this report. Ten percent of the calculations in this data package were verified for the Level D validation. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February, 1994, were used in evaluating the data in this summary report.

Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

PESTICIDE/PCBs NFESC LEVEL D

Site: NAS Jacksonville, Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 14, 1999

Laboratory: Quanterra, Inc., North Canton, Ohio Reviewer: Nancy Weaver

Client Sample ID	Laboratory Sample ID	Matrix
09S00102	CT7GR106	Soil
09SBK101	CT7N0104	Soil
09W00201	CT7N3101	Water
09W00301	CT7N4101	Water
37D00101	CT7GN104	Soil
37D00201	CT7GP103	Soil
37D00301	CT7GQ103	Soil
40D00101	CT7N810V	Soil
40D00301	CT7N710V	Soil
JXR93740	CT7NH101	Water

Holding Times - All samples were extracted within 7 days for water samples and 14 days for soil samples and analyzed within 40 days for all samples. No qualifications were required.

Initial Calibration - The initial calibrations analyzed on 4/12/99 exhibited acceptable %RSD values. No qualifications were required.

Calibration Verification - The calibration verification QC limits were met as specified below.

1. The %D values of the PEM and Individual Mixes were $\leq 25\%$.
2. The 4,4'-DDT breakdown was $\leq 20\%$.
3. The endrin breakdown was $\leq 20\%$.
4. The combined breakdown was $\leq 30\%$.

Resolution - Resolution criteria have been met and no action has been taken.

Method Blanks - Method blank PBLANK1 (4/2/99) exhibited alpha-BHC, beta-BHC, delta-BHC, and gamma-BHC contamination at 0.0046 ug/L, 0.013 ug/L, 0.0030 ug/L; and 0.0029 ug/L, respectively, however, all associated results are non-detect and no qualifications were required.

Method blank PBLANK2 (4/2/99) exhibited alpha-chlordane contamination at 0.0029 ug/L, however, all associated results are non-detect and no qualifications were required.

Method blank PBLANK3 (4/2/99) exhibited alpha-BHC, methoxychlor, and alpha-chlordane contamination at 0.052 ug/kg, 0.86 ug/kg, and 0.10 ug/kg, respectively. Alpha-BHC has been qualified (U) in associated sample 09SBK101. All other associated results are non-detect and no further qualifications were required.

Field, equipment blank - Rinsate blank JXR93740 was free of contamination. No qualifications were required.

Surrogates - Sample JXR93740 exhibited low %R values for surrogate compounds DCB1 and DCB2 of 8% and 8%, respectively. All results for this sample have been rejected (R).

MS/MSD - A MS/MSD sample was not analyzed with this data package.

Laboratory Control Samples - A LCS sample was not analyzed with this data package.

Field Duplicates - Field duplicate samples were not analyzed with this data package.

Compound Identification - Retention times were acceptable and no further action was taken.

Pesticide Cleanup Checks - The % recoveries were within the QC limits for the florisol cartridge cleanup and GPC cleanup. No qualifications were required.

Compound Quantitation - Several compounds in several samples exhibited high %D values (>25%) between columns and were flagged (P) by the laboratory and further qualified (J) by the reviewer.

Comments - The analyses of environmental samples and quality control samples are valid within the constraints identified with the data quality flags as presented in the method blank and compound quantitation sections of this report with the exception of all results for sample JXR93740 which have been rejected (R) due to low surrogate recoveries. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February, 1994, were used in evaluating the data in this summary report.

Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

TAL METALS/MERCURY NFESC LEVEL D

Site: NAS Jacksonville - Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 13, 1999

Laboratory: Quanterra, North Canton, Ohio Reviewer: Douglas Weaver

Client Sample ID	Laboratory Sample ID	Matrix
JXR93740	CT7NH	Water
09SBK101*	CT7N0	Soil
09S00102*	CT7GR	Soil
37D00101	CT7GN	Soil
37D00101MS	CT7GNMS	Soil
37D00101MSD	CT7GNMSD	Soil
37D00201	CT7GP	Soil
37D00301	CT7GQ	Soil
40D00101	CT7N8	Soil
40D00301	CT7N7	Soil

* - Analyzed for mercury only.

Holding Times - All samples were prepared and analyzed within the recommended holding time of 180 days for all metals and 28 days for mercury. No qualifications were required.

Initial and Continuing Calibration Verification (ICV/CCV) - All ICV and CCV %R values were acceptable. No qualifications were required.

Method and Calibration Blanks - The water preparation blank PBW (4/6/99), initial, and/or continuing calibration blanks exhibited contamination for several compounds, however, all sample results are non-detect or greater than 5X the blank concentration with the exception of the following. Barium, cadmium, calcium, cobalt, copper, iron, magnesium, manganese, and sodium have been qualified (U) in sample JXR93740.

The soil preparation blank PBS (4/6/99), initial, and/or continuing calibration blanks exhibited contamination for several compounds, however, all sample results are non-detect or greater than 5X the blank concentration with the exception of the following. Antimony has been qualified (U) in sample 40D00101. Beryllium has been qualified (U) in samples 37D00201 and 37D00301. Cadmium has been qualified (U) in sample 37D00101.

Cobalt has been qualified (U) in samples 37D00101 and 40D00101. Mercury has been qualified (U) in samples 09SBK101, 09S00102, and 40D00101. Silver has been qualified (U) in samples 37D00101, 37D00301, and 40D00301.

ICP Interference Check Sample - The ICP interference check sample %R results met the 80-120% QC criteria. No qualifications were required.

Field and equipment blank - Rinsate blank JXR93740 was free of contamination. No qualifications were required.

LCS - The water LCS exhibited acceptable %R values. No qualifications were required.

The soil LCS exhibited acceptable results within QC limits. No qualifications were required.

ICP Serial Dilution - Water ICP serial dilution sample JXR93740L exhibited acceptable %D values. No qualifications were required.

Soil ICP serial dilution sample 37D00101L exhibited acceptable %D values. No qualifications were required.

Matrix Spike - Water matrix spike sample JXR93740S exhibited acceptable %R values. No qualifications were required.

Soil matrix spike sample 37D00101S exhibited a low %R value for mercury of 62.3%. Positive mercury results have been qualified (J) in all soil samples.

Matrix Duplicate - Water matrix duplicate sample JXR93740D exhibited acceptable RPD values. No qualifications were required.

Soil matrix duplicate sample 37D00101D exhibited acceptable RPD values. No qualifications were required.

Field Duplicates - Field duplicate samples were not analyzed with this data package.

Compound Quantitation - All results between the IDL and CRDL which have been flagged with a "B" by the laboratory have been qualified as estimated "J" by the reviewer.

Comments - The analyses of environmental samples and quality control samples are valid within the constraints identified with the data quality flags as presented in the method blank, matrix spike, and compound quantitation sections of this report. Ten percent of the calculations in this data package were verified for the Level D validation. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February, 1994, were used in evaluating the data in this summary report.

Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

TOTAL ORGANIC CARBON (TOC) NFESC LEVEL C

Site: NAS Jacksonville - Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 14, 1999

Laboratory: Quanterra, Inc., North Canton, Ohio Reviewer: Nancy Weaver

Client Sample ID	Laboratory Sample ID	Matrix
37D00101	A9D010139-001	Soil
37D00201	A9D010139-002	Soil
37D00301	A9D010139-003	Soil
40D00301	A9D010139-008	Soil
40D00101	A9D010139-009	Soil

Holding Times - All samples were analyzed within the recommended holding time of 28 days for TOC. No qualifications were required.

Method Blanks - The method blanks were non-detect. No qualifications were required.

Field and equipment blank - Field QC samples were not associated with the samples in this data package.

LCS - The LCS samples exhibited acceptable %R values. No qualifications were required.

Matrix Spike - A MS/MSD sample was not analyzed with this data package. No qualifications were required.

Field Duplicates - Field duplicate samples were not analyzed with this data package.

Comments - The analyses of environmental samples and quality control samples are valid. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February, 1994, were used in evaluating the data in this summary report.

APPENDIX E
TOXICITY TEST REPORT

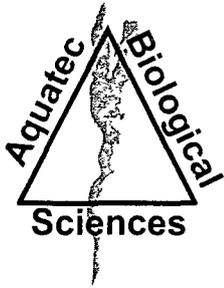
Draft
Results of
Leptocheirus plumulosus Survival and Reburial
Toxicity Tests
BTR 2838

Prepared for:
Harding Lawson Associates
2590 Executive Center, East Circle
Tallahassee, Florida 32301



Prepared by:
Aquatec Biological Sciences
75 Green Mountain Drive
South Burlington, Vermont

April 1999



Aquatec Biological Sciences



Ecology



Environmental
Toxicology



Natural Resource
Assessments



Microbiology

BTR: 2838

PROJECT: 99020

I have reviewed this data package, which was completed under my supervision. This data package is complete, and to the best of my ability, accurately reflects the conditions and the results of the reported tests.

John W. Williams
Toxicity Laboratory Manager

4/27/99

Date

I have reviewed and discussed this data package with the responsible laboratory manager. Based on this review, the data package was, to the best of my knowledge and belief, conducted in accordance with established company quality assurance procedures.

Philip C. Downey, Ph.D.
Director

4/27/99

Date

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
INTRODUCTION	2
METHODS	2
PROTOCOL DEVIATIONS	2
RESULTS	2
QUALITY ASSURANCE	2

LIST OF APPENDICES

- APPENDIX A: RESULTS OF WHOLE SEDIMENT TOXICITY TESTS
- APPENDIX B: CHAIN-OF-CUSTODY DOCUMENTATION
- APPENDIX C: LABORATORY DOCUMENTATION AND DATA ANALYSES FOR
Leptocheirus plumulosus TOXICITY TESTS
- APPENDIX D: RESULTS OF STANDARD REFERENCE TOXICANT TESTS

EXECUTIVE SUMMARY

Results of the *Leptocheirus plumulosus*
Sediment Toxicity Tests
Conducted March-April 1999
NAS Jacksonville, Florida for Harding Lawson Associates

Laboratory Sample ID	Client Sample ID	Species	Mean Survival (%)	Mean Reburial (%)
8820	37D00101	<i>Leptocheirus plumulosus</i>	95	95
8821	37D00201	<i>Leptocheirus plumulosus</i>	95	95
8822	37D00301	<i>Leptocheirus plumulosus</i>	96	96
8823	40D00101	<i>Leptocheirus plumulosus</i>	93	90
8824	40D00301	<i>Leptocheirus plumulosus</i>	96	94
8827	Laboratory Control	<i>Leptocheirus plumulosus</i>	94	94

* Statistically significantly different from the control sediment ($p \leq 0.05$)

INTRODUCTION:

Samples were received for toxicity testing at Aquatec Biological Sciences of 75 Green Mountain Drive, South Burlington, Vermont. The results of the following tests are reported:

Client:	Harding Lawson Associates, Tallahassee, Florida
Permit Number:	N/A
Sites:	NAS Jacksonville, PSC 37 and PSC 40
Initial Sampling Date:	3/29/99
Tests Conducted:	<i>Leptocheirus plumulosus</i> , Survival and Reburial

METHODS:

The procedures followed in conducting the toxicity tests were based on methods described by the USEPA (EPA 600/R-94/025). Specific test parameters for the *Leptocheirus plumulosus* toxicity test are listed in Table 1.

PROTOCOL DEVIATIONS:

Protocol deviations were not encountered.

RESULTS:

Tabulated summary results for the *Leptocheirus plumulosus* toxicity tests are located in Appendix A. None of the tested samples were shown to have significantly less ($p < 0.05$) survival or reburial responses than the Control sample (8827) which had 94 percent survival and reburial.

QUALITY ASSURANCE:

A standard reference toxicity test performed with *Leptocheirus plumulosus*, the resulting LC50 value was plotted on the developing control chart limit was deemed acceptable.

Table 1. Test conditions for the amphipod (*Leptocheirus plumulosus*) 10-day whole sediment survival and reburial toxicity test.

ASSOCIATED PROTOCOL: EPA 1994. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Estuarine and Marine Amphipods* (EPA/600/R-94/025).

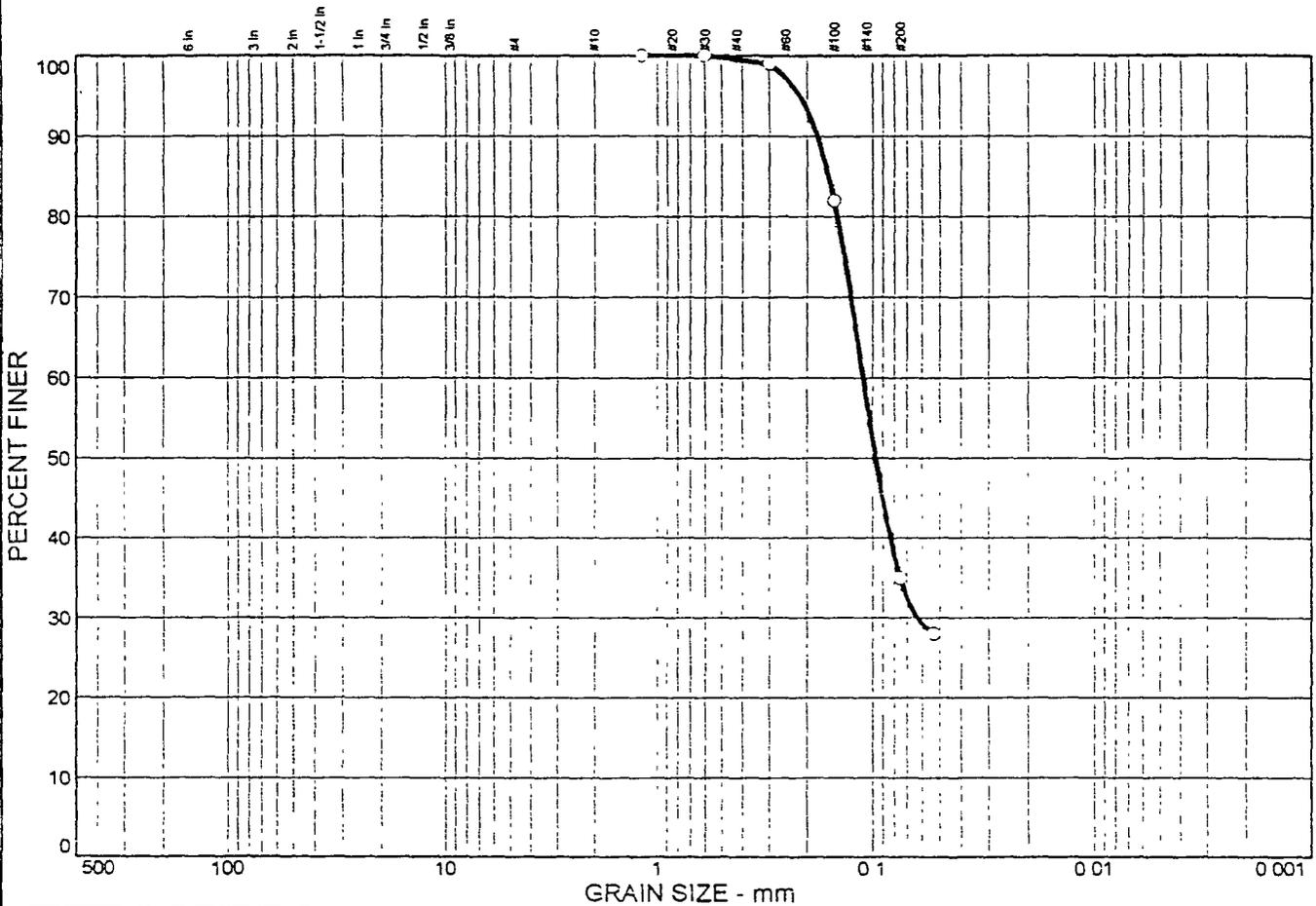
1. Test type:	Static
2. Temperature:	25 ± 1 °C
3. Light quality:	Wide-spectrum fluorescent lights
4. Light illuminance:	500 to 1000 lux (46-93 ft-c)
5. Photoperiod:	Continuous
6. Test chamber size:	1000 mL beaker
7. Sediment volume:	175 mL
8. Overlying water volume:	750 mL
9. Renewal of overlying water:	None
10. Age of test organism:	Juvenile (2-4 mm)
11. Organism Source:	Chesapeake Cultures, Hayes, Virginia
12. Number of organisms / test chamber:	20
13. Number of replicate test chambers/tested:	5
14. Feeding regime:	None
15. Aeration:	Gentle aeration with outlet positioned above sediment
16. Overlying Water:	Forty Fathoms artificial sediment (salinity 20‰ ± 2‰)
17. Control sediment:	Natural marine sediment collected from organism source, 0.5 mm sieved

Table 1. Test conditions for the amphipod (*Leptocheirus plumulosus*) 10-day whole sediment survival and reburial toxicity test (continued).

18. Sediment preparation:	Thoroughly homogenize sediments, add 175 mL aliquots to each replicate test chamber
19. Test chamber cleaning:	None
20. Water quality monitoring:	
Temperature	Daily (overlying water)
Dissolved oxygen	Daily (overlying water)
pH	Daily (overlying water)
Salinity	Beginning of test (porewater)
Ammonia, total	Daily (overlying water)
	Beginning of test (pore water)
	Days 2 and 8 (overlying water)
	Beginning of test (pore water)
21. Biological monitoring/ organism behavior:	Daily, all replicates
22. Test duration:	10 days
23. Retrieval of organisms	0.5 mm sieve and repicked if recovery <90%
24. End points:	Survival and reburial
25. Reference toxicant:	Cadmium chloride 96-h acute, water only
26. Test acceptability:	Minimum mean negative control survival of $\geq 90\%$
28. Data interpretation:	Hypothesis testing versus the negative control and/or the reference site responses

Appendix A

Grain Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0	0	65	35	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100		
#30	100		
#50	99		
#100	82		
#200	35		
#270	28		

Soil Description

HLAFLA Sediment
Sample #8820

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.159 D₆₀= 0.110 D₅₀= 0.0964
D₃₀= 0.0626 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Delivered By Mail on 4-16-99
Tested By Peter Rixford on 4-22-99
F.M.=0.19

(no specification provided)

Sample No.: 1 Source of Sample: Date: 4-22-99
Location: Elev./Depth:

Knight Consulting Engineers, Inc.

Client: Aquatec Biological Services
Project: General Testing

Project No: 99207

Page 1 of 6

Appendix B

Chain of Custody Record

75 Green Mtg Dr
South Burlington, VT 05403

BTR
2838

Quanterra
Aquatic Biological Sciences

QUA 4124

Client HARDING LAWSON ASSOC		Project Manager LISSA MILLER		Date 3/29/99	Chain Of Custody Number 07279
Address Building 554 NAS Jacksonville		Telephone Number (Area Code)/Fax Number 904 772 7688 / 779 9348 Fax		Lab Number	Page 1 of 1
City Jacksonville	State FL	Zip Code 32212	Site Contact Alex Ollis	Analysis	
Project Name GTO 40 RRDS 2508.09		Carrier/Waybill Number 8112330237-45			
Contract/Purchase Order/Quote No					

Aquatic

Sample No.	Sample ID No and Description	Date	Time	Sample Type	Total Volume	Containers		Preservative	Condition on Receipt	Amphipod Toxicity Test	Heartworm Toxicity	Rotifer Seed germination
						Type	No					
820	37 D 001 01	3/29/99	1130	SED	1 gal		1	Ice to 4°C				
821	37 D 002 01	↓	1230	↓	↓		1	↓				
822	37 D 003 01	↓	1300	↓	↓		1	↓				
823	40 D 001 01	3/30/99	1130	↓	↓		1	↓				
824	40 D 003 01	3/29/99	1515	↓	↓		1	↓				
825	09 S 001 02	3/30/99	1400	SOIL	↓		1	↓			XX	XX
826	09 S BK 1 01	3/30/99	1440	SOIL	↓		1	↓				

Special Instructions

Possible Hazard Identification <input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown				Sample Disposal <input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months							
Turn Around Time Required <input type="checkbox"/> Normal <input checked="" type="checkbox"/> Rush		QC Level <input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III		Project Specific (Specify)							
1 Relinquished By Alexander Ollis		Date 3/30/99		Time 1530 H		1 Received By Aquatic Biological Sciences		Date 3/31/99		Time 10:00	
2 Relinquished By		Date		Time		2 Received By		Date		Time	
3 Relinquished By		Date		Time		3 Received By		Date		Time	

Comments
Temperature 0.8°C on delivery 3/31/99

DISTRIBUTION WHITE - Stays with Sample, CANARY - Returned to Client with Report, PINK - Field Copy

Aquatec Biological Sciences

Chain-of-Custody Record

75 Green Mountain Drive
 South Burlington, VT 05403
 TEL: (802) 860-1638
 FAX: (802) 658-3189

COMPANY INFORMATION	COMPANY'S PROJECT INFORMATION	SHIPPING INFORMATION	VOLUME/CONTAINER TYPE/ PRESERVATIVE (NOTE 4)					
Name: <u>John Williams</u> Address: <u>AQUATEC BIOLOGICAL SCIENCES</u> Telephone: <u>(802) 860-1638</u> Facsimile: <u>(802) 658-3189</u> Contact Name: <u>John Williams</u>	Project Name: <u>HLATLA</u> Project Number: <u>99020</u> Sampler Name(s): <u>John Williams</u> Quote #: _____ Client Code: _____	Carrier: _____ Airbill Number: _____ Date Shipped: _____ Hand Delivered: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No						

SAMPLE IDENTIFICATION (NOTE 1)	COLLECTION		GRAB	COMPOSITE	MATRIX	ANALYSIS/REMARKS (NOTE 2,3)	NUMBER OF CONTAINERS					
	DATE	TIME										
8820	3/24/99	11:30	X			Grain Size						
8821	3/29	11:30	X									
8822	3/29	11:30	X									
8823	3/30	11:30	X									
8824	3/29	15:15	X									
8829	3/30	-	X									

Relinquished by: (signature)	DATE	TIME	Received by: (signature)	NOTES TO SAMPLER(S). (1) Limit Sample Identification to 30 characters, if possible; (2) Indicate designated Lab Q C sample and type (e.g. :MS/MSD/REP) and provide sufficient sample, (3) Field duplicates are separate sample, (4) e.g. : 40 ml/glass/H ₂ SO ₄ Notes to Lab: _____ _____ _____
Relinquished by: (signature)	DATE	TIME	Received by: (signature)	
Relinquished by: (signature)	DATE	TIME	Received by: (signature)	

Appendix C

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	8827	1	1.0000	1.4588
1	8827	2	0.9500	1.3453
1	8827	3	0.9500	1.3453
1	8827	4	0.9000	1.2490
1	8827	5	0.9000	1.2490
2	8820	1	0.9000	1.2490
2	8820	2	1.0000	1.4588
2	8820	3	1.0000	1.4588
2	8820	4	0.9500	1.3453
2	8820	5	0.9000	1.2490
3	8821	1	1.0000	1.4588
3	8821	2	1.0000	1.4588
3	8821	3	1.0000	1.4588
3	8821	4	0.9500	1.3453
3	8821	5	0.8000	1.1071
4	8822	1	0.9500	1.3453
4	8822	2	1.0000	1.4588
4	8822	3	1.0000	1.4588
4	8822	4	0.9500	1.3453
4	8822	5	0.9000	1.2490
5	8823	1	0.9500	1.3453
5	8823	2	0.8500	1.1731
5	8823	3	0.9500	1.3453
5	8823	4	0.9000	1.2490
5	8823	5	1.0000	1.4588
6	8824	1	0.9500	1.3453
6	8824	2	1.0000	1.4588
6	8824	3	0.9500	1.3453
6	8824	4	1.0000	1.4588
6	8824	5	0.9000	1.2490

T 4/26/99

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.2776

W = 0.9391

Critical W = 0.9000 (alpha = 0.01 , N = 30)

W = 0.9270 (alpha = 0.05 , N = 30)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 1.9114

(p-value = 0.8613)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)

= 11.0705 (alpha = 0.05, df = 5)

Title: Leptocheirus plumulosus survival
File: 2838lps Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	8827	5	1.2490	1.4588	1.3295
2	8820	5	1.2490	1.4588	1.3522
3	8821	5	1.1071	1.4588	1.3657
4	8822	5	1.2490	1.4588	1.3714
5	8823	5	1.1731	1.4588	1.3143
6	8824	5	1.2490	1.4588	1.3714

Title: Leptocheirus plumulosus survival
File: 2838lps Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	8827	0.0075	0.0868	0.0388	6.5306
2	8820	0.0110	0.1049	0.0469	7.7600
3	8821	0.0233	0.1527	0.0683	11.1794
4	8822	0.0079	0.0889	0.0397	6.4809
5	8823	0.0117	0.1084	0.0485	8.2463
6	8824	0.0079	0.0889	0.0397	6.4809

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.0143	0.0029	0.2475
Within (Error)	24	0.2776	0.0116	
Total	29	0.2919		

(p-value = 0.9370)

Critical F = 3.8951 (alpha = 0.01, df = 5,24)

= 2.6207 (alpha = 0.05, df = 5,24)

Since $F < \text{Critical F}$ FAIL TO REJECT H_0 : All equal (alpha = 0.05)

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	8827	1.3295	0.9400		
2	8820	1.3522	0.9500	-0.3337	
3	8821	1.3657	0.9500	-0.5331	
4	8822	1.3714	0.9600	-0.6166	
5	8823	1.3143	0.9300	0.2233	
6	8824	1.3714	0.9600	-0.6166	

Dunnett critical value = 2.3600 (1 Tailed, alpha = 0.05, df = 5,24)

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	8827	5			
2	8820	5	0.0959	10.2	-0.0100
3	8821	5	0.0959	10.2	-0.0100
4	8822	5	0.0959	10.2	-0.0200
5	8823	5	0.0959	10.2	0.0100
6	8824	5	0.0959	10.2	-0.0200

Title: Leptocheirus plumulosus reburial

File: 2838lpr

Transform:

ARC SINE(SQUARE ROOT(Y))

Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	8827	1	1.0000	1.4588
1	8827	2	0.9500	1.3453
1	8827	3	0.9500	1.3453
1	8827	4	0.9000	1.2490
1	8827	5	0.9000	1.2490
2	8820	1	0.9000	1.2490
2	8820	2	1.0000	1.4588
2	8820	3	1.0000	1.4588
2	8820	4	0.9500	1.3453
2	8820	5	0.9000	1.2490
3	8821	1	1.0000	1.4588
3	8821	2	1.0000	1.4588
3	8821	3	1.0000	1.4588
3	8821	4	0.9500	1.3453
3	8821	5	0.8000	1.1071
4	8822	1	0.9500	1.3453
4	8822	2	1.0000	1.4588
4	8822	3	1.0000	1.4588
4	8822	4	0.9500	1.3453
4	8822	5	0.9000	1.2490
5	8823	1	0.9500	1.3453
5	8823	2	0.7500	1.0472
5	8823	3	0.9500	1.3453
5	8823	4	0.8500	1.1731
5	8823	5	1.0000	1.4588
6	8824	1	0.9500	1.3453
6	8824	2	1.0000	1.4588
6	8824	3	0.9500	1.3453
6	8824	4	0.9500	1.3453
6	8824	5	0.8500	1.1731

4/26/99

Title: Leptocheirus plumulosus reburial

File: 2838lpr

Transform:

ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.3468

W = 0.9477

Critical W = 0.9000 (alpha = 0.01 , N = 30)

W = 0.9270 (alpha = 0.05 , N = 30)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: Leptocheirus plumulosus reburial

File: 2838lpr

Transform:

ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 2.7912

(p-value = 0.7321)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)

= 11.0705 (alpha = 0.05, df = 5)

Title: Leptocheirus plumulosus reburial
File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	8827	5	1.2490	1.4588	1.3295
2	8820	5	1.2490	1.4588	1.3522
3	8821	5	1.1071	1.4588	1.3657
4	8822	5	1.2490	1.4588	1.3714
5	8823	5	1.0472	1.4588	1.2739
6	8824	5	1.1731	1.4588	1.3335

Title: Leptocheirus plumulosus reburial
File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	8827	0.0075	0.0868	0.0388	6.5306
2	8820	0.0110	0.1049	0.0469	7.7600
3	8821	0.0233	0.1527	0.0683	11.1794
4	8822	0.0079	0.0889	0.0397	6.4809
5	8823	0.0265	0.1627	0.0728	12.7737
6	8824	0.0105	0.1023	0.0457	7.6690

Title: Leptocheirus plumulosus reburial

File: 2838lpr

Transform:

ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.0314	0.0063	0.4350
Within (Error)	24	0.3468	0.0144	
Total	29	0.3782		

(p-value = 0.8196)

Critical F = 3.8951 (alpha = 0.01, df = 5,24)
= 2.6207 (alpha = 0.05, df = 5,24)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal (alpha = 0.05)

Title: Leptocheirus plumulosus reburial
 File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	8827	1.3295	0.9400		
2	8820	1.3522	0.9500	-0.2985	
3	8821	1.3657	0.9500	-0.4769	
4	8822	1.3714	0.9600	-0.5517	
5	8823	1.2739	0.9000	0.7308	
6	8824	1.3335	0.9400	-0.0534	

Dunnett critical value = 2.3600 (1 Tailed, alpha = 0.05, df = 5,24)

Title: Leptocheirus plumulosus reburial
 File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	8827	5			
2	8820	5	0.1097	11.6	-0.0100
3	8821	5	0.1097	11.6	-0.0100
4	8822	5	0.1097	11.6	-0.0200
5	8823	5	0.1097	11.6	0.0400
6	8824	5	0.1097	11.6	0.0000

Amphipod, *Leptocheirus plumulosus*, 10 Day Survival in Sediment

Sample No.: NA

Organism Survival Data

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Client Sample ID: NA Sample Descriptor: NA

Laboratory Water: NA Receiving Water: NA

Test ended 4/12/99

Test Initiated: 4/2/99 12:00 JTG

Sample Number	Replicate	No. Surviving	Initials/ Date	No. Recov. on Repick	Initials/ Date	Total Surviving	No. Reburied*	Remarks/Comments
8820	A	18	JTG 4/12	—	—	18	18	2 chironomids found in 8820A (removed) JTG 4/12
8820	B	20	JTG 4/12	—	—	20	20	
8820	C	19/20	JTG 4/12	—	—	20	20	
8820	D	19	JTG 4/12	—	—	19	19	1 chironomid found 8820D (removed) JTG 4/12
8820	E	18	JTG 4/12	—	—	18	18	

8821	A	20	JTG 4/12	—	—	20	20	
8821	B	20	JTG 4/12	—	—	20	20	1 nematode found (small). JTG 8821B 4/12
8821	C	20	JTG 4/12	—	—	20	20	
8821	D	19	JTG 4/12	—	—	19	19	1 chironomid found JTG 4/12 8821D
8821	E	16	JTG 4/12	—	—	16	16	

8822	A	19	JTG 4/12	—	—	19	19	2 nematodes found 8822A JTG 4/12
8822	B	20	JTG 4/12	—	—	20	20	
8822	C	20	JTG 4/12	—	—	20	20	
8822	D	19	JTG 4/12	—	—	19	19	
8822	E	18	JTG 4/12	—	—	18	18	1 dead found 8822E - JTG 4/12

8823	A	19	JTG 4/12	—	—	19	19	found
8823	B	17	JTG 4/12	—	—	17	15	found 1 dead 8823B JTG 4/12
8823	C	19	JTG 4/12	—	—	19	19	
8823	D	18	JTG 4/12	—	—	18	17	
8823	E	21	JTG 4/12	—	—	21	21	

Comments/Notes: * # reburied = # surviving (initial count) - # not reburied, OLW = overlying water

Reviewed By/Date: JTG 4/26/99

Amphipod, Leptocheirus plumulosus, 10 Day Survival in Sediment

Sample No.: NA

Organism Survival Data

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838
 Client: Harding Lawson Associates Client Project Reference: NA
 Client Sample ID: NA Sample Descriptor: NA
 Laboratory Water: NA Receiving Water: NA

Test ended 4/12/99

Test Initiated: 4/2/99 12:00 J

Sample Number	Replicate	No. Surviving	Initials/ Date	No. Recov. on Repick	Initials/ Date	Total Surviving	No. Reburied*	Remarks/Comments
8824	A	19	JJG 4/12	—		19	19	
8824	B	20 19	JJG 4/12	—		20	20	
8824	C	19	JJG 4/12	—		19	19	
8824	D	20	JJG 4/12	—		20	19	
8824	E	18	JJG 4/12	—		18	17	1 dead found 8:30 AM JJG 4/12
8827	A	20	JJG 4/12	—		20	20	
8827	B	19	JJG 4/12	—		19	19	
8827	C	19	JJG 4/12	—		19	19	
8827	D	18	JJG 4/12	—		18	18	
8827	E	18	JJG 4/12	—		18	18	

Comments/Notes: * # reburied = # surviving (initial count) - # not reburied. OLW = overlying water

Reviewed By/Date: J 4/26/99

Amphipod, Leptocheirus plumulosus, 10 Day Survival in Sediment
Daily Biological Monitoring

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Laboratory Water: NA Receiving Water: NA

Sample Number	Replicate	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
8820	A	AB	AB	AB	AB	AB	AB	AB	1 on surface dead?	AB	AB	Some
8820	B								AB			motus
8820	C											or
8820	D											dead
8820	E											on
8821	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	Some
8821	B			1 dead on surface								motus
8821	C			AB								or
8821	D											dead
8821	E											on
8822	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	Some
8822	B											motus
8822	C											or
8822	D											dead
8822	E											on
8823	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	Some
8823	B											motus
8823	C											or
8823	D											dead
8823	E											on
8824	A	AB	AB	AB	1 dead on surface	AB	AB	AB	AB	AB	AB	Some
8824	B				AB				1 on surface dead?			motus
8824	C								AB			or
8824	D			1 dead on surface								dead
8824	E			AB								on

Initials:	JJG	JJG	JJG	JJG								
Date/Time:	4/2/99 13:45	4/3/99 11:15	4/4/99 14:00	4/5/99 12:15	4/6/99 10:15	4/7/99 14:40	4/8/99 11:45	4/9/99 11:15	4/10/99 12:15	4/11/99 12:00	4/12/99 03:30	

Comments/Notes: Codes AB = all burrowed, S = swimming, F = floating, AS = avoiding sediment

Record the number exhibiting coded behaviors Any floaters should be resubmerged

1 dead on surface, may be a molt. JJG

Reviewed By/Date: JJG 4/26/99

Amphipod, *Leptocheirus plumulosus*, 10 Day Survival in Sediment
Daily Biological Monitoring

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Laboratory Water: NA Receiving Water: NA

Sample Number	Replicate	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
8827	A	AB										
8827	B											
8827	C											
8827	D											
8827	E											

Initials:	JJG	JJG	JJG	JJG								
Date/Time:	4/2/99 13:45	4/3/99 11:15	4/4/99 14:00	4/5/99 12:15	4/6/99 10:15	4/7/99 14:00	4/8/99 11:45	4/9/99 11:15	4/10/99 12:15	4/11/99 12:00	4/12/99 0830	

Comments/Notes: Codes AB = all burrowed, S = swimming, F = floating, AS = avoiding sediment

Record the number exhibiting coded behaviors Any floaters should be resubmerged

Reviewed By/Date: J 4/26/99

Initial Sediment Characterization

Test Facility: Aquatic Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838
 Client: Harding Lawson Associates Client Project Reference: NA
 Client Sample ID: NA Sample Descriptor: NA
 Laboratory Water: NA Receiving Water: NA

Sample Number	Sediment Visual Characterization	volume wt. (g) per sediment per replicate	Vol. (mL) pore water	Pore Water Characterization			
				pH	Salinity	mg/L Ammonia (✓)	Sulfide (✓)
8820	blackish, silty (fine), no organisms found	200	NS ³⁰⁰ / _{JG}	7.0	17‰	29	
8821	blackish, silty (fine) no organisms found	200	NS ³⁰⁰ / _{JG}	6.9	1‰	49	
8822	blackish-brown (fine) lumpy - some clams found (removed)	200	350	6.9	2‰	49	
8823	blackish-brown (gritty). lumpy, no organisms	200	175	7.3	1‰	5	
8824	blackish, silty (fine), no organisms found	200	350	6.9	3‰	34	
8827	dark gray, fine-gritty, watery - no organisms	200	325	7.5	20‰	7.4	

Comments/Notes: ✓ = Sample preserved for subsequent analysis NS indicates insufficient pore water for analysis

SEDIMENTS were distributed to test chambers and setup with aeration. 4/1/99 JJG
 TEST START - 4/2/99 12:00 JJG

Entered By/Date: J

Reviewed By/Date: 4/26/99

Amphipod, Leptocheirus plumulosus, 10 Day Survival in Sediment

Water Chemistry Data

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Laboratory Water: NA Receiving Water: NA

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8820	pH	7.9	8.1	8.1	8.0	8.0	8.0	7.9	7.8	7.7	7.7	7.6
	DO (mg/L)	7.2	7.0	7.6	7.4	7.4	7.4	7.0	7.3	7.3	7.2	7.4
	Temp (°C)	24.8	25.1	23.0	22.4	23.7	24.7	25.4	24.4	24.5	24.3	24.1
	Salinity (‰)	19	X	X	X	X	20	X	X	X	X	21

24.0 after temp. adjustment.

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8821	pH	8.1	8.1	8.1	8.0	8.0	8.0	7.9	7.8	7.7	7.6	7.5
	DO (mg/L)	7.3	7.0	7.1	6.9	6.9	6.8	6.8	7.1	7.1	7.1	7.0
	Temp (°C)	24.7	25.1	25.1	24.9	25.5	25.7	25.6	25.3	25.0	24.6	24.5
	Salinity (‰)	19	X	X	X	X	20	X	X	X	X	20

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8822	pH	8.1	8.0	8.1	8.0	8.0	8.0	7.9	7.9	7.8	7.7	7.6
	DO (mg/L)	7.3	7.1	7.1	6.9	6.9	6.8	6.8	7.1	7.1	7.0	7.1
	Temp (°C)	24.8	25.2	25.3	25.3	25.8	25.8	25.7	25.6	25.4	25.1	24.9
	Salinity (‰)	20	X	X	X	X	20	X	X	X	X	20

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8823	pH	8.0	8.1	8.1	8.0	8.1	8.1	8.0	8.0	8.1	8.0	8.0
	DO (mg/L)	7.3	6.9	7.2	6.9	7.0	6.8	6.9	7.2	7.2	7.2	7.3
	Temp (°C)	25.0	25.1	25.2	24.9	25.5	25.9	25.9	25.7	25.4	25.2	25.3
	Salinity (‰)	20	X	X	X	X	20	X	X	X	X	20

Initials/Date/ Time:	JJG 4/2/99 10:30	JJG 4/3/99 11:15	JJG 4/4/99 13:50	JJG 4/5/99 12:00	JJG 4/6/99 16:15	JJG 4/7/99 14:40	JJG 4/8/99 11:30	JJG 4/9/99 11:00	JJG 4/10/99 12:15	JJG 4/11/99 11:55	JJG 4/12/99 11:00
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Comments/Note: X = no sample required Test temperature regulated by waterbath. JJG. Turned up heater for cart with SS20, SS24, SS27 ENV beakers to increase temperature of test. 4/4/99 JJG. Adjusted heater again for same cart 4/5/99 JJG.

Amphipod, Leptocheirus plumulosus, 10 Day Survival in Sediment

Water Chemistry Data

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Laboratory Water: NA Receiving Water: NA

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8824	pH	7.9	8.0	8.0	8.0	8.0	7.9	7.9	7.8	7.7	7.6	7.6
	DO (mg/L)	7.1	7.0	7.4	6.9	7.0	7.1	6.8	7.0	7.0	6.9	7.0
	Temp (°C)	24.2	25.3	23.3	23.5	24.3	25.3	26.0	25.2	25.4	25.1	24.6
	Salinity (‰)	20	X	X	JJG X ↑	X	20	X	X	X	X	20

24.7 after temp. adjustment.

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8827	pH	8.1	8.1	8.0	8.0	7.9	7.9	7.9	7.8	7.9	7.9	7.8
	DO (mg/L)	7.2	7.0	7.4	7.0	7.1	7.1	6.9	7.2	7.2	7.2	7.2
	Temp (°C)	24.9	25.5	23.3	23.5	24.2	25.2	25.7	24.9	25.0	24.7	24.4
	Salinity (‰)	20	X	X	JJG X ↑	X	20	X	X	X	X	21

24.5 after temp. adjustment.

Initials/Date/ Time:	JJG 4/2/99 10:30	JJG 4/3/99 11:15	JJG 4/4/99 13:50	JJG 4/5/99 12:00	JJG 4/6/99 10:15	LLS 4/7/99 1440	JJG 4/8/99 11:30	JJG 4/9/99 11:00	JJG 4/10/99 12:15	JJG 4/11/99 11:55	JJG 4/12/99 NR
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Comments/Note. X = no sample required

Reviewed By/Date: J 4/26/99

Organism Holding and Acclimation

Species: <i>Leptocheirus plumulosus</i>	Date Received: 3/31/99 No. ordered: 750
Supplier: Chesapeake Cultures	Collection Date: 3/30/99 (Cultured)
Apparent Condition: Good	Culture ID: LP33199

Acclimation / Holding Procedures: Daily remove 50% L of shipping water, 20 ‰ Forty Fathoms artificial seawater. Feed algal food stock supplied with organisms. Aerate lightly. Provide 8-12h dark cycle for feeding. Hold at 25°C.

Daily Feeding: Several mL of algal food stock

Monitoring. Examine over a light box daily, record apparent condition. Temperature daily; pH, D.O, salinity.

1999 Date	Fed	Temp	pH	D.O.	Cond uct.	Sal.	Hard.	Alk.	Water Chg.	Condition *	Init.
3/31 ¹⁴⁴⁰	✓	22.6	7.8	7.8		20			1/3 ✓	OK/N	JW
4/1	✓	25.6	7.9	7.1	—	20			1/2 ✓	NORMAL	JTG
4/2	✓	25.5	7.8	6.9		20				NORMAL	JTG
4/3											
4/4											

* N = normal, appear healthy. Record # dead if any observed.

Sediment test start (Date/time/init.) J 4/2/99 SRT test start: (Date/time/init.) 4/2/99 J.

Chesapeake Cultures

P.O. Box 507 Hayes, Va. 23072 (804) 693-4046

Shipment Information

Species Leptocheirus plumulosus Date 3/30/99
Age 2-4 mm P.O. No. verbal
Quantity 150+ Invoice No. 3070

Temperature 22°C Salinity 20‰ pH 7.94

Rec. Conditions Temp. 18.7°C Organisms active.
D.O. > 20 mg/l
Sel. 20‰
pH 7.3

Notes Sediment is from pristine York River Marsh, passed through
a 250 micron sieve and subsequently frozen. No water is
added during processing. Sediment provided by Chesapeake
Cultures is from the same source as sediment used at our
facility for culturing L. plumulosus. It is the responsibility
of the recipient to determine its suitability for testing.

Biologist SG More

Rec
3/31/99

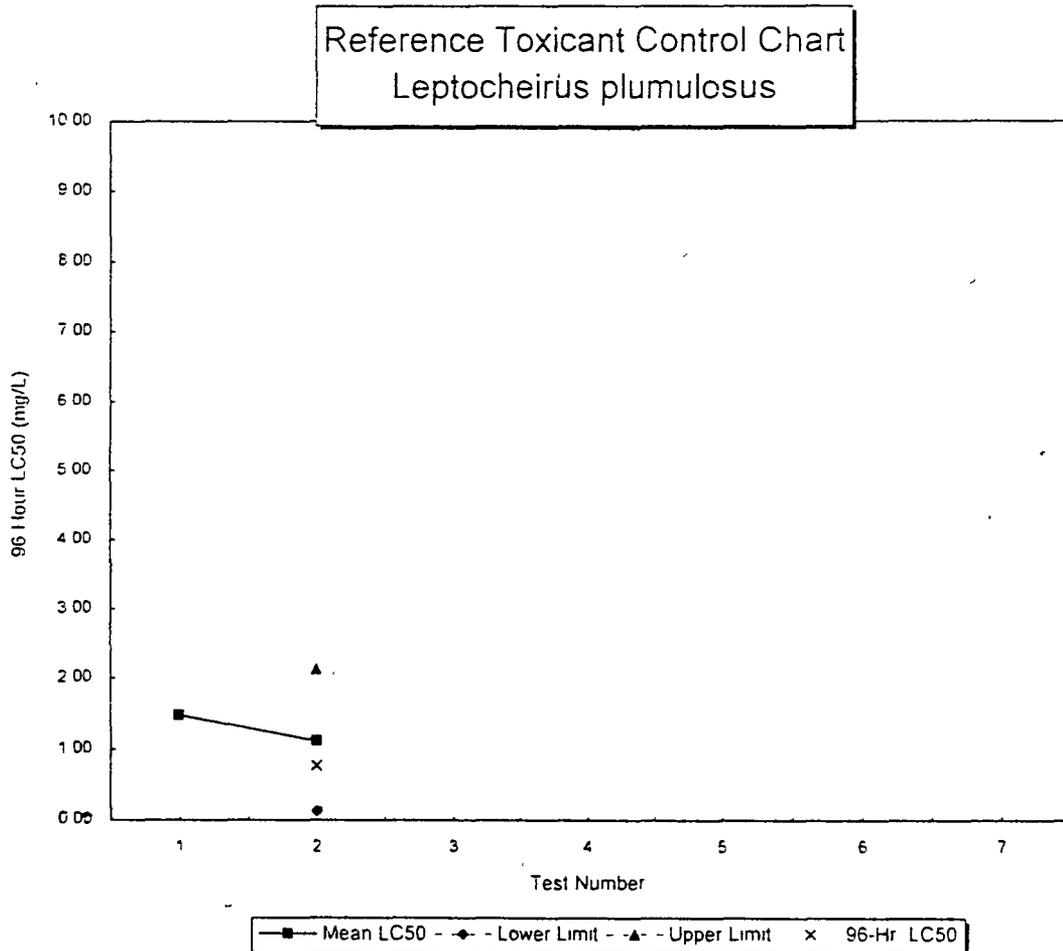
: Please inspect shipment carefully upon arrival and report any problem immediately.

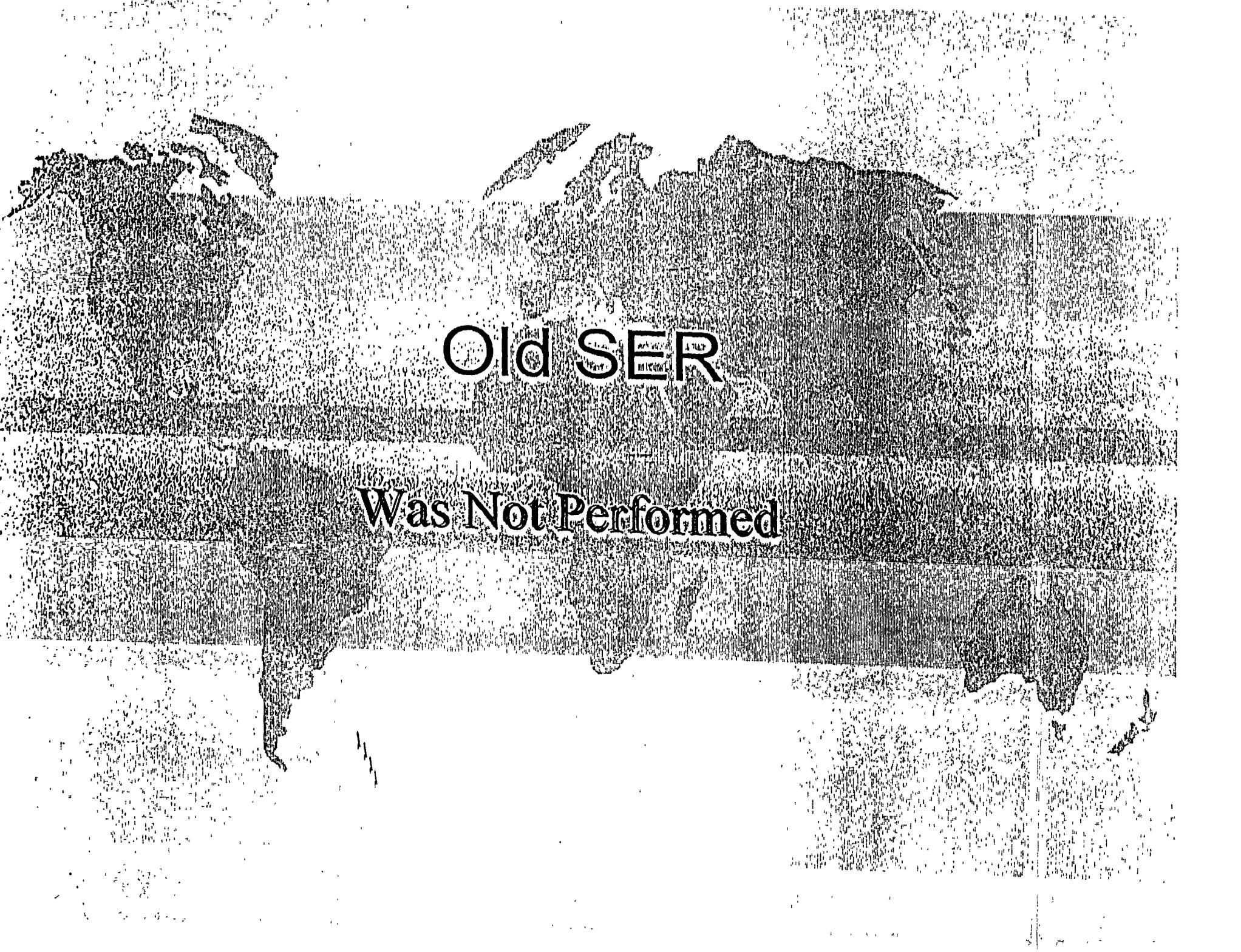
JW

Appendix D

Leptocheirus plumulosus
Cadmium Chloride Reference Toxicant Control Chart

TEST NUMBER	TEST DATE	96-Hr. LC50 (mg/L)	Mean LC50 (mg/L)	Lower Limit	Upper Limit	Organism Source
1	12/20/97	1.479	1.48			Chesapeake Cultures
2	04/02/99	0.772	1.13	0.13	2.13	Chesapeake Cultures
3						
4						
5						
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18						
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Old SER

Was Not Performed