APPENDIX E
SEDIMENT BIOASSAY DATA QUALITY REVIEW AND LABORATORY AUDITS AND MARINE SEDIMENT BIOASSAY REPORT EVS ENVIRONMENTAL CONSULTANTS

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This appendix summarizes the Laboratory Audit and Sediment Bioassay Data Quality Review of the amphipod and juvenile polychaete sediment bioassays conducted by EVS, Environmental Consultants of N. Vancouver, B.C. Dinnel Marine Research was contracted to provide an audit of the larval bivalve bioassays and that report is included as Attachment E-1 to this appendix. EVS, Environmental Consultants is a State of Washington-accredited laboratory (Lab accreditation number C046: Expires on April 23, 1997) and is certified to perform the sediment bioassays under the Puget Sound Estuary Program (PSEP) protocols. The marine sediment bioassay report prepared by EVS, Environmental Consultants is included as Attachment E-2 to this appendix. Attachment E-3 presents A Toxicity Profile and Analysis of 4-Methyl Phenol conducted by EVS.

Laboratory Audit

A laboratory audit was performed of the EVS, Environmental Consultants North Vancouver Laboratory on October 4, 1996, to evaluate the 10-day amphipod and 20-day juvenile polychaete sediment bioassays. The checklists used to perform this audit are included at the end of this appendix.

Amphipod Bioassays

The amphipod 10-day bioassay using *Eohaustorius estuarius* was initiated on September 27, 1996. Sediment bioassays were conducted in accordance to revised Puget Sound Estuary Program (PSEP, 1995) protocols. Two reference toxicant tests were performed; a 4-day acute toxicity positive control with cadmium chloride and a 10-day spiked sediment positive control with ammonia. No deviations from the amphipod test protocols were observed during the laboratory audit. One beaker had a glass aeration pipette that was out of the overlying water in the test chamber. This was noted to the laboratory attendant and remedied immediately. Laboratory personnel stated that the air lines for the test beakers are checked two to three times a day and any problems immediately corrected.

Juvenile Polychaete Bioassay

The 20-day juvenile polychaete bioassay using *Neanthes arenaceodentata* was being set up on the day of the laboratory audit. The polychaetes were received

by EVS on September 24, 1996, and the test was to have been initiated by October 4, 1996. However, because of low initial body weights for the polychaetes, test initiation was delayed. Therefore, a full test-in-progress audit was not conducted. The laboratory test area and the test chambers that had been set up for bioassay initiation were evaluated. The sediment bioassay was being set up in accordance to PSEP (1995) protocols. Two reference toxicant tests were performed; a 4-day acute toxicity positive control with cadmium chloride and a 20-day spiked sediment positive control with ammonia.

No deviations from the juvenile polychaete test protocols were observed during the laboratory audit

Sediment Bioassay Data Quality Review

Samples from 25 locations (including three reference sites) were submitted for toxicity testing to EVS Environmental Consultants of North Vancouver, BC. Sediment samples were collected between September 3 and 13, 1996, and were transported to the laboratory between September 4 and 13, 1996. The following three bioassays were conducted using the sediments collected from the Whatcom Waterway Site:

- 10-day amphipod mortality test using *Eohaustorius estuarius*;
- 20-day juvenile polychaete growth test using *Neanthes arenaceodentata*; and
- 48-hour bivalve larval development test using *Mytilus edulis*.

The following criteria were evaluated as part of this data quality review:

- Holding times;
- Bioassay performance in negative control and reference sediments;
- Bioassay performance in positive control tests; and
- Bioassay test conditions.

Laboratory performance in the sediment bioassays were evaluated against the most recent Puget Sound Estuary Program (PSEP, 1995) protocols and Sediment Management Standards Marine Bioassays Recommended Quality Assurance and Quality Control Deliverables (Ecology, 1996). This report presents the QA/QC summary only for the 10-day amphipod mortality test using

Eohaustorius estuarius and the 20-day juvenile polychaete growth test using *Neanthes arenaceodentata*. Dinnel Marine Research was contracted to provide a QA/QC evaluation of the 48-hour bivalve larval development test using *Mytilus edulis*.

10-Day Amphipod Mortality Test Using Eohaustorius estuarius

The amphipod bioassay using *Eohaustorius estuarius* as the test species was conducted on 22 sediment samples from Whatcom Waterway, three reference site sediments (Carr Inlet, WA), and one clean, negative control sediment (Beaver Creek, OR). The bioassay was conducted according to EVS SOP 1077-1 (EVS, 1995a).

The amphipod bioassay was initiated on September 27, 1996, well within the 56-day PSDDA holding time limit. The sediments were held in the dark at 4°C during the holding period. Nitrogen was added to sediment sample jars with headspace prior to storage.

The amphipod bioassay was successfully completed with no protocol deviations and only minor water quality deviations (salinity exceedences) that should not have affected the quality or usability of the data.

The reference toxicant test 96-hour 50% Lethal Concentration (96-h LC50) of 11.9 mg/L cadmium was within the laboratory mean of 7.3 $\pm$ 6.4 mg/L Cd (mean $\pm$ 2SD) obtained by EVS in previous testing. There are no PSSDA-specified control limits for *Eohaustorius estuarius*; however, the reported 96-h LC50 for Cd is within the control limits reported in ASTM (1995) for *Eohaustorius estuarius* of 9.33 (7.20 to 12.09) mg/L Cd. Water quality parameters measured in the cadmium reference toxicity test were within the following acceptable ranges: temperature, 15.0 to 15.5 °C; pH, 7.6 to 7.9; dissolved oxygen, 7.9 to 8.3 mg/L; and salinity, 29 to 30 ppt.

A second reference toxicity test was performed with ammonia-spiked sediment. The 10-day LC50 was 191.8 mg/L NH_3. This value was within the laboratory mean of 2.55 $\pm$ 75.3 mg/L NH_3 (mean $\pm$ 2SD) obtained by EVS in previous testing. Water quality parameters measured in the 10-day test were within the following ranges: temperature, 15.0 to 15.5 °C; pH, 7.4 to 8.1; dissolved oxygen, 6.3 to 8.4 mg/L; and salinity, 29 to 30 ppt.

There was no reported mortality in the negative controls for this bioassay, and the test was acceptable by SMS performance standards. The mortality response from all three reference sediments were within the SMS limit of <25 percent mortality.

The maximum detected concentration of ammonia (total ammonia in mg/L NH_3) in interstitial water (collected on days 0, 5, and 10) was 51.5 mg/L in sample EVS-25. While SMS does not provide a critical control limit for ammonia for the amphipod *Eohaustorius estuarius,* this value was below the EPA application limit of 60 mg/L NH_3 for *Eohaustorius estuarius* (EPA, 1995) and the 10-day LC50 of 191.8 mg/L NH_3 recorded for the positive control.

SMS does not provide a specific control limits for salinity in overlying water for *Eohaustorius estuarius* but states that the seawater should be maintained at the ambient interstitial salinity for the sediment collection site for *Eohaustorius estuarius.* The sediment from the collection site (Beaver Creek, OR) was used as the negative control (EVS-23) with a measured interstitial salinity of 28 to 30 ppt. All of the interstitial and overlying water salinity measurements were within the acceptable range of 27 to 31 ppt.

All reported pH and dissolved oxygen values were within acceptable limits. All temperatures recorded for the test chambers were within the SMS specified range of 15 ± 1°C.

Final QA Determination. All *Eohaustorius estuarius* data are of acceptable quality and fully usable.

20-Day Juvenile Polychaete Growth Test Using Neanthes arenaceodentata

The 20-day static-renewal juvenile polychaete (*Neanthes arenaceodentata*) bioassay was conducted on 22 sediment samples from Whatcom Waterway, three reference site sediments (Carr Inlet, WA), and one clean, negative control sediment (West Beach, Whidbey Island, WA). The bioassay was conducted according to EVS SOP 1078-1 (EVS, 1995b).

The juvenile polychaete bioassay was initiated on October 4, 1996, within the 56-day PSEP holding time limit. The sediments were held in the dark at 4°C during the holding period. Nitrogen was added to sediment sample jars with headspace prior to storage.

The juvenile polychaete bioassay was successfully completed with no protocol deviations and only minor water quality deviations (high ammonia levels in one test sample) that should not have affected the quality or usability of the data.

The reference toxicant test 96-hour 50% Lethal Concentration (96-h LC50) of 13.4 mg/L cadmium was slightly higher the laboratory mean of 8.2 ± 3.8 mg/L

Cd (mean ± 2SD) obtained by EVS in previous testing, indicating that this batch of polychaetes may have been slightly more tolerant to cadmium than the others tested by the laboratory. However, this reported value was within the LC50 values of 12.5 ± 5.4 mg/L cadmium calculated using the data in the Corps DAIS database as presented in PSEP (1995) and are considered acceptable. Water quality parameters measured in the cadmium reference toxicity test were within the following acceptable ranges: temperature, 19.0 to 19.5 °C; pH, 7.7 to 8.1; dissolved oxygen, 7.4 to 8.0 mg/L; and salinity, 26 to 28 ppt.

A second reference toxicity test was performed with ammonia-spiked sediment. The 20-day LC50 was 141.4 mg/L NH_3. A laboratory mean for ammonia-spiked reference toxicant was not available because of insufficient data points; however, EVS reported that the calculated LC50 value was consistent with the range of values previously obtained; 138.4 to 176.2 mg/L NH_3. Water quality parameters measured in the 20-day reference toxicant test were within the following acceptable ranges: temperature, 19.5 to 20.5 °C; pH, 7.7 to 8.1; dissolved oxygen, 6.4 to 7.3 mg/L; and salinity, 28 to 30 ppt.

There was no reported mortality in the negative control for this bioassay, and the test is acceptable by SMS performance standards. The calculated individual growth rate in the negative control (0.53 mg/ind/day) was greater than the minimum QA/QC control level of 0.38 mg/ind/day and therefore considered acceptable. The calculated individual growth rates from all three reference sediments were within the acceptable SMS limit of at least 80 percent of that of the negative control. In addition, the mean initial dry weight of the juvenile polychaetes was 0.79 mg, which is within the SMS performance standard of 0.5 and 1.0 mg.

The maximum detected concentration of ammonia (total ammonia in mg/L NH_3) in interstitial water (collected on days 0, 5, and 10) was 39.5 mg/L in Sample EVS-25. PSEP provides a control limit for unionized ammonia for *Neanthes arenaceodentata* of 0.7 mg/L. Using a general rule of thumb that for the waters of Puget Sound, the unionized ammonia is approximately 2% of the total ammonia concentration, the maximum detected concentration is slightly above the 0.7 mg/L limit. However, the ammonia levels did not appear to cause any adverse effects (mortality or growth) in this test sample. Additionally, the maximum detected concentration was well below the calculated LC50 of 141.4 mg/L for total NH_3. All of the reported sulfide results in overlying water were below the PSEP control limit of 5.0 mg/L.

All of the recorded overlying water salinity measurements were within the SMS specified acceptable range of 28 ± 2 ppt. The interstitial water measurements were all above the SMS control limit of 20 ppt.

All pH and dissolved oxygen were within acceptable limits. All temperatures recorded for the test chambers were within the SMS specified range of 20 ± 1°C.

Final QA Determination. All *Neanthes arenaceodentata* data are of acceptable quality and fully usable.

References for Appendix E

Ecology, 1995. Sediment Sampling and Analysis Plan Appendix, Department of Ecology, Sediment Management Unit. Draft. December 1995.

EVS (EVS Environment Consultants), 1995a. *Eohaustorius estuarius* 10-d amphipod toxicity test. EVS SOP 1077-1. In:EVS Consultants Laboratory Standard Operating Procedures (SOPs) Manual. Volume II: Sediment. EVS Environment Consultants, North Vancouver, BC.

EVS, 1995b. *Neanthes* 20-d sediment toxicity test. EVS SOP 1078-1. In: EVS Consultants Laboratory Standard Operating Procedures (SOPs) Manual. Volume II: Sediment. EVS Environment Consultants, North Vancouver, BC.

PSEP (Puget Sound Estuary Program), 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. July 1995. 85 pp.

Appendix-E.doc

Hart Crower Testing-Progress Audit of Sediment Bioassay

Checklist for 10-day Amphipod Bioassay

Species: Coho

Project Name: WHATCOM WATERWAY
Laboratory: EVS - VANCOUVER
Test Personnel: JENNIFER STEWART et al
Test Initiation Date: 9/27/96
Audit Date: 10/4/96
Auditor: TAKU FUJI
Test Type: 10-DAY MORTALITY
Test SOP: PSEP '95
Number of Samples: 22
Date After Initiation:
SOP Deviations:

Other Notes:

I. Shipping and Holding Conditions

\# Samples Received: 54
\# Samples Tested: 22
Holding Time at Test Initiation:
Holding Conditions: 4°C DARK
Problems Noted in Shipping and Holding:

II. Test Set-up Conditions

Protocol Used: PSEP '95
Deviations?:
Number of Samples: 22
Test Species: Coho
Holding Conditions: 15 ± 1 °C
Feeding During Holding?: No
Protocol Available?: YES
Test Initiation Date: 9/27/96
Multiple Batches?: No
Animal Source: NW AQUATICS
Holding Time: 3-DAYS
Size Selection Criteria:
Other Notes: 9/24/96 REC'D
9/19/96 COLLECTED

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Checklist for 10-day Amphipod Bioassay

III. Bioassay Test Conditions

Source of Negative Control Sediment: Brown Creek
Volume of Sediment Used: 175 ml
Seatwater Source: EVS - MARINE LAB BURRARD INLET
Seatwater Holding Time: < 48 HRS
Sediment Equilibration Period?: OVERNIGHT
Number of Amphipod/Beaker: 20
Interstitial Salinities Checked?: YES
All Beakers Aerated?: ALL EXCEPT ONE (EVS-9 REP A)
Water Salinity: 29-30‰
Water pH: 7.7 - 8.4
Reburial Test to be Conducted?: YES

Species

of Reference Sediments: 3 SEDIMENT
Volume of Overlying Water: ~800 ml
Seawater Treatment: SAND FILTRATION + U.V.
Number of Replicated: 5
Photoperiod: CONT. LIGHT
Feeding During Test: NO
Salinity Adjustment Conducted?: —
Water Temperature: 16.0 - 15.0
Water DO: 7.9 - 8.3
Emergence Data Collected: YES

IV. Quality Assurance Conditions

Beakers Randomized: YES
Positive Controls Used: YES
Sulfide and Ammonia Monitoring - Overlying Water?: SULFIDE T=0 T=10
Sulfide and Ammonia Monitoring - Interstitial Water?: AMMONIA T=0 T=5 T=10

Daily Test Records Maintained?: YES
Positive Control Toxicant: Cd

V. SOP Deviations of Problems Noted:

- GLASS PIPETTE OUT OF OVERLYING WATER IN ONE BEAKER
- PIPETTE REPLACED, AIR LINES CHECKED 2-3 TIMES

QA Officer: TAKU FUJI
Audit Date: 10/4/96

Hart Crower Testing-Progress Audit of Sediment Bioassay

Checklist for 20-day Juvenile Polychaete Bioassay

Species: NEANTHES SP.

Project Name: WHATCOM
Laboratory: EVS-VANCOUVER
Test Personnel: JENNIFER STEWART
Test Initiation Date: 10/4/96
Audit Date: 10/4/96

Auditor: TAKU FUJI
Test Type: 20-DAY GROWTH
Test SOP: PSEP '95
Number of Samples:
Date After Initiation: 0

SOP Deviations:

Other Notes:

I. Shipping and Holding Conditions

Samples Received:
Samples Tested:
Holding Time at Test Initiation:
Holding Conditions:
Problems Noted in Shipping and Holding:

II. Test Set-up Conditions

Protocol Used: PSEP '95
Deviations?:
Number of Samples:
Test Species: NEANTHES
Holding Conditions: 20°C CONT LIGHT
Feeding During Holding?: YES
Other Notes: 9/30/96 COLLECT
10/1/96 REC'D

Protocol Available?: YES
Test Initiation Date: 10/4/96
Multiple Batches?: NO
Animal Source: DAN REISCH
Holding Time: 3-DAYS
Average Weight At To: 0.79

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HARTCROWSER

Checklist for 20-day Juvenile Polychaete Bioassay

III. Bioassay Test Conditions

Source of Negative Control Sediment: WEST BEACH
Volume of Sediment Used: 175 ml
Seatwater Source: EVS-MAINE LAB
Seatwater Holding Time: LESS THAN 2-DAY
Sediment Equilibration Period?: OVERNIGHT
Number of Worms/Beaker: 5
Interstitial Salinities Checked?: YES
All Beakers Aerated?: -
Water Salinity: -
Water pH: -

Species

of Reference Sediments: 3 - REFS
Volume of Overlying Water: ~ 900 ml
Seawater Treatment: SAND FILTRATION + U.V.
Number of Replicated: 5
Photoperiod: CONT LIGHT
Feeding During Test: YES
Salinity Adjustment Conducted?:
Water Temperature: -
Water DO: -
Seawater Renewal Schedule: 1/3 VOLUME EVERY

IV. Quality Assurance Conditions

Beakers Randomized: YES
Positive Controls Used: YES
Daily Test Records Maintained?: YES
Positive Control Toxicant: $CdCl_2$
Sulfide and Ammonia Monitoring - Overlying Water?: SULFIDE T=0 T=20
Sulfide and Ammonia Monitoring - Interstitial Water?: ~~AMMONIA~~ T=0 T=10 T=20

V. SOP Deviations of Problems Noted:

QA Officer: TAKU FUJI
Audit Date: 10/4/96

ATTACHMENT E-1
QUALITY ASSURANCE EVALUATION
OF THE MUSSEL (*Mytilus edulis*) LARVAL BIOASSAYS
DINNEL MARINE RESEARCH

DMR-9701

DMR

Dinnel Marine Research

QUALITY ASSURANCE EVALUATION OF THE MUSSEL (*Mytilus edulis*) LARVAL BIOASSAYS OF WHATCOM WATERWAY, BELLINGHAM SEDIMENT SAMPLES

For

Hart Crowser & Associates
Seattle, Washington

Final Report

13 February 1997

Prepared By

Dinnel Marine Research

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Tables

Figures

1.0 INTRODUCTION

EVS Environment Consultants (EVS), North Vancouver, British Columbia, Canada was contracted by Hart Crowser & Associates to conduct a suite of bioassays of sediment samples for the Bellingham Bay Whatcom Waterway Project sponsored by the Georgia Pacific Corporation. EVS is a State of Washington accredited laboratory (Lab accreditation number C046, expiration: 23 April 1997) and is certified to perform mussel larval development tests using the Puget Sound Estuary Program (PSEP 1995) protocol. A copy of EVS's accreditation certificate and Scope of Accreditation appears in Appendix 1.

This report summarizes the Quality Assurance/Quality Control (QA/QC) evaluations of the mussel (*Mytilus edulis*) larval bioassays of Whatcom Waterway sediments conducted in October/November 1996.

The QA steps taken before, during and after testing to ensure high quality data and maximum data completeness are described in this report. Major QA tasks included the following:

- A pre-test review of the laboratory protocol and Standard Operating Procedures (SOPs)
- Audits of tests in progress
- An initial evaluation of all data for completeness, correct data entries, and accurate transcription
- A final QA evaluation of overall data quality and usability

2.0 QUALITY ASSURANCE AUDIT RESULTS

2.1 REVIEW OF LABORATORY PROTOCOLS AND SOPs

The PSEP protocol for conducting the mussel larval sediment bioassay (PSEP 1995) and general laboratory Standard Operating Procedures (SOPs) were reviewed in detail prior to test initiation. The protocol and SOPs were found to be in agreement with the newly-revised PSEP (1995) protocol.

2.2 TEST-IN-PROGRESS AUDITS

Three mussel larval bioassays were conducted on the Whatcom Waterway sediment samples. The first two tests failed to meet the control survival/abnormality criterion (≥70% normal survivorship) and thus the test was repeated a third time, when a successful test was obtained. Test-in-progress audits of the first two mussel tests on 20 and 27 October revealed that the tests was being performed according to PSEP (1995) and Puget Sound Dredged Disposal Analysis Program (PSDDA 1994) protocol specifications. Results of the test-in-progress audits of the first two unsuccessful tests appear in Appendix 2. Due to a lapse of communication in EVS's Seattle office, DMR was not notified of the start time of the third (successful) test, and thus did not conduct a test-in-progress audit of this test. However, based on EVS's performance during the first two unsuccessful tests, it is reasonable to believe that the proper protocol methods and specifications were observed during the third test.

2.3 INITIAL DATA EVALUATION

All raw data forms and the electronic database file were reviewed for completeness and fidelity of transcriptions of raw data to electronic formats. A 100% check was made of all data entered into EVS's internal electronic database. All errors, omissions, clarifications, or changes needed were documented and communicated to EVS. A copy of the initial data evaluation report to EVS and EVS's response letter appear in Appendix 3. PSEP (1995) water quality assurance parameters were primarily used for QA assessments of the sediment tests. Where specific values were lacking in PSEP, PSDDA (1994) values were used. Critical protocol values for the mussel larval sediment bioassay are as follows:

Temperature, °C	15-16
Salinity, ppt	27-29
Dissolved oxygen, mg/liter	4-10
pH	7-9
Ammonia, unionized	0.13 mg/liter (oyster); values not available for mussels
Sulfide	Not given

2.4 FINAL QA EVALUATION OF OVERALL DATA QUALITY AND USABILITY

Following corrections to the data package by EVS personnel, a 100% check was made to verify each correction. Following this, an overall evaluation of data completeness and quality was accomplished. Conclusions regarding data completeness and quality are as follows (summary details for this test are given in Table 1):

1. Mussel larval bioassays were conducted on 22 Whatcom Waterway sediment samples. Three Carr Inlet reference sediments and positive (toxic) control tests with sodium dodecyl sulfate (SDS) and ammonia were run concurrently with the Whatcom Waterway test sediments.

2. Chain-of Custody procedures appeared to be satisfactory and well documented. Test and reference sediments were stored at 4° C in the dark, under nitrogen headspace, in a locked refrigerator.

3. The third (successful) mussel test was conducted within the PSDDA-allotted eight-week holding time.

4. The third test was successfully completed with no protocol deviations or exceedances in PSEP/PSDDA physical/chemical parameters.

5. The reference toxicant 50% Effective Concentrations (EC50 -- based on embryo abnormality) for this test were 3.8 mg/liter for SDS and 15.9 mg/liter for total ammonia. The SDS EC50 value was within EVS's SDS control chart upper and lower warning limits (Figure 1). No control chart limits were available for total ammonia, due to limited testing with this toxicant. There are presently no PSDDA control limits for either SDS or total ammonia for the mussel larval test because of limited test data for these two toxicants.

6. Negative (seawater only) control combined mortality/abnormality was <30% for this test series and thus acceptable by present PSDDA standards. The combined mortality/abnormality responses for all three reference sediments were within the PSDDA limit of ≤35% normalized to the negative control.

7. All unionized ammonia values were at or below about 0.024 mg/liter for the third (successful) test (the percent unionized ammonia is only about 3% of the total ammonia at 16 °C and pH of about 8.0 -- APHA, 1975). While there are no PSEP/PSDDA criteria for ammonia for mussel larvae, the maximum unionized ammonia value for this test was below limits specified for both oyster larvae (0.13 mg/liter) and echinoderm larvae (0.04 mg/liter). Therefore, any toxicity observed in this test was probably not caused by ammonia concentrations in the overlying water.

8. All sulfide values were at or below 0.05 mg/liter for this test. While there are no PSEP/PSDDA criteria for sulfide for mussel larvae, the maximum sulfide values observed in this test are well below the sulfide limit (0.5 mg/liter) specified for the echinoderm larval test. Therefore, any toxicity observed in this test was probably not caused by sulfide in the overlying water.

9. Replication was five-fold for all samples as specified by PSDDA.

10. Data completeness for the 22 Whatcom Waterway samples tested by EVS was 100%.

11. **Final QA determination:** All data are judged to be of high quality and fully usable for any future application.

Table 1. Summary of the third (successful) mussel larval test.

Mytilus edulis, 30 October to 1 November 1996:

Number of samples: 22
Number of reference sediments: 3
Holding time <8 weeks?: Yes
Average negative control combined mortality/abnormality: 25.6%
Average reference sediment combined mortality/abnormality ≤35% normalized to the negative control?: Yes
Reference toxicant 48-hr EC50s: 3.8 mg/liter for SDS; 15.9 mg/liter for total ammonia
Test parameter deviations: None
Ammonia and sulfide concentrations < critical limits?: No critical limits are available for this species. However, comparison with other similar species and their critical limits strongly suggests that ammonia and sulfide toxicity were not factors in this bioassay.

QA reviewer conclusion: Very good test with no protocol or test parameter deviations. All data fully usable for any application.

4.0 REFERENCES

APHA (American Public Health Association). 1975. Standard Methods for the Examination of Water and Wastewater. Fourteenth Edition. American Public Health Association, Washington, D. C. Page 717.

PSDDA (Puget Sound Dredged Disposal Analysis). 1994. Dredged Analysis Information System (DAIS), Version 4.4. Electronic database from Seattle District, U. S. Army Corps of Engineers.

PSEP (Puget Sound Estuary Program). 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound Sediments. Final Report by PTI Environmental Services for U. S. Environmental Protection Agency, Region 10, Office of Puget Sound, Seattle, WA. Pp 52-61.

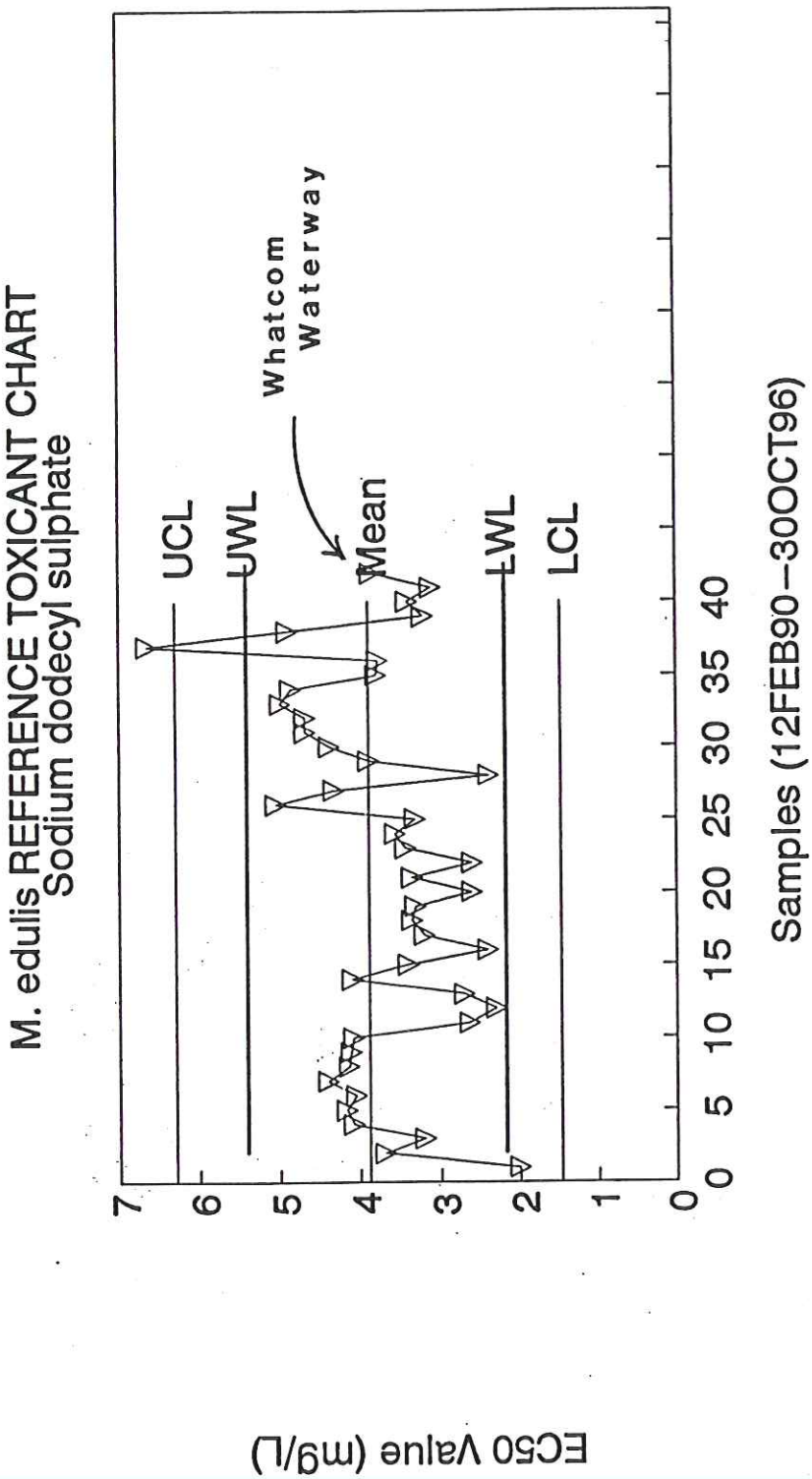

Figure 1. EVS's control chart for sodium dodecyl sulfate (SDS).

Appendix 1

EVS's State of Washington Accreditation Certificate and Scope of Accreditation

The State of Washington

Department of Ecology

This is to certify that

EVS Environment Consultants Laboratory
North Vancouver, British Columbia

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an **ACCREDITED LABORATORY** for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective on the **24th day of April, 1996** and shall expire on the **23rd day of April, 1997**.

Witnessed under my hand this **13th day of May, 1996**.

Cliff J. Kirchmer, Ph.D.
Quality Assurance Officer

LAB ACCREDITATION NUMBER
C046

SCOPE OF ACCREDITATION

EVS Environment Consultants Laboratory
North Vancouver, British Columbia

is accredited by the State of Washington Department of Ecology to perform analyses for the parameters listed below using the analytical methods indicated. This Scope of Accreditation applies to non-potable water analyses only. Accreditation for all parameters is final unless indicated otherwise in a note. EPA refers to methods of the U.S. Environmental Protection Agency. "SM" refers to APHA *Standard Methods for the Examination of Water and Wastewater*, 19th Edition.

PARAMETER	METHOD	NOTES
Algal Freshwater Growth	EPA 1003.0	7
Algal Marine Reproduction	EPA 1009	11
Algal (*Champia parvula*)	ASTM E1498-92.	14
Amphipods	ASTM E1383-94.	12
Amphipods	Swartz *et al.*, ASTM	4
Amphipod *Rhepoxynius* (Sed)	PSEP 1991	5
Bivalve Larvae	ASTM E 724-89	6
Bivalve Larvae	PTI	13
Bivalve Larvae (Sed)	PSEP 1995	5
Daphnid	EPA 600/4-90/027F	1
Daphnid Freshwater Survival Reproduction	EPA 1002.0	7
Echinoderm	EPA 600/4-87/028	11
Echinoderm	Dinnel 1987	9
Echinoderm (Sed)	PSEP 1995	5
Fathead Minnow Larval Surv Growth	EPA 1000.0	7
Salmonid	WDOE 80-12 Part A	2
Fish	EPA 600/4-90/027F	1
Inland Silverside Larval Surv Growth	EPA 1006	11
Mysid	EPA 600/4-90/027F	1
Mysid Marine Survival Growth Fecundity	EPA 1007	11
Polychaetes/*Neanthes* (Sed)	PSEP 1995	5

Fecal Coliforms	SM	9222 D	3
Fecal Coliforms	SM	9221 E	3
Fecal Streptococci/Enterococci	SM	9230 C	3
Total Coliforms	SM	9222 B	3,10
Total Coliforms	SM	9221 B	3,10

NOTES:
1. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fourth Edition).
2. Washington Department of Ecology. Biological Testing Methods. DOE 80-12, Revised June, 1991.
3. Standard Methods for the Examination of Water and Wastewater, 19th ed., 1995.
4. Swartz et al., 1985. Phoxocephalid Amphipod Bioassay of Marine Sediment Toxicity. In: Aquatic Toxicology and Hazard Assessment: Seventh Symposium ASTM STP 854.
5. Puget Sound Estuary Program. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments. July, 1995.
6. Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Four Species of Saltwater Bivalve Molluscs. ASTM 1995.
7. EPA/600/4-91/002. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Surface Waters to Freshwater Organisms.
8. Dinnel, P.A., and Q.J. Stober. 1985 Methodology and analysis of sea urchin embryo bioassays. FRI Circular No. 85-3, University of Washington, Seattle.
9. Dinnel, P.A. et al. 1987. Improved methodology for a sea urchin sperm cell bioassay for marine waters. Arch Environ Contam Toxicol. 16:23-32.
10. Applies to non-drinking water testing only.
11. EPA/600/4-91-003. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms.
12. Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates.
13. Test Protocol for West Coast Species Chronic Protocol Variability Study.
14. Standard Guide for Conducting Sexual Reproduction Tests with Seaweeds.

AUTHENTICATION: Cliff J. Kirchmer

Cliff J. Kirchmer, Ph.D.
Quality Assurance Officer

April 23, 1997
Expiration Date

Appendix 2

Results of the First Two Test-in-Progress Audits by Dinnel Marine Research

Dinnel Marine Research

CHECKLIST FOR ~~ECHINODERM~~ MUSSEL LARVAL BIOASSAY

Project Name: WHATCOM W.W. Auditor: PAUL DINNEL

Laboratory: EVS, NORTH VANCOUVER, BC Test Type: MUSSEL LARVAL

Test Personnel: JENIFER STEWART, ARMANDO TANG Test SOP: PSEP '95

Test Date: 18 OCT 96 Number of Samples: 22 + 3 REF.

SOP Deviations: NO

Other Notes:

Shipping and Holding Conditions

Samples Received: 22 + 3 REF. # Samples Tested: 22 + 3 REF.

Holding Time at Test Initiation: 45 DAYS

Holding Conditions: 4°C w/ NITROGEN

Problems Noted in Shipping and Holding: NONE

Testing Conditions

Protocol Used: PSEP '95 Protocol Available?: YES

Deviations?: NO Test Initiation Date: 18 OCT '96

Number of Samples: 22 + 3 REF. Multiple Batches?: NO

Test Species: MYTILUS SP. Animal Source: SONOMA COAST, CA

Holding Conditions: ICE CHEST Holding Time: FEW HOURS

Feeding During Holding?: NO Acceptable Spawning?: YES

Other Notes:

CHECKLIST FOR ~~ECHINODERM~~ MUSSEL LARVAL BIOASSAY

Quality Assurance Audit

Audit date: 20 OCT 96

Hours After Initiation: 40 Hr.

Source of Neg. Control Sediment: NONE

# of Reference Sediments: 3

Amount of Sediment Used: 18g

Final Water Volume: 900ml

Seawater Source BURRARD INLET

Seawater Treatment: SWO + 0.45 um FILTERS + UV.

Seawater Holding Time: 24 Hr

Number of Replicates: 5 + WQ.

Four-Hr. Settling Time?: 6 Hr.

Water Quality Replicates?: YES

Embryo Stocking Density: 30,000/JAR

Initial % Fertilization: ~ 99%

All Beakers Aerated?: NO AERATION

Water Temperature: 16.0 °C

Water Salinity: 28-29 ‰

Water DO: 5.8 - 8.7 (FROM LAB SHEETS)

Water pH: 7.3 - 7.7.

Negative Controls Used?: NO

Positive Controls Used?: SDS & AMMONIA

Positive Control Toxicant:

Daily Test Records Maintained?: YES

Internal QA Checks?: YES

QA Officer: KATHY MCPHERSON

Photoperiod: 14:10, L:D

Sulfides and Ammonia Measured at Initiation and End?: YES

Perforated Plunger/Precision Pipettes Available for Test Termination?: YES

SOP Deviations or Problems Noted: NO

QA Officer: PAUL DINNEL

Audit Date: 20 OCT 96

Dinnel Marine Research

BIVALVE (MUSSEL)

CHECKLIST FOR ~~ECHINODERM~~ LARVAL BIOASSAY

Project Name: WHATCOM WATERWAY

Auditor: PAUL DINNEL

Laboratory: EVS CONSULTANTS NORTH VANCOUVER

Test Type: BIVALVE LARVAL

Test Personnel: HOWARD BAILY ARMANDO TANG

Test SOP: PSEP '95

Test Date: 25 OCT 96

Number of Samples: 22 + 3 REF.

SOP Deviations: NO

Other Notes:

Shipping and Holding Conditions

Samples Received: 22 + 3 REF

Samples Tested: 22 + 3 REF.

Holding Time at Test Initiation: 52 DAYS

Holding Conditions: 4 °C W/ NITROGEN

Problems Noted in Shipping and Holding: NONE

Testing Conditions

Protocol Used: PSEP '95

Protocol Available?: YES

Deviations?: NO

Test Initiation Date: 25 OCT '96

Number of Samples:

Multiple Batches?: NO

Test Species: MYTILUS SP. (BLUE MUSSEL)

Animal Source: KIM SIEWERS SANTA CRUZ, CA

Holding Conditions: ICE CHEST

Holding Time: < 1 DAY

Feeding During Holding?: NO

Acceptable Spawning?: GOOD

Other Notes:

CHECKLIST FOR ~~ECHINODERM~~ BIVALVE (MUSSEL) LARVAL BIOASSAY

Quality Assurance Audit

Audit date: 27 OCT 96

Hours After Initiation: 42 HRS.

Source of Neg. Control Sediment: NONE

# of Reference Sediments: 3

Amount of Sediment Used: 18 g

Final Water Volume: 900 ml

Seawater Source BURRARD INLET

Seawater Treatment: UV + 0.45 M FILTER

Seawater Holding Time: 24 HR.

Number of Replicates: 5 + 1 WQ.

Four-Hr. Settling Time?: 5 HR.

Water Quality Replicates?: YES

Embryo Stocking Density: 37,000 / Beaker

Initial % Fertilization: >95 %

All Beakers Aerated?: NO AERATION

Water Temperature: 16.5-16.8 °C

Water Salinity: 28-28.5 ‰

Water DO: 6.1-8.3 ppm (FROM LAB SHEETS)

Water pH: 7.4-7.7 (FROM LAB SHEETS)

Negative Controls Used?: NO

Positive Controls Used?: YES

Positive Control Toxicant: SDS & ALSO AMMONIA

Daily Test Records Maintained?: YES

Internal QA Checks?: YES

QA Officer: KATHY MCPHERSON

Photoperiod: 14:10 LIGHT:DARK

Sulfides and Ammonia Measured at Initiation and End?: YES

Perforated Plunger/Precision Pipettes Available for Test Termination?: YES

SOP Deviations or Problems Noted:

NO

QA Officer: PAUL DINNEL

Audit Date: 27 OCT 96

Appendix 3

Comments by Dinnel Marine Research to EVS Following DMR's QA Review of the Final Data and EVS's Response

DMR

Dinnel Marine Research
9205 126th NE • Kirkland • WA 98033
Phone & Fax 206-822-4460

Quality Assurance Data Evaluation Report

for

Whatcom Waterway Sediment Tests Using Developing Larvae of the Blue Mussel, *Mytilus edulis*

Introduction

EVS Environment Consultants (EVS) was contracted by Hart Crowser & Associates to conduct bioassays of sediments for the Bellingham Bay Whatcom Waterway Project. This report details the Quality Assurance (QA) auditor's findings of a review of the Final Data Report for the blue mussel (*Mytilus edulis*) larval development bioassay conducted by EVS in October/November of 1996.

EVS's Final Data Report for the mussel larval development test was reviewed for errors or omissions. The Draft Report was well written, concise, and contained very few errors. However, a few corrections or clarifications need to be made to the Final Report and associated data files:

Section 4.2.1 (bottom of page 22): The acceptable PSDDA range for pH is 7.0-9.0 (8 ±1), instead of 7.5-8.5. Thus, none of your observed pH values in the mussel test fall outside the acceptable range.

Table 4-3 (page 26): Four of the total ammonia values for 0-hour appear to be transcribed incorrectly from the laboratory reporting sheets -- see enclosed photocopy of page 26.

Regarding raw data sheets for the mussel larval counts: I note that on some occasions a second vial is counted and that part of the time the second count is used instead of the first count, although there is no apparent consistency in this. Did EVS have a pre-determined plan for rejecting first counts and accepting second counts, or was the selection simply made at the discretion of the technician doing the counting? If the selection of the second counts was essentially an "arbitrary" decision on the part

of the technician, then a case could be made for "technician bias." Please review your "counting" criteria and, if use of second counts does not agree with logical *a priori* criteria, please use only the first sample counted. I would further suggest that if there is a major difference (say ±25%) between the first and second counts, then it might be best to count all three samples and average the three. In any case, please let me know your conclusions on this point.

When you are through troubleshooting the above three items, please send confirmation of any changes to the Final Report so that I might verify the corrections/changes. I will subsequently prepare a full QA report for the mussel test for Hart Crowser, with copies for both offices of EVS.

In summary, your Final Data Report is well written and contains very few errors. My congratulations and regards to your staff.

Paul A. Dinnel
QA Auditor

5 December 1996

CC: Todd Thornburg, Hart Crowser & Associates
Kim Magruder, EVS, Seattle

EVS ENVIRONMENT CONSULTANTS

Our File: 9/231-06.3

January 13, 1997

Dr. Paul Dinnel
Dinnel Marine Research
9205 126th NE
Kirkland, WA 98033

Dear Paul:

Re: Whatcom Waterway Sediment Tests Using Developing Larvae of the Blue Mussel

Thank you for your comments regarding our Draft Report for the above project. We have addressed the items outlined in your Quality Assurance Data Evaluation Report. We have made the appropriate revisions to the Draft Report and data files, affected pages are appended. They are as follows:

Section 4.2.1 (page 22).

The sentences regarding acceptable pH ranges have been removed to be consistent with the acceptable range of 7.0-9.0 specified by PSDDA.

Table 4-3 (page 26).

During preparation our Draft Report, we had only received faxed copies of the 0 h ammonia data, thus some of the values were difficult to read. We have since received the Final ammonia data (please see attached) and confirmed that the values in question were correct. Therefore no changes were made to this table.

Raw data sheets for the mussel laval counts.

We now have a "a priori" in-house criteria for counting. This criteria will be added to our standard operating procedures (SOP). However, a few mistakes did manage to get by. We have made some changes to our raw data counts. Specifically:

- Sample EVS 19, replicate A: original count used for analysis.
- Samples EVS 9, replicate B and EVS 5, replicate A: the third vial was counted and the three counts were averaged.

Table 4-1 summarizing the endpoints has been revised. Although the mean of the endpoints changed slightly, they did not affect any of the statistical results.

If you have any further comments or questions please do not hesitate to contact me at (604) 986-4331.

Yours truly,

EVS ENVIRONMENT CONSULTANTS

Jennifer Stewart

Jennifer Stewart, B.Sc.
Supervisor, Toxicology Testing

JVS/sms

1988 Triumph Street, Vancouver, B.C., Canada V5L 1K5

analytical
service
laboratories
ltd.

FAX: (604) 253-6700 TEL: (604) 253-4188

CHEMICAL ANALYSIS REPORT

Date: November 25, 1996

ASL File No. G6891

Report On: 9/231-06.3 Water Analysis

Report To: **EVS Environment Consultants**
195 Pemberton Avenue
North Vancouver, BC
V7P 2R4

Attention: **Mr. Armando Tang**

Received: November 8, 1996

ASL ANALYTICAL SERVICE LABORATORIES LTD.
per:

Heather A. Ross, B.Sc.
Project Chemist

Liana Campbell, B.Sc.
Project Chemist

REMARKS

File No. G6891

Some of the the samples reported in the following data tables contain material that interferes with the colourimetric determination of sulphide. As such, these samples were diluted to remove the interference and the detection limit was increased accordingly.

RESULTS OF ANALYSIS - Water

File No. G6891

	Sulphide S
EVS-1 Day 0 1996 Oct 30	<0.04
EVS-2 Day 0 1996 Oct 30	<0.04
EVS-3 Day 0 1996 Oct 30	<0.04
EVS-4 Day 0 1996 Oct 30	<0.02
EVS-5 Day 0 1996 Oct 30	0.04
EVS-6 Day 0 1996 Oct 30	<0.04
EVS-7 Day 0 1996 Oct 30	<0.04
EVS-8 Day 0 1996 Oct 30	0.05
EVS-9 Day 0 1996 Oct 30	<0.02
EVS-10 Day 0 1996 Oct 30	<0.04
EVS-11 Day 0 1996 Oct 30	<0.02
EVS-12 Day 0 1996 Oct 30	<0.02
EVS-13 Day 0 1996 Oct 30	<0.04
EVS-14 Day 0 1996 Oct 30	<0.02
EVS-15 Day 0 1996 Oct 30	<0.04
EVS-16 Day 0 1996 Oct 30	<0.04
EVS-17 Day 0 1996 Oct 30	0.05
EVS-18 Day 0 1996 Oct 30	<0.04
EVS-19 Day 0 1996 Oct 30	0.05
EVS-20 Day 0 1996 Oct 30	<0.04

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water

File No. G6891

	Sulphide S
EVS-21 Day 0 1996 Oct 30	<0.04
EVS-22 Day 0 1996 Oct 30	<0.04
EVS-23 Day 0 1996 Oct 30	<0.02
EVS-24 Day 0 1996 Oct 30	<0.04
EVS-25 Day 0 1996 Oct 30	<0.04
EVS-26 Day 0 1996 Oct 30	<0.04

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G6891

Water

	EVS-21 Day 0	EVS-21 Day 0
	96 10 30	QC # 77158
Inorganic Parameters		
Sulphide S	<0.02	<0.02

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 2 - METHODOLOGY

File No. G6891

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows:

Conventional Parameters in Water

These analyses are carried out in accordance with procedures described in "Methods for Chemical Analysis of Water and Wastes" (USEPA), "Manual for the Chemical Analysis of Water, Wastewaters, Sediments and Biological Tissues" (BCMOE), and/or "Standard Methods for the Examination of Water and Wastewater" (APHA). Further details are available on request.

End of Report

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94 - 99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: TAKS / Oct 30/96
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 1	A	203	23		JH
	B	229	20		JH
	C	227	29		JH
	D	196	21		JH
	E	247	29		JH
EVS 2	A	192 ~~152~~ JH	28 ~~13~~ JH		JH
	B	170 ~~201~~ JH	29 ~~24~~ JH		JH
	C	233 ~~205~~ JH	41 ~~25~~ JH		JH
	D	222	39		JH
	E	219	29		JH
EVS 3	A	152	13		JH
	B	201	24		JH
	C	205	25		JH
	D	160	19		JH
	E	237	21		JH
EVS 4	A	222	24		JH
	B	226	24		JH
	C	225	29		JH
	D	210	22		JH
	E	268	32		JH

Certified by: [signature] Date Certified: 27NOV96

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus ~~sp.~~ edulis
Source/Date: AK-5/Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 5	(2)(1) AT A	50	62	2nd Vial counted 84 NORMAL 73 ABNORMAL	JHE
	B	101	112	Normals all had leaky protoplasm	JHE
	(1) AT C	219	32	2nd Vial Counted 246 NORMAL 47 ABNORMAL	JHE
	(1) D	90	78	2nd Vial Counted 92 NORMAL 71 ABNORMAL	JHE
	E	198	72		JHE
EVS 6	A	230	16		JHE
	B	295	17		JHE
	C	314	16		JHE
	D	257	12		JHE
	E	(203)	(19)	Vials partially spilled	JHE
EVS 7	A	113	51		JHE
	B	169	70		JHE
	C	159	51		JHE
	D	126	64		JHE
	E	140	48		JHE
EVS 8	A	246	37		JHE
	B	213	25		JHE
	C	247	19		JHE
	D	244 ~~242~~ JHE	18		JHE
	E	218	25		JHE

Certified by: [signature] Date Certified: 27NOV96

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(1) Used original counts for analyses.
(2) ~~Used last count.~~ AT Averaged three counts.

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600 633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: ~~ATS~~ / Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 9	(2) A	~~JHK 134~~ 133	76	2nd Vial Counted 138 NORMAL 56 ABNORMAL	JHK
	(3) B	106	45	2nd Vial Counted 175 NORMAL 59 ABNORMAL	JHK
	C	260	28	*3rd vial Counted 91 Normal, 41 Abnormal	JHK
	D	258	33		JHK
	(2) E	158	67	2nd Vial Counted 134 ~~138~~ JHK NORMAL 71 ~~56~~ ABNORMAL	JHK
EVS 10	A	158	103		JHK
	B	156	92		JHK
	C	184	62		JHK
	D	177	81		JHK
	(2) E	94 ~~147~~ JHK	110 ~~60~~ JHK	2nd Vial Counted 119 NORMAL 128 ABNORMAL	JHK
EVS 11	A	195	70		JHK
	B	166	84		JHK
	C	147 ~~166~~ JHK	JHK ~~84~~ 60		JHK
	(2) D	110 ~~109~~ JHK	72	2nd Vial Counted 103 NORMAL 68 ABNORMAL	JHK
	E	~~JHK 152~~ 151	97		JHK
EVS 12	A	249	39		JHK
	(2) B	221	33	2nd Replicate counted 219 Normal 27 Abnormal	JHK
	C	229	29	Normals look ~~shockey~~ normal	JHK
	(2) D	169	88	2nd Replicate counted ~~157~~ JHK 154 NORMAL 105 ABNORMAL	JHK
	(2) E	40	186	(1) Abnormals very irregularly shaped Abnormality rate confirmed by HCB	JHK

Certified by: [signature] Date Certified: 27 NOV 96

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(1) 2nd Replicate counted 32 Normal 204 Abnormal

(2) Used original counts for analyses.

(3) AT ~~Used 2nd count.~~ Averaged three counts.

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: ~~AKS~~ / Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 13	A	136	44		JHL
	B	153	41		JHL
	C	177	41		JHL
	D	135	43		JHL
	E	122	32		JHL
EVS 14	A	259	24		JHL
	B	229	23		JHL
	C	193	33		JHL
	D	171	41		JHL
	E	216	20		JHL
EVS 15	A	239	24		JHL
	B	199	19		JHL
	C	203	JHL NR17		JHL
	D	195	14		JHL
	E	211	22		JHL
EVS 16	A	240	24		JHL
	B	225	21		JHL
	C	234	21		JHL
	D	229	23		JHL
	E	255	18		JHL

D. Certified by: [signature] Date Certified: 22NOV96

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06-3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: ~~AES~~ S/Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 17	① A	43	22	2nd Replicate counted NORMAL 31 ABNORMAL 17	JHK
	① B	47	17	2nd Replicate AB N 48 21	JHK
	C	188	74		JHK
	D	232	46		JHK
	E	133	42		JHK
EVS 18	A	182	42		JHK
	B	164	41		JHK
	C	238	17		JHK
	D	219	25		JHK
	E	209	32		JHK
EVS 19	~~②~~ ① A	67	51	2nd replicate counted JHK 72 normal 68 abnormal	JHK
	B	179	60		JHK
	C	199	59		JHK
	D	161	69		JHK
	E	185	77		JHK
EVS 20	A	JHK ~~249~~ 212	JHK ~~74~~ 15		JHK
	B	270	19		JHK
	C	219	14		JHK
	D	198	16		JHK
	E	247	17		JHK

Certified by: [signature] Date Certified: 27NOV96

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① Used original counts for analysis.
~~② Used 2nd count.~~ AP

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06-3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: NK-5 / Oct 30, 1996
Initial Embryo Density: 364 embryos/10 mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 21	A	219	13		JHK
	B	287	16		JHK
	C	278	16		JHK
	D	297	16		JHK
	E	258	22	~~2nd Vial Counted JHK~~ JHK	JHK
EVS 22	① A	136	83	2nd Vial Counted NORMAL ~~134~~ 141 ABNORMAL ~~69~~ 72	JHK 203
	① B	200	29	2nd Vial Counted NORMAL 187 ABNORMAL 38	JHK 225
	① C	63	43	2nd Vial Counted NORMAL 72 ABNORMAL 24	JHK 96
	① D	137	34	2nd Vial Counted NORMAL 129 ABNORMAL 31	JHK 160
	① E	84	35	2nd Vial Counted NORMAL 69 ABNORMAL 35	JHK 104
EVS 23	A	272 ~~184~~ JHK	37 ~~36~~ JHK		JHK
	B	268	32		JHK
	C	252	39		JHK
	D	298	26		JHK
	E	265 ~~132~~ JHK	32 ~~54~~ JHK		JHK
EVS 24	A	184	36		JHK
	B	165	36		JHK
	C	120	21		JHK
	D	139	33		JHK
	E	132	54		JHK

Data certified by: [signature] Date Certified: 27 Nov 96

① Used original counts for analysis.

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: ~~AS~~ AKS / Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
EVS 25	A	224	18		JPR
	① B	167	22	2nd Vial Counted NORMAL 178 ABNORMAL 16	ART
	① C	185	13	2nd Vial Counted NORMAL 184 ABNORMAL 12	ART
	D	237	21		JPR
	E	204	18		JPR
EVS 26	A	219	64		JPR
	B	236	48		JPR
	C	212	39		JPR
	D	~~196~~ 207	~~8~~ 28		JPR
	E	220	53		JPR
	A				
	B				
	C				
	D				
	E				
	A				
	B				
	C				
	D				
	E				

Lab Certified by: [signature] Date Certified: 27NOV96

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① Used original counts for analysis.

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - WATER

Clier: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: AKS / Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
Reference Toxicant					
NH_3 40 mg/L	A	10	53		JHK
	B	2	~~53~~ 55		JHK
	C	~~12~~ 13	~~53~~ 81		JHK
NH_3 20 mg/L	A	52	132		JHK
	B	46	102		JHK
	C	49	134		JHK
NH_3 10 mg/L	A	204	65		JHK
	B	144	87		JHK
	C	164	64		JHK
NH_3 5 mg/L	A	175	20		JHK
	B	199	15		JHK
	C	171	14		JHK
NH_3 2.5 mg/L	A	213	23		JHK
	B	162	20		JHK
	C	177	22		JHK
Control Seawater					
Control Seawater was cooled.	A				
	B				
	C				
	D				

Data Certified by: [signature] Date Certified: 27 NOV 96

orms\lab\datashu\Larval\LDREFTOX.WAT

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - WATER

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9602633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: AKS / Oct 30, 1996
Initial Embryo Density: 364 embryos/10mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
Reference Toxicant					
SDS 10 mg/L	A	1	16		
	B	0	22		
	C	0	13		
SDS 5.6 mg/L	A	21	153		
	B	29	74		
	C	15	64		
SDS 3.2 mg/L	A	140	86		
	B	119	64		
	C	122	90		
SDS 1.8 mg/L	A	158	36		
	B	132	38		
	C	168	30		
SDS 1.0 mg/L	A	163	21		
	B	116	~~38~~ 38		
	C	129	17		
Control Seawater					
	A				
	B				
	C				
	D				

Data Certified by: [signature] Date Certified: 27 NOV 96

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - WATER

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99
Aliquot Size (mL): 10

Date Initiated: Oct 30, 1996
Date Terminated: Nov 1, 1996
Test Species: Mytilus edulis
Source/Date: ARS / Oct 30, 1996
Initial Embryo Density: 364 embryos/10 mL
Test Volume (mL): 900 mL

Sample I.D.	Replicate	Number of Normal Larvae	Number of Abnormal Larvae	Comments	Tech. Initials
Reference Toxicant					
NH_3 1.25 mg/L	A	144	19	2nd Vial Control 149 NORMAL 14 ABNORMAL	[illegible]
	B	224	21		[illegible]
	C	213	22		[illegible]
	A				
	B				
	C				
	A				
	B				
	C				
	A				
	B				
	C				
	A				
	B				
	C				
Control Seawater					
	A				
	B				
	C				
	D				

Data Certified by: [signature] Date Certified: 27NOV96

orma\lab\datashts\Larval\LDREFTOX.WAT

ATTACHMENT E-2
MARINE SEDIMENT TESTING
EVS ENVIRONMENT CONSULTANTS

November 1996

LABORATORY REPORT

Hart Crowser & Associates Whatcom Waterway Project

Marine Sediment Testing

PREPARED FOR:

Hart Crowser & Associates
Seattle, WA

PREPARED BY:

EVS ENVIRONMENT CONSULTANTS
Seattle, WA

Hart Crowser & Associates

WHATCOM WATERWAY PROJECT
MARINE SEDIMENT TESTING

LABORATORY REPORT

Prepared for

Hart Crowser & Associates
1910 Fairview Avenue East
Seattle, WA 98102-3699
USA

Prepared by

EVS Environment Consultants
200 West Mercer St.
Suite 403
Seattle, WA 98119
USA

EVS Project No.

9/231-06.3

November 1996

Environmental Services for
Industry and Government

Seattle, U.S.A.
Vancouver, Canada

EVS ENVIRONMENT CONSULTANTS

Our File #: 9/231-06.3
Work Order # 9600631, 900632, 9600633

November 28, 1996

Ms. Kim Magruder
EVS Environment Consultants
200 West Mercer Street, Suite 403
Seattle, WA 98119
USA

Dear Ms. Magruder:

Re: Report of the Marine Sediment Toxicity Testing Program for the Whatcom Waterway Project

We are pleased to provide the results of the sediment toxicity testing on marine samples received from Hart Crowser and Associates.

We have completed marine toxicity testing on twenty six (26) sediment samples collected between September 2 - 12, 1996.

This report includes data and results for tests using the marine amphipod, juvenile polychaete and bivalve larvae. The test methods, results and raw data including statistical printouts are provided in the following report. If you have any questions or comments, please do not hesitate to contact the undersigned at (604) 986-4331.

Yours truly,

EVS ENVIRONMENT CONSULTANTS

Jennifer V. Stewart, B.Sc.
Supervisor, Toxicology Testing

Certified by:

QA/QC Committee:
Cathy McPherson, B.Sc.
Patrick Allard, M.Sc.
Farida Bishay, B.Sc.
Margot Daykin, B.Sc.
Bettina Sander, M.Sc.
Erika Szenasy, M.Sc.

JVS/sms

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TABLE OF CONTENTS

1.0
INTRODUCTION

Sediment samples were collected by EVS Environment Consultants (Seattle, WA) between September 3 and 12, 1996. The samples arrived at the EVS Environment Consultants laboratory on September 4 to 13, 1996. Samples were shipped in 5 x 2-L and 1 x 8-L glass and plastic containers. Sediments were held for 57 days from collection prior to testing and were stored at 4°C in the dark. The 56-d holding time was exceeded with the client's approval due to difficulties originating with the bivalve larval development test. If there was head space in the jars, nitrogen was added prior to storage (PSDDA, 1989).

Toxicity testing of the sediments was conducted using the amphipod, *Eohaustorius estuarius*, the juvenile polychaete, *Neanthes arenaceodentata* and the bivalve larva, *Mytilus edulis*.

The amphipod toxicity test was initiated on September 27, 1996, using field-collected immature adult amphipods. The exposure period was 10 days and the test endpoints were survival and behaviour (sediment avoidance and ability to rebury in clean sediment). The polychaete test was initiated on October 4, 1996, with juvenile polychaetes obtained from laboratory cultures. The exposure period was 20 days and the test endpoints were survival and growth (change in dry weight). The bivalve larval development test was initiated on October 30, 1996. The exposure period was 48 hours and the test endpoints were normal development, survival and combined survival/normality.

Chain-of-Custody forms submitted with the samples are provided in Appendix A. The blind coding scheme used for all testing is provided in Appendix B. The following report provides the methods and results of this testing. *Eohaustorius estuarius*, *Neanthes arenaceodentata* and *Mytilus edulis* test results and statistical printouts are provided in Appendices C, D and E, respectively.

1.1 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This study was conducted under our comprehensive QA/QC Program to ensure full documentation and minimize possible errors in computation and reporting of results. The details of our QA/QC Program are documented in our Laboratory QA/QC Manual which describes all aspects of our program, including information on general laboratory procedures, sample handling, toxicity test procedures, data interpretation and management, and documentation of results.

2.0
10-d *Eohaustorius estuarius* SEDIMENT TOXICITY TESTS

2.1 METHODS

Ten-day toxicity tests using the amphipod, *Eohaustorius estuarius*, were conducted according to EVS (EVS Environment Consultants) SOP 1077-1 (EVS, 1995a), which is based on methods described in PSEP (1995). Amphipods were collected during low tide at the mouth of Beaver Creek, Oregon using a shovel. Amphipods were sieved from the sediments, counted and then transferred to sandwich containers containing approximately 200 mL of native sediment. Each container held a maximum of 100 amphipods. The containers were acclimated 3 - 4 days to a salinity of 31 ppt by the supplier and then transported on ice to the EVS laboratory. Following arrival in the laboratory, amphipods were kept in holding containers filled with seawater (28 ± 2 ppt salinity) and maintained at 15 ± 1°C under continuous light. The amphipods were acclimated to laboratory conditions for 2 - 10 days before testing; amphipods received aeration, but were not fed during acclimation. Seawater in the holding containers was replaced every 2 days.

Sediment from the collection site was also retained for use as the negative (clean) control sediment for the toxicity tests. This material was stored at 4°C in the dark prior to testing. Clean seawater, used for acclimation and as the overlying water for the toxicity tests, was obtained from Burrard Inlet, Vancouver, BC, at a depth of 12 m. This water was passed through a sand filter, a 0.5-μm filter and an ultraviolet light sterilizer, aerated vigorously and used within 2 d of collection.

Testing was conducted in 1-L glass jars containing 175 mL of sediment and approximately 800 mL of clean seawater. Eight replicates were prepared for each sample as well as the negative control. Five replicates for the samples and the negative control were used for toxicity testing, and one for daily water quality measurements (temperature, pH, dissolved oxygen, salinity) and Day 10 interstitial ammonia and salinity measurements. Two replicates were sacrificial, to measure interstitial ammonia and salinity on Days 0 and 5.

Sediments were distributed to the test containers one day before test initiation (Day -1). Each test sediment was homogenized by thorough hand mixing and any large pieces of organic material (e.g., grasses, algae) or live animals were removed. A 175-mL volume (~2-cm layer) of test sediment was added to each test container. Approximately 800 mL of clean seawater (28 ± 2 ppt salinity) was added to each jar, taking care not to disturb the sediment. The jars were covered with clean plastic lids, fitted with aeration lines, aerated and left to settle overnight. The following day, total ammonia concentrations were measured in the interstitial water from each sample, using the Salicylate Method (Hach Company, 1992). Interstitial

a negative (clean) control, was prepared from a 1,000 mg/L Cd stock solution. The 96-h LC50 value for the test, expressed as mg/L Cd, was calculated using the TOXCALC program.

In addition, a 10-d ammonia spiked sediment test was conducted using a series of five test concentrations, with eight replicates each. Approximately 900 mL of each concentration was added to 175 mL of clean West Beach sediment in a 1-L glass jar, mixed for 30 seconds and allowed to settle. Each treatment was seeded with 20 amphipods. Ammonia measurements were taken on Days 0, 5 and 10 from the interstitial water. Composite samples of overlying water were collected on Day 10 from each concentration of the NH_3 reference toxicant for ammonia analyses by EVS and ASL for confirmation of test concentrations. Water quality measurements and mortalities were recorded daily. At the end of the 10-d exposure, the numbers of surviving amphipods were recorded and the 10-d LC50 value was calculated using the TOXCALC program. The results of both reference toxicant tests were compared to the respective laboratory value (mean ± 2SD) to assess the health and sensitivity of the organisms.

2.2 RESULTS

Results of the 10-d *E. estuarius* tests are summarized in Table 2-1; raw data and statistical printouts are provided in Appendix C. Results of interstitial salinity and ammonia concentrations measured during testing are provided in Tables 2-2 and 2-3 respectively. Results of sulphide analysis is provided in Table 2-4. Reference toxicant interstitial salinity is shown in Table 2-5 and ammonia results in Table 2-6.

Mean survival in the negative control was 100%. Mean survival in the reference sediments ranged from 91.0 to 96.0%. Mean survival in the samples ranged from 86.0 to 99.0%. Mean avoidance (expressed as amphipods/jar/day) in the negative control and reference sediments ranged from 0 to 0.04. Mean avoidance in the samples ranged from 0.04 to 0.32. The percentage of surviving amphipods able to rebury in clean sediment and seawater within 1 h was 100% in the negative control. Percent reburial in the reference sediments ranged from 92 to 100%. In the samples, reburial ranged from 96.0 to 100%.

2.2.1 Quality Assurance/Quality Control (QA/QC)

Mean survival in the negative control met the criterion for test acceptability (PSEP, 1995). Water quality parameters during the 10-d exposure were within the following acceptable ranges: temperature, 15.0 - 16.0°C; pH, 7.6 - 8.7; dissolved oxygen, 7.0 - 8.4 mg/L and salinity, 28 - 31 ppt. Although some samples had salinity values (31 ppt) outside of the

Table 2-1. Summary of 10-d amphipod (*E. estuarius*) sediment toxicity tests.

SAMPLE ID	SURVIVAL (%) [1] (MEAN ± SD)	AVOIDANCE [2] (MEAN ± SD)	REBURIAL (%) [3]
EVS-1	99.0 ± 2.2	0.10 ± 0.17	100
EVS-2	94.0 ± 8.2	0	100
EVS-3	99.0 ± 2.2	0.04 ± 0.09	100
EVS-4	94.0 ± 4.2	0.08 ± 0.08	100
EVS-5	94.0 ± 4.2	0.08 ± 0.11	100
EVS-6	92.0 ± 7.6	0.04 ± 0.05	98
EVS-7	88.0 ± 4.5*	0.32 ± 0.16	100
EVS-8	94.0 ± 4.2	0.16 ± 0.25	99
EVS 9	90.0 ± 5.0	0.32 ± 0.16	99
EVS-10	99.0 ± 2.2	0.06 ± 0.05	100
EVS-11	95.0 ± 0	0.06 ± 0.09	100
EVS-12	92.0 ± 5.7	0.04 ± 0.05	100
EVS-13	87.0 ± 6.7*	0.12 ± 0.16	96
EVS-14	94.0 ± 5.5	0.10 ± 0.12	100
EVS-15	99.0 ± 2.2	0.14 ± 0.21	100
EVS-16	96.0 ± 4.2*	0.04 ± 0.05	100
EVS-17	87.0 ± 16.0	0.10 ± 0.12	97
EVS-18	95.0 ± 3.5	0.08 ± 0.08	100
EVS-19	96.0 ± 2.2	0.22 ± 0.11	100
EVS-20	98.0 ± 4.5	0.04 ± 0.05	100
EVS-21	89.0 ± 4.2*	0.14 ± 0.26	100
EVS-22	90.0 ± 9.4	0.12 ± 0.08	100
EVS-23	100.0 ± 0	0	100
EVS-24	91.0 ± 4.2	0.22 ± 0.22	100
EVS-25	91.0 ± 8.9*	0.04 ± 0.05	92
EVS-26	86.0 ± 8.9*	0.06 ± 0.13	100

1 n = 5, 20 amphipods seeded per replicate.
2 Number of amphipods on the sediment surface per jar per day (out of a maximum of 20.0).
3 Percentage of surviving amphipods able to rebury in clean sediment and seawater within 1 h after a 10-d exposure.
* indicates a significant difference in comparing reference to negative control (EVS-23).
+ indicates a significant difference in comparing test samples to reference sediment, EVS-16.

Table 2-3. Summary of Days 0, 5 and 10 interstitial ammonia results for 10-d amphipod (*E. estuarius*) sediment toxicity test.

SAMPLE ID	DAY 0 (mg/L NH_3)	DAY 5 (mg/L NH_3)	DAY 10 (mg/L NH_3)
EVS-1	7.4	3.5	2.2
EVS-2	30.0	16.9	13.5
EVS-3	11.6	7.9	5.3
EVS-4	20.3	13.8	7.5
EVS-5	11.9	9.0	5.4
EVS-6	9.6	8.0	3.0
EVS-7	9.8	7.2	4.5
EVS-8	14.3	7.5	4.9
EVS-9	9.6	6.4	3.0
EVS-10	11.7	6.6	5.3
EVS-11	13.8	8.0	5.9
EVS-12	15.9	9.6	5.1
EVS-13	15.9	13.8	7.0
EVS-14	11.7	6.1	4.3
EVS-15	12.7	4.3	2.4
EVS-16	21.1	10.1	4.3
EVS-17	16.9	13.8	8.5
EVS-18	9.6	4.0	2.7
EVS-19	10.6	5.6	3.7
EVS-20	8.5	4.3	3.0
EVS-21	10.1	3.5	3.7
EVS-22	9.6	3.7	3.7
EVS-23	0.3	0.3	0.6
EVS-24	23.2	13.3	9.1
EVS-25	51.5	26.6	26.5
EVS-26	18.5	9.1	5.9

Table 2-5. Summary of Days 0, 5 and 10 interstitial salinity from ammonia reference toxicant for 10-d amphipod (*E. estuarius*) sediment toxicity test.

CONCENTRATION ($mg/L\ NH_3$)	DAY 0 (PPT)	DAY 5 (PPT)	DAY 10 (PPT)
500	30	29	30
250	30	30	30
125	27	29	30
62.5	29	29	30
31.2	28	29	30
Control	28	29	30

Table 2-6. Summary of Day 0, 5 and 10 ammonia results from ammonia reference toxicant for 10-d amphipod (*E. estuarius*) sediment toxicity test.

CONCENTRATION	INTERSTITIAL			OVERLYING	
($mg/L\ NH_3$)	Day 0 ($mg/L\ NH_3$)	Day 5 ($mg/L\ NH_3$)	Day 10 ($mg/L\ NH_3$)	Day 10[1] ($mg/L\ NH_3$)	Day 10[2] ($mg/L\ NH_3$)
500	422.3	369.9	369.9	390.9	634.4
250	185.0	195.5	205.9	185.0	327.0
125	103.0	103.0	97.7	95.1	124.4
62.5	66.3	58.4	55.8	50.6	74.8
31.2	33.9	28.6	32.8	31.8	23.3
Control	7.0	5.8	5.6	4.3	2.6

1 analysis conducted by EVS
2 analysis conducted by ASL

additional replicates of five worms were also set aside for determination of initial (Day 0) dry weight.

Testing was conducted in a constant environment chamber at 20 ± 1°C under continuous light. All test containers were completely randomized during testing. Every three days, approximately one-third of the water in each jar was removed and replaced with clean seawater, taking care not to disturb the sediments. Water quality parameters (temperature, pH, dissolved oxygen, salinity) were recorded in the "water quality" replicate from each treatment just prior to each water renewal. The worms were fed ground TetraMarin® fish flakes (8 mg per worm) every two days during testing.

At the end of the 20-d exposure, the sediments were sieved through a 0.5-mm screen, and counts were made of the number of live, dead and missing worms in each replicate. Worms were considered dead when there was no response to physical stimulation and examination revealed no evidence of movement. Missing worms were assumed to have died and decomposed prior to the termination of the test. Surviving worms from each replicate were rinsed in distilled water, transferred to pre-weighed aluminum pans (one per replicate), dried at 60°C overnight, and then weighed to determine dry weight. For the test to be considered valid, mean survival in the negative control had to be ≥90% (PSEP, 1995). The mean survival and dry weight responses in the treatments were calculated using the TOXCALC computer program (Tidepool Scientific Software, 1994).

A positive (toxic) control was conducted using the standard reference toxicant, cadmium (prepared from cadmium chloride [$CdCl_2 \cdot 2½H_2O$]). This 96-h LC50 test was conducted without sediment in 1-L glass jars containing 1 L of test solution and 10 worms. Five concentrations, plus a negative control, one replicate each, were prepared from a 1,000 mg/L Cd stock solution. Water quality measurements and mortalities were recorded every day. The 96-h LC50 value (expressed as mg/L Cd) was calculated using the TOXCALC program. The results of the reference toxicant test were then compared to the laboratory value (mean ± 2SD) to assess the health and sensitivity of the organisms.

In addition, a 20-d ammonia spiked sediment test was conducted using a series of five test concentrations, with eight replicates each. Approximately 800 mL of each concentration was added to 175 mL of clean West Beach sediment in a 1-L glass jar, mixed for 30 seconds and allowed to settle. Each treatment was seeded with 5 juvenile worms. Ammonia measurements were taken on Days 0, 10 and 20 from the interstitial water. Water quality measurements and mortalities were recorded daily. Every three days approximately one-third of the water in each jar was removed and replaced with clean seawater, taking care not to disturb the sediment. At the end of the 20-d exposure, the numbers of live, dead and missing worms were recorded and the 20-d LC50 value was calculated using the TOXCALC program.

Table 3-1. Summary of 20-d juvenile polychaete (N. arenaceodentata) sediment toxicity test results.

SAMPLE ID	SURVIVAL (%)[1] (MEAN ± SD)	DRY WEIGHT[1] (mg) (MEAN ± SD)
EVS-1	100.0 ± 0	9.4 ± 3.1 (•)
EVS-2	100.0 ± 0	10.3 ± 2.1
EVS-3	100.0 ± 0	11.6 ± 2.1
EVS-4	96.0 ± 8.9	10.7 ± 3.3
EVS-5	100.0 ± 0	9.4 ± 1.5 (•+)
EVS-6	100.0 ± 0	8.3 ± 0.9 (•+*)
EVS-7	96.0 ± 8.9	12.4 ± 2.5
EVS-8	100.0 ± 0	9.7 ± 2.0 (•+)
EVS-9	100.0 ± 0	10.1 ± 2.4
EVS-10	100.0 ± 0	10.1 ± 2.4
EVS-11	100.0 ± 0	12.3 ± 2.3
EVS-12	100.0 ± 0	13.0 ± 0.8
EVS-13	100.0 ± 0	11.8 ± 1.3
EVS-14	100.0 ± 0	8.6 ± 1.7 (• +)
EVS-15	100.0 ± 0	10.8 ± 0.7 (•)
EVS-16	100.0 ± 0	12.0 ± 1.4
EVS-17	100.0 ± 0	11.4 ± 1.5
EVS-18	100.0 ± 0	8.5 ± 2.0 (•+)
EVS-19	100.0 ± 0	11.7 ± 3.0
EVS-20	96.0 ± 8.9	10.4 ± 0.7 (•+)
EVS-21	92.0 ± 11.0	9.4 ± 2.3 (•+)
EVS-22	96.0 ± 8.9	10.8 ± 1.5
EVS-23	100.0 ± 0	11.4 ± 2.2
EVS-24	100.0 ± 0	10.3 ± 3.0
EVS-25	100.0 ± 0	12.4 ± 1.6
EVS-26	100.0 ± 0	8.2 ± 4.7 (•)

[1] n = 5, five worms seeded per replicate.
* Indicates significant difference in comparing test samples to reference sediments, EVS-2.
\+ Indicates significant difference in comparing test samples to reference sediments, EVS-16.
• Indicates significant difference in comparing test samples to reference sediments, EVS-25.

Table 3-3. Summary of Days 0, 10 and 20 interstitial ammonia results for 20-d juvenile polychaete (*N. arenaceodentata*) sediment toxicity test.

SAMPLE ID	DAY 0 (mg/L NH_3)	DAY 10 (mg/L NH_3)	DAY 20 (mg/L NH_3)
EVS-1	9.6	3.3	4.9
EVS-2	32.3	13.2	2.7
EVS-3	12.6	7.2	3.3
EVS-4	17.5	9.7	2.4
EVS-5	14.8	7.7	4.5
EVS-6	9.8	3.8	1.4
EVS-7	10.9	6.2	2.4
EVS-8	13.4	6.2	2.4
EVS-9	13.4	6.3	2.7
EVS-10	9.8	6.4	2.4
EVS-11	15.8	7.9	2.4
EVS-12	16.2	4.7	2.4
EVS-13	15.8	6.4	2.4
EVS-14	9.6	4.9	1.7
EVS-15	11.8	2.4	4.2
EVS-16	27.4	10.2	4.2
EVS-17	18.0	6.1	2.4
EVS-18	9.3	4.7	1.2
EVS-19	10.4	5.5	9.1
EVS-20	8.2	3.2	2.4
EVS-21	6.3	4.1	2.7
EVS-22	12.0	7.1	2.4
EVS-23	27.0	12.6	11.7
EVS-24	23.5	7.2	4.7
EVS-25	39.5	18.5	7.2
EVS-26	12.9	4.6	4.2

Table 3-5. Summary of Days 0, 10 and 20 interstitial salinity from ammonia reference toxicant for 20-d juvenile polychaete (*N. arenaceodentata*) sediment toxicity test.

CONCENTRATION ($mg/L\ NH_3$)	DAY 0 (PPT)	DAY 10 (PPT)	DAY 20 (PPT)
400	28	30	30
200	26	30	30
100	28	30	30
50	27	30	30
25	26	30	30
Control	30	30	30

Table 3-6. Summary of Day 0, 10 and 20 ammonia results from ammonia reference toxicant for 20-d juvenile polychaete (*N. arenacedodentata*) sediment toxicity test.

CONCENTRATION ($mg/L\ NH_3$)	INTERSTITIAL		
	Day 0 ($mg/L\ NH_3$)	Day 10 ($mg/L\ NH_3$)	Day 20 ($mg/L\ NH_3$)
40	297.6	100.6	54.5
200	164.2	60.6	38.8
100	74.1	38.0	27.2
50	50.9	23.5	24.4
25	29.6	15.3	15.5
Control	27.0	12.6	11.7

Within 2 h of fertilization, each container was inoculated with approximately 20,000 to 40,000 developing embryos using an automatic pipette. The number of embryos introduced was confirmed by removing 10-mL subsamples from the five "zero-time" controls immediately after inoculation, preserving them in formalin and counting the number of embryos under a microscope.

After 48 h, the overlying water from each replicate was poured off, collected, and then mixed to re-suspend the larvae. A 10-mL subsample of larvae was quantitatively transferred to a screw-cap vial using an automatic pipette, and preserved in 5% buffered formalin. Two other subsamples were also collected as a back-up to confirm results if needed. The preserved samples were later examined in Sedgewick-Rafter counting chambers under 40X magnification. Samples collected from the "zero-time" controls on Day 0 were counted to confirm the number of embryos introduced. Salinity, dissolved oxygen, temperature and pH were measured in each container at the termination of the larval toxicity test.

Adverse effects on development were determined on the basis of normal shell development to the 48-h prodissoconch I stage. Normal and abnormal prodissoconch I larvae were recorded in each replicate to determine percent normality. Larvae which failed to transform to the fully shelled, straight hinged "D" shaped prodissoconch I stage were considered abnormal. Normal and abnormal prodissoconch I larvae were enumerated for each replicate, and mean percent normal larvae was calculated using the following equation:

$$\textit{Mean Normal Larvae (\%)} = \frac{\textit{mean no. normal larvae}}{\textit{mean no. of total larvae}} \times 100$$

Mean survival was calculated using the following equation:

$$\textit{Mean Survival (\%)} = \frac{\textit{mean no. of total larvae}}{\textit{no. of embryos introduced}} \times 100$$

Mean survival/normal larvae was calculated using the following equation:

$$\textit{Mean Survival/Normal Larvae (\%)} = \frac{\textit{mean no. of normal larvae}}{\textit{no. of embryos introduced}} \times 100$$

The survival/normal larvae endpoint uses data from both endpoints to determine the percentage of larvae which survive and develop normally. Percent normal larvae, survival and survival/normal larvae data were analyzed using the TOXCALC computer program (Tidepool Scientific Software, 1994).

comparable to previous values obtained in the past suggesting that the test results were not affected.

The 48-h EC50 value for the ammonia reference toxicant was 15.9 mg/L NH_3 (95% CL: 15.1 and 16.7 mg/L NH_3). No laboratory mean has been generated yet due to insufficient data points. Water quality parameters measured in the reference toxicant test were within the following acceptable ranges: temperature, 16.0 - 17.0°C; pH, 7.5 - 7.7; dissolved oxygen, 7.7 - 8.6 mg/L; and salinity, 28 ppt. Ammonia concentrations at 0 h ranged from 1.3 - 41.9 mg/L NH_3 and from 1.5 - 43.2 mg/L NH_3 at 48 h.

Table 4-2. Summary of 0 and 48-h overlying ammonia results for 48-h *M. edulis* sediment toxicity test.

SAMPLE ID	0-h (mg/L NH_3)	48-h (mg/L NH_3)
EVS-1	0.4	0.2
EVS-2	0.5	0.7
EVS-3	0.1	<0.1
EVS-4	0.6	0.7
EVS-5	0.6	0.6
EVS-6	0.4	0.3
EVS-7	0.3	0.2
EVS-8	0.6	0.3
EVS-9	0.4	0.4
EVS-10	0.1	<0.1
EVS-11	0.4	0.4
EVS-12	0.6	0.5
EVS-13	0.1	<0.1
EVS-14	0.4	0.3
EVS-15	0.5	0.3
EVS-16	0.8	0.5
EVS-17	0.5	0.6
EVS-18	0.4	0.3
EVS-19	0.5	0.5
EVS-20	0.4	0.2
EVS-21	0.3	0.2
EVS-22	0.4	0.5
EVS-23	<0.1	<0.1
EVS-24	0.6	0.6
EVS-25	0.8	0.8
EVS-26	0.2	0.2

5.0
REFERENCES

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PSEP (Puget Sound Estuary Program). 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. July 1995. 85 pp.

Swartz, R.C., W.A. DeBen, J.K. Phillips, J.O. Lamberson and F.A. Cole. 1985. Phoxocephalid amphipod bioassay for marine sediment toxicity. R.D. Cardwell, R. Purdy and R.C. Bahner (eds). In: Aquatic Toxicology and Hazard Assessment: Proceedings of the Seventh Annual Symposium ASTM STP 854, American Society for Testing and Materials, Philadelphia, PA.

APPENDIX A

Chain-of-Custody Forms

To: EVS 9/231-06.3 2 15 COOLERS

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

HARTCROWSER

Sample Custody Record

DATE 9/3/96 PAGE 1 OF 2

JOB NUMBER 4478-05 LAB NUMBER

PROJECT MANAGER T. Thornburg, Clay Patmont

PROJECT NAME Whatcom Waterway

SAMPLED BY: A. Fitzpatrick, J. Herzog, K. Magruder

Head Space (inches)	LAB NO.	SAMPLE	TIME	DATE	STATION Depth	MATRIX	TESTING: Contingent Biological Test *	Field grain size sieve >230	Field grain size sieve <230	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/COMPOSITING INSTRUCTIONS
0"		HC-SS-01	0930	9/3/96	0-10cm	sediment	X	18	82	5	* Archive until verbal approval from HC
0"		HC-SS-02	1045				X	20	80	5	
0"		HC-SS-04	1120				X	22	78	5	
0"		HC-SS-05	1200				X	16	84	5	Samples rec'd @ ~12.5°C
1/4"		HC-SS-07	1230				X	22	78	5	
0"		HC-SS-09	1315				X	16	84	5	
0"		HC-SS-10	1445				X	14	86	5	Nitrogen added to jars requiring Sep 05/96
0"		HC-SS-35	1610				X	22	78	5	
1/4"		HC-SS-37	1700				X	40	60	5	
1/4"		HC-SS-11	1730				X	**		5	
1"		HC-SS-12	1810				X	**		5	CARRIER # B1411

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE Kim Magruder	9-4-96	SIGNATURE Armando Tang	9/4/1996
PRINTED NAME Kim Magruder	TIME 15:35	PRINTED NAME ARMANDO TANG	TIME 1920
COMPANY EVS for HC		COMPANY EVS	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	TIME	SIGNATURE	TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 85 in percent

METHOD OF SHIPMENT Courier: BORDER CARGO SERVICES

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS Field grain size sieve using #230 sieve → percent retained on sieve

** - WILL CALL/FAX TO REPORT GRAIN SIZE

EVS PROJECT # 2/231-06.2

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

EVS

HART CROWSER
Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

Sample Custody Record

DATE 9/5/96 PAGE 1 OF ~~1~~ 2 KA

JOB NUMBER 4478-05 LAB NUMBER

PROJECT MANAGER TODD THORNBURG /CITY PAYMENT

PROJECT NAME WHITCOM WATERWAY

SAMPLED BY: A. FITZ~~GERALD~~ Patrick, K. MAGRUDER, K. ANDERSON

LAB NO.	SAMPLE	TIME	DATE	DEPTH	MATRIX	* Contingent Biological Test	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
HC-	SS-42	1000	9/5/96	0-10 cm	SEDIMENT		5	(2) * Archive until verbal approval from HC.
HC-	SS-44	1040	9/5/96	0-10 cm	SEDIMENT		5	(1)
HC-	SS-46	1130	9/5/96	0-10 cm	SEDIMENT		5	(2)
HC-	SS-48	1220	9/5/96	0-10 cm	SEDIMENT		5	(2)
HC-	SS-43	1420	9/5/96	0-10 cm	SEDIMENT		5	

Samples rec'd @ 5°C
Nitrogen added on Sept 6/96 to ~~necessary~~ jars requiring

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: [signature]	9-5-96	SIGNATURE: Jennifer Stewart	9-5-96
PRINTED NAME: Kim Magruder	TIME 19:03	PRINTED NAME: JENNIFER STEWART	TIME 19:03
COMPANY: EVS for HC		COMPANY: EVS N.V.	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 45 ~~25~~

METHOD OF SHIPMENT
HAND COURIER: Kim MAGRUDER

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS Refer to project work order for project requirements.

EVS PROJECT #
2/231-06.2

DISTRIBUTION:
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2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

... head space ... 0.1 inch head space

TO: EVS

9/231-06.3

Sample Custody Record

DATE 9/6/96 PAGE 1 OF 3

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 4478-05 LAB NUMBER

PROJECT MANAGER TODD THORNBURG / CRAIG PATMONT

PROJECT NAME WHATCOM WATERWAY

SAMPLED BY: A. FITZPATRICK, K. MEGRUDER, K. ANDERSON

LAB NO.	SAMPLE	TIME	DATE	SECTION DEPTH	MATRIX	TESTING: Contingent *	TESTING: Biological Test	NO. OF CONTAINERS	OBSERVATIONS / COMMENTS / COMPOSITING INSTRUCTIONS
	HC-SS-30	1030	9/6/96	0-10 cm	SEDIMENT	X		5	① * Archive until
	HC-SS-29	1120				X		5	① Verbal approval from
	HC-SS-28	1140				X		5	① HC
	HC-SS-23	1215				X		5	① Samples requiring pot
	HC-SS-24	1240				X		5	② vndw nitrogen
	HC-SS-22	~~1400~~ 1300				X		5	
	HC-SS-25	1435				X		5	
	~~HC-SS-20~~	~~1500~~						—	AF
	HC-SS-03	~~1500~~ 1520				X		5	①
	HC-SS-06	1545				X		5	③
	HC-SS-08	1630				X		5	②
	HC-SS-19	1650				X		5	②

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE Anne Fitzpatrick	9/6/96	SIGNATURE Armando Tang	9/6/96
PRINTED NAME Hart Crowser	TIME 2200	PRINTED NAME ARMANDO TANG	TIME
COMPANY		COMPANY EVS Temp 10°C	2200h
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	TIME	SIGNATURE	TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 55

METHOD OF SHIPMENT hand deliver

SPECIAL SHIPMENT / HANDLING OR STORAGE REQUIREMENTS See project work order for requirements

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

1 Jar Broken — Put 1-

EVS

9/6/96

9/231-06.3

Sample Custody Record

DATE 9/5/96 PAGE 3 OF 3

HART CROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER 4478-05 LAB NUMBER

PROJECT MANAGER TODD THORNBURG / CLAY PATMONT

PROJECT NAME WHATCOM WATERWAY

SAMPLED BY: A. FITZPATRICK, K. MACRUDER, K. ANDERSON

LAB NO.	SAMPLE	TIME	DATE	STATION DEPTH	MATRIX	TESTING: Continuent *	TESTING: Bioligical Test	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
✓	HC-SS-41	1515	9/5/96	0-10cm	SEDIMENT	X		5	②
✓	HC-SS-40	1650	9/5/96	0-10cm	SEDIMENT	X		5	* Archive until verbal
✓	HC-SS-26	1630	9/5/96	0-10cm	SEDIMENT	X		5	② approval from HC
✓	HC-SS-36	1730	9/5/96	0-10cm	SEDIMENT	X		5	②
✓	HC-SS-32	1810	9/5/96	0-10cm	SEDIMENT	X		5	Samples Requiring put under Nitrogen

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: Anne Fitzpatrick	9/6/96	SIGNATURE: Armando Tang	9/6/96
PRINTED NAME: Anne Fitzpatrick	TIME	PRINTED NAME: ARMANDO TANG	TIME
COMPANY: Hart Crowser	2200	COMPANY: EVS Temp ~10°C	2200h
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	TIME	SIGNATURE	TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS: 25

METHOD OF SHIPMENT: hand deliver

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS: See project work order

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

Client Name: H.M.T. CROWSER Ship to: EVS - NORTH VANCOUVER

Contact Name: ANNE FITZPATRICK (HC) OR KIM MAGRUDER (EVS)

Sampled By: DEN PERKOWSKI Attn: JENNIFER STEWART Shipping Date: 9/13/96

HAND COURIERED: DEN PERKOWSKI

Temp on Receipt 7°C

Sample Collection Date (d/m/y) m/d/y	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required) ARCHIVE *							Comments/Instructions
9/12/96	2:00pm	CR02-1	2 gal/1						84% fines		
9/12/96	2:00pm	CR02-2	" "								* DO NOT START
9/12/96	2:00pm	CR02-3	" "								ANALYSIS UNTIL
9/12/96	3:30pm	CR24-1	" "								NOTIFIED IN
9/12/96	3:30pm	CR24-2	" "						65% fines		WRITING BY
9/12/96	3:30pm	CR24-3	" "								HART CROWSER
9/12/96	5:00pm	CR22-1	" "								
9/12/96	5:00pm	CR22-2	" "						19% fines		
9/12/96	5:00pm	CR22-3	" "								

1) Released by:	2) Released by:	3) Released by:	To be completed by EVS Laboratory upon sample receipt:	
Date/Time: 9/13/96 11:40	Date/Time:	Date/Time:	EVS Project #: 9/231-06.3	EVS W.O. # 9600631 632 633
1) Rec'd by: KTB	2) Rec'd by:	3) Rec'd by:	Date of Receipt: Sept 13/96	Time of receipt: 1140
Date/Time: Sept 13/96 1140	Date/Time:	Date/Time:	Condition Upon Receipt: Good	Received by: KTB

* Instructions for completion of Chain-of-Custody/Test Request Form on back.
* Distribution: White and yellow copies accompany shipment; pink-consignor's copy; white-consignee return with results; yellow-consignee's copy.

EVS ENVIRONMENT CONSULTANTS

- 195 Pemberton Avenue, North Vancouver, B.C., Canada, V7P 2R4, Tel: (604) 986-4331, Fax: (604) 662-8548
- 200 West Mercer Street, Suite 403, Seattle, WA 98119, Tel: (206) 217-9337, Fax: (206) 217-9343

9/231-06.3

9600631, -632, ~~-632~~ -633 10MB

APPENDIX B

Coding Scheme for Samples, References and Negative Control

Table B-1. Coding Scheme for Samples, References and Negative Control.

HART CROWSER SAMPLE ID	EVS SAMPLE ID
HC-SS-41	EVS-3
CR-22 (Reference)	EVS-25
HC-SS-34	EVS-7
HC-SS-32	EVS-24
HC-SS-21	EVS-8
HC-SS-23	EVS-14
HC-SS-33	EVS-13
HC-SS-24	EVS-12
HC-SS-25	EVS-10
CR-24 (Reference)	EVS-2
HC-SS-29	EVS-9
HC-SS-03	EVS-26
HC-SS-08	EVS-17
HC-SS-30	EVS-19
HC-SS-26	EVS-11
HC-SS-31	EVS-22
HC-SS-35	EVS-5
HC-SS-17	EVS-21
HC-SS-14	EVS-15
HC-SS-22	EVS-6
HC-SS-06	EVS-4
CR-02 (Reference)	EVS-16
HC-SS-13	EVS-18
HC-SS-15	EVS-20
HC-SS-19	EVS-1
Control	EVS-23

APPENDIX C

10-d *E. estuarius* Sediment Toxicity Test Raw Data

BIOASSAY QA CHECKLIST

Project Name/No. Hart Crowser / 9231-06.3 Staff GSY Date Oct. 7/96

NOTE: White cell denotes required data

AMPHIPOD MORTALITY AND EMERGENCE		Each Batch	Test Sediment	Reference Sediment	Control Sediment
Species Name	Eohaustorius estuarius	✓			
Mortality and Emergence:	Start date	September 27/96			
	Daily emergence (for 10 days)		✓	✓	✓
	Survival at end of test		✓	✓	✓
	Number failing to rebury at end of test		✓	✓	✓
Positive Control:	Toxicant used	Cd / NH_3 spiked	✓	✓	
	Toxicant concentrations	[18, 10, 5.6, 3.2, 1.8, 1.0, 0.56] mg/L Cd [500, 250, 125, 62.5, 31.2] mg/L NH_3	✓		
	Exposure time	96h / 10d	✓		
	LC50		✓		
	LC50 method of calculation	Trimmed-Spearman			
	Start date	Sept. 27/96 / Sept 27/96			
	Survival data		✓		
Water Quality Measurement Methods:	Dissolved oxygen		✓		
	Ammonia (Interstitial)		✓		
	Interstitial salinity		✓		
	Sulfide		✓		
	Water salinity		✓		
Water Quality:	Temperature (day 0 through day 10)		✓	✓	✓
	pH (day 0 through day 10)		✓	✓	✓
	Dissolved oxygen (day 0 through day 10)		✓	✓	✓
	Water salinity (day 0 through day 10)		✓	✓	✓
	Sulfide (day 0, day 10)		✓	✓	✓
	Ammonia (day 0, day 10)		✓	✓	✓
	Interstitial water salinity (day 0)		✓	✓	✓

EVS CONSULTANTS
AMPHIPOD TOXICITY TEST DATA SUMMARY

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS Work Order No.: 9600632

EVS Analyst(s) DLG AWD CEB JLS BSJ MKL LJS SVS ART PAH GSH
Test Type 10d Sediment Toxicity Test
Test Initiation Date September 27, 1996

SAMPLE
Identification EVS-1 to EVS-26
Amount Received 5x2L of each sample ID
Date Collected September 3-9, 1996
Date Received September 4-9, 1996

TEST SPECIES INFORMATION
Organism Eohaustorius estuarius
Source Northwest Aquatic Sciences (Beaver Creek, OR)
Date Received September 24, 1996
Reference Toxicant 96h Cd Rebox / 10d NH_3 Spiked Rebox
Current Reference Toxicant Result 119 mg/L Cd: 852 Cl: 8.3 and 17.0 mg/L Cd) / 191.8 mg/L NH_3: 1952 Cl: 187.3 and 20[illegible] mg/L
Laboratory Range for Reference Toxicant (mean ± 2SD) 7.3 ± 6.4 mg/L Cd / 255.0 ± 95.3 mg/L NH_3.

DILUTION AND CONTROL MEDIUM
Water UV sterilized, filtered seawater (Barnard Inlet)
Temperature (°C) 15.0
pH 7.7
Dissolved Oxygen (mg/L) 8.1
Salinity (ppt) 28
Conductivity (µmhos/cm) –
Hardness (mg/L as $CaCO_3$) –
Alkalinity (mg/L as $CaCO_3$) –
Other: –

TEST CONDITIONS
Temperature Range (°C) 15.0 – 16.0
pH Range 7.6 8.7 – 8.7
Dissolved Oxygen Range (mg/L) 7.0 – 8.4
Salinity Range (ppt) 28 29 – 31
Conductivity (µmhos/cm) –
Hardness (mg/L as $CaCO_3$) –
Alkalinity (mg/L as $CaCO_3$) –

Other:	Day 0	Day 5	Day 10
NH_3 (mg/L NH_3):	0.3 – 51.5	0.3 – 26.6	0.6 – 26.5
Sulfides (mg/L S):	<0.02 – 0.06	–	<0.02 – 0.0[illegible]
Interstitial salinity (ppt):	27 – 30	27 – 30	29 – 31

Sample ID	Survival (%) Mean ± SD	Avoidance (Amphipods/jar/day) Mean ± SD	Reburial (%)
EVS-9	90.0 ± 5.0	0.32 ± 0.16	99
EVS-10	99.0 ± 2.2	0.06 ± 0.05	100
EVS-11	95.0 ± 0	0.06 ± 0.09	100
EVS-12	92.0 ± 5.7	0.04 ± 0.05	100
EVS-13+	87.0 ± 6.7	0.12 ± 0.16	96
EVS-14	94.0 ± 5.5	0.10 ± 0.12	100
EVS-15	99.0 ± 2.2	0.14 ± 0.21	100
EVS-16*	96.0 ± 4.2	0.04 ± 0.05	100

* indicates a significant difference in comparing references to negative control.
+ indicates a significant difference in comparing samples to EVS-16.

Data Certified By: C. McPherson
Date Certified: Nov 6/96

EVS CONSULTANTS
AMPHIPOD TOXICITY TEST DATA SUMMARY

Client: Hart Crowser
EVS Project No.: 9123I-06.3
EVS Work Order No.: 9600632

EVS Analyst(s) MKL LJS SVS ART PAH GSH DLG AWD CEB JLS BSJ
Test Type 10d Sediment Toxicity Test
Test Initiation Date September 27, 1996

SAMPLE
Identification EVS-1 to EVS-26
Amount Received 5x2L of each sample ID
Date Collected September 3-9, 1996
Date Received September 4-9, 1996

TEST SPECIES INFORMATION
Organism Eohaustorius estuarius
Source Northwest Aquatic Sciences (Beaver Creek, OR)
Date Received September 24, 1996
Reference Toxicant 96h Cd Ptrox / 10d NH_3 Spiked Ptrox
Current Reference Toxicant Result (95% CL: 8.3 and 13.0 mg/L Cd) / (95% CL: 182 and 202 mg/L NH_3)
Laboratory Range for Reference Toxicant (mean ± 2SD) 7.3 ± 6.4 mg/L Cd / 255.0 ± 75.3 mg/L NH_3

DILUTION AND CONTROL MEDIUM
Water UV sterilized, filtered seawater (Burrard Inlet)
Temperature (°C) 15.0
pH 7.7
Dissolved Oxygen (mg/L) 8.1
Salinity (ppt) 28
Conductivity (µmhos/cm) –
Hardness (mg/L as $CaCO_3$) –
Alkalinity (mg/L as $CaCO_3$) –
Other: –

TEST CONDITIONS
Temperature Range (°C) 15.0 - 16.0
pH Range ~~7.6~~ 7.7 - 8.7
Dissolved Oxygen Range (mg/L) 7.0 - 8.4
Salinity Range (ppt) ~~28~~ 29 - 31
Conductivity (µmhos/cm) –
Hardness (mg/L as $CaCO_3$) –
Alkalinity (mg/L as $CaCO_3$) –

Other:	Day 0	Day 5	Day 10
NH_3 (mg/L NH_3):	0.3 - 51.5	0.3 - 26.6	0.6 - 26.5
Sulfides (mg/L S):	<0.02 - 0.06	–	<0.02 - 0.02
Interstitial salinity (ppt):	27 - 30	27 - 30	29 - 31

Sample ID	Survival (%) Mean ± SD	Avoidance (Amphipods/jar/day) Mean ± SD	Reburial (%)
EVS-25*	91.0 ± 8.9	0.04 ± 0.05	92
EVS-26+	86.0 ± 8.9	0.06 ± 0.13	100

* indicates a significant difference in comparing references to negative control.
+ indicates a significant difference in comparing samples to EVS-16.

Data Certified By: C. McPherson
Date Certified: Nov 6/96

EVS CONSULTANTS
10-d AMPHIPOD SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Water Quality Instruments Used:

D.O. Meter: II-A-1900 #4
pH Meter: II-A-26
Salinity: II-C-22
Temperature: calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9231-06.3
EVS Work Order No.: 9600632
Day 0: Sept 27/96
Day 10: Oct. 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: N.A.S. (Sept 19/96)

SAMPLE I.D.	TEMPERATURE (°C)											DISSOLVED OXYGEN (mg/L)										
	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10
EVS-20	16.0	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.2	8.1	8.3	8.0	8.2	8.2	8.1	8.2	8.1	8.0	8.1
EVS-15	16.0	15.5	15.5	15.0 ①	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.0	7.9	8.2	7.9	7.9	8.1	8.0	8.0	8.2	8.3	8.3
EVS-8	16.0	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.1	8.1	8.2	8.1	8.0	8.1	8.0	8.0	8.2	8.3	8.0
EVS-5	16.0	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.1	8.1	8.3	8.1	8.0	8.2	8.0	8.0	8.0	8.3	7.6
EVS-2	16.0	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.1	8.1	8.3	7.9	7.9	8.1	8.0	8.1	8.0	8.3	8.2
EVS-4	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.2	7.8	8.3	7.9	7.9	8.1	8.1	8.0	8.2	8.3	8.2
EVS-17	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.2	8.0	8.3	8.0	8.0	8.0	8.2	8.0	8.2	8.1	7.5
EVS-19	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.1	8.0	8.3	8.2	7.8	8.1	7.7	8.0	8.2	8.1	7.6
EVS-21	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.2	8.0	8.2	8.1	7.9	8.1	8.1	8.0	8.2	8.3	7.9
EVS-24	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.2	8.1	8.3	8.1	8.0	8.1	8.1	8.0	8.1	8.3	7.5
EVS-16	16.0	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.5	15.0	8.1	8.1	8.2	8.1	7.9	8.0	8.1	8.2	8.1	8.3	8.0
Technician's Initials																						

COMMENTS: ① REDFISH - BEGAN FILM STARTING TO FORM ON SED. SURFACE

Data Certified By: C. McPherson

Date Certified: Oct 24/96

EVS CONSULTANTS
10-d AMPHIPOD SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Water Quality Instruments Used

D.O. Meter: II-A-19 DO #4
pH Meter: II-A-26
Salinity: II-C-22
Temperature: calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9231-06.3
EVS Work Order No.: 9600632
Day 0: Sept 27/96
Day 10: October 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: NWAS (Sept 19/96)

SAMPLE I.D.	SALINITY (ppt)											pH										
	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10
EVS-12	30	27	30	30	29	30	30	29	27	29	30	7.9	8.0	8.0	8.0	8.0	7.9	8.0	8.0	8.1	8.1	8.4
EVS-6	30	30	30	30	30	30	30	29	27	29	29	7.9	7.7	7.9	8.0	8.0	7.9	7.7	7.9	7.7	7.9	8.1
EVS-3	30	29	30	30	29	29	29	29	27	29	30	7.8	7.8	7.8	7.9	7.9	7.8	8.0	7.9	8.0	8.0	8.1
EVS-7	30	30	30	30	29	30	30	29	27	29	30	7.9	7.7	7.8	8.1	8.1	8.1	8.2	8.3	8.3	8.3	8.5
EVS-18	30	29	29	30	30	30	30	29	27	29	30	7.9	7.7	7.9	8.0	8.0	7.8	7.7	7.9	8.0	8.0	8.1
EVS-26	30	30	30	30	30	30	30	30	27	30	30	7.9	7.7	8.0	8.1	8.0	7.9	8.0	8.0	8.1	8.0	8.2
EVS-1	30	27	29	30	29	29	30	29	27	29	30	7.9	7.8	7.8	8.0	8.0	7.9	7.8	7.8	7.7	7.9	8.1
EVS-11	30	27	30	30	29	30	30	29	27	30	30	7.8	7.7	7.9	8.0	8.0	7.9	8.0	8.0	8.0	8.2	8.4
EVS-14	30	27	30	30	29	30	30	29	28	29	30	7.8	7.7	7.9	7.9	8.0	7.9	7.9	7.9	8.0	8.0	8.3
EVS-23	29	27	29	29	29	29	29	29	27	29	30	7.8	7.8	7.9	7.9	8.0	7.8	7.7	7.8	8.0	7.9	8.1
EVS-9	30	30	30	30	29	29	30	30	30	30	30	7.9	7.7	8.0	8.0	8.0	7.9	8.1	8.2	8.4	8.6	8.7
Technician's Initials	M	JF	M	SVS	SVS	SVS	SVS	SVS	JF	KRT	SVS/PAH	JF M	JF	M	SVS	SVS	SVS	SVS	JF	SVS	JF	KRT	SVS/PAH

COMMENTS: ① Meter II-A-27 used JF. ② Recalibrated pH meter & obtained same reading. Measured replicates A to E: pH ranged 8.3 to 8

Data Certified By: C. McPherson

Date Certified: Oct 24/96

EVS CONSULTANTS
10-d AMPHIPOD SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Water Quality Instruments Used

D.O. Meter: II-A-19 DO#4
pH Meter: II-A-26
Salinity: II-C-22
Temperature: calibrated thermometer

Client: Hart Crowser
EVS Project No.: 91231-06.3
EVS Work Order No.: 9600632
Day 0: Sept 27/96
Day 10: October 7/96
Test Species: Echaustorius estuarius
Source/Collection Date: NWAS (Sept 19/96)

SAMPLE I.D.	SALINITY (ppt)											pH										
	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8 ①	9	10
EVS-10	30	27	30	30	30	30	30	29	27	29	30	7.7	7.9	8.0	8.0	8.1	8.0	8.1	8.0	8.2	8.2	8.5
EVS-13	30	27	30	30	30	30	30	30	27	29	30	7.9	7.9	8.0	8.1	8.1	8.0	8.2	8.2	8.4	8.3	8.5
EVS-22	30	27	30	30	30	30	30	30	27	29	30	7.7	7.9	8.0	8.0	8.1	8.0	8.1	8.1	8.4	8.3	8.6
EVS-25	30	27	30	30	30	30	30	30	27	30	30	7.9	7.9	8.0	8.1	8.1	7.9	8.1	7.9	8.0	8.1	8.3
Technician's Initials	h	j.	h	SYS	SYS	SYS	SYS	SYS	j.	ART	SYS/BAH	j	j.	h	SK	SYS	SYS	SYS/j.	CB/SYS	j	ART	SYS/BAH

COMMENTS: ① Meter I-A-27 used j.

Data Certified By: C. McPherson   Date Certified: Oct 24/96

Form/LabData/AmphipodWQ (6.2)

EVS CONSULTANTS - AMPHIPOD SEDIMENT TOXICITY TESTS
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY

Water Quality Instruments Used

D.O. Meter II-A-19 ID#4
pH Meter II-A-26
Salinity II-C-22
Temperature calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9231-06.3
EVS W.O. No.: 9600632
Day 0: Sept. 27/96
Day 10: Oct. 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: NWAS (Sept 19/96)

SAMPLE I.D. EVS-4

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	1	0	0	0	0	0	0	0	0	0	19	0	15.0	8.1	30	7.9
B	0	0	0	0	0	0	0	0	0	0	18	0	15.0	8.1	30	8.0
C	0	0	0	0	0	0	0	0	0	0	18	0	15.0	8.1	30	8.0
D	0	0	0	1	0	0	0	0	0	0	19	0	15.0	8.2	31	8.0
E	1	0	0	1	0	0	0	0	0	0	20	0	15.0	8.2	30	8.0
Tech'n	JF	M	SVS	SVS	SVS	SVS	SVS	JF	MT	SVS	JLS	JLS	SVS/PAH	SVS/PAH	SVS/PAH	SVS/PAH

(# dead:# missing) - A(0:1) B(1:1) C(1:1) D(0:1) E(0:0)

SAMPLE I.D. EVS-5

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	0	0	0	18	0	15.0	8.0	30	8.3
B	1	1	0	0	0	0	0	0	0	0	20	0	15.0	7.8	30	8.4
C	0	0	1	0	0	0	0	1	0	0	18	0	15.0	7.8	30	8.3
D	0	0	0	0	0	0	0	0	0	0	19	0	15.0	7.9	30	8.4
E	0	0	0	0	0	0	0	0	0	0	19	0	15.0	7.9	30	8.3
Tech'n	JF	M	SVS	SVS	SVS	SVS	SVS	JF	MT	SVS			SVS/PAH	SVS/PAH	SVS/PAH	SVS/PAH

(# dead:# missing) - A(1:1) B(0:0) C(0:2) D(0:1) E(0:1)

SAMPLE I.D. EVS-6

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	0	0	0	16	1	15.0	7.9	31	8.2
B	1	0	0	0	0	0	0	0	0	0	20	0	15.0	7.8	30	8.2
C	0	0	0	0	0	0	0	0	0	0	19	0	15.0	7.9	30	8.2
D	0	0	0	0	0	0	0	0	0	0	19	1	15.0	8.0	30	8.2
E	0	0	0	0	0	0	1	0	0	0	18	0	15.0	8.0	30	8.2
Tech'n	JF	M	SVS	SVS	SVS	SVS	SVS	JF	MT	SVS	DLS	TMS	SVS/PAH	SVS/PAH	SVS/PAH	SVS/PAH

(# dead:# missing) - A(2:2) B(0:0) C(1:0) D(0:1) E(2:0)

Data Certified By: C. McPherson Date Certified: Oct 24/96

EVS CONSULTANTS - AMPHIPOD SEDIMENT TOXICITY TESTS
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY

Water Quality Instruments Used

D.O. Meter II-A-19 00#4
pH Meter II-A-26
Salinity II-C-22
Temperature calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9123I-06.3
EVS W.O. No.: 9600632
Day 0: Sept. 27/96
Day 10: Oct. 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: NWAS (Sept 19/96)

SAMPLE I.D. EVS-10

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	0	0	0	19	1	15.0	7.7	29	8.4
B	0	0	0	0	0	0	0	0	0	0	20	0	15.0	7.5	30	8.4
C	1	0	0	0	0	0	0	0	0	0	19	0	15.0	7.7	30	8.3
D	0	0	1	0	0	0	0	0	0	0	20	0	15.0	7.7	29	8.3
E	1	0	0	0	0	0	0	0	0	0	20	0	15.0	7.7	30	8.4
Tech'n	SVS	SVS	SVS	SVS	SVS	SVS	SVS	SVS	ART	SVS	CEB	CEB	SVS PAH	SVS PAH	SVS PAH	SVS PAH

(# dead:# missing) - A(0 : 1) B(0 : 0) C(0 : 0) D(0 : 0) E(0 : 0)
1 Oly was lost during transfer; could not determine if it would rebury.

SAMPLE I.D. EVS-11

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	1	0	0	0	1	19	0	15.0	7.9	30	8.4
B	0	0	0	0	0	0	0	0	0	0	19	0	15.0	7.9	30	8.4
C	0	0	0	0	0	0	0	0	0	0	19	0	15.0	7.8	30	8.4
D	0	0	0	0	0	0	0	0	0	0	19	0	15.0	8.0	30	8.4
E	1	0	0	0	0	0	0	0	0	0	19	0	15.0	8.0	30	8.4
Tech'n	SVS	SVS	SVS	SVS	SVS	SVS		SVS	ART	SVS	SVS	SVS	SVS PAH	SVS PAH	SVS PAH	SVS PAH

(# dead:# missing) - A(0 : 1) B(0 : 1) C(0 : 1) D(0 : 1) E(0 : 1)

SAMPLE I.D. EVS-12

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	0	0	0	19	0	15.0	8.6	30	8.4
B	0	0	0	0	0	0	0	0	0	0	20	0	15.0	8.0	30	8.3
C	0	0	1	0	0	0	0	0	0	0	18	0	15.0	8.6	30	8.4
D	0	1	0	0	0	0	0	0	0	0	17	0	15.0	8.0	30	8.3
E	0	0	0	0	0	0	0	0	0	0	18	0	15.0	8.0	30	8.4
Tech'n	SVS	SVS	SVS	SVS	SVS	SVS	SVS	SVS	ART	SVS			SVS PAH	SVS PAH	SVS PAH	SVS PAH

(# dead:# missing) - A(0 : 1) B(0 : 0) C(0 : 2) D(0 : 3) E(0 : 2)

Data Certified By: C. McPherson Date Certified: Oct 24/96

EVS CONSULTANTS - AMPHIPOD SEDIMENT TOXICITY TESTS
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY

Water Quality Instruments Used

D.O. Meter II-A-19 DO #4
pH Meter II-A-26
Salinity II-C-22
Temperature calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS W.O. No.: 9600632
Day 0: Sept. 27/96
Day 10: Oct. 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: Sept 19/96 Nuhas

SAMPLE I.D. EVS-16

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	-	0	0	19	0	15.0	7.8	30	8.3
B	0	0	0	0	0	0	0	0	0	0	20	0	15.0	8.0	30	8.3
C	1	0	0	0	0	0	0	0	0	0	20	0	15.0	7.8	30	8.3
D	1	0	0	0	0	0	0	0	0	0	19	0	15.0	7.6	30	8.3
E	0	0	0	0	0	0	0	0	0	0	18	0	15.0	7.8	30	8.3
Tech'n	JF	M	SVS	SVS	SVS	SVS	SVS	JF	KFT	SVS	CEB	CEB	SVS	PAH	SVS	PAH	SVS	PAH

(# dead:# missing) - A(0:1) B(0:0) C(0:0) D(0:1) E(0:2)

SAMPLE I.D. EVS-17

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	0	0	0	17	0	15.0	7.9	31	8.2
B	0	0	0	0	0	0	0	0	0	0	SVS 19	0	15.0	8.1	30	8.2
C	0	0	0	0	0	0	0	0	0	0	SVS 19	0	15.0	8.0	30	8.2
D	0	0	0	0	0	0	0	0	1	1	120	1	15.0	8.0	30	8.2
E	0	0	1	0	0	0	0	0	0	0	20	1	15.0	8.0	31	8.2
Tech'n	JF	M	SVS	SVS	SVS	SVS	SVS	JF	KFT	SVS	SVS	SVS	SVS	PAH	SVS	PAH	SVS	PAH

(# dead:# missing) - A(0:2) B(0:0) C(0:1) D(2:0) E(2:0)
① worms + small crabs present.

SAMPLE I.D. EVS-18

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	1	1	0	0	-	0	0	19	0	15.0	8.1	30	8.1
B	1	0	0	0	0	0	0	0	0	0	20	0	15.0	8.0	30	8.1
C	0	0	0	0	0	0	0	0	0	0	18	0	15.0	8.0	30	8.1
D	1	0	0	0	0	0	0	0	0	0	19	0	15.0	8.1	30	8.1
E	0	0	0	0	0	0	0	0	0	0	19	0	15.0	8.1	30	8.1
Tech'n	JF	M	SVS	SVS	SVS	SVS	SVS	JF	KFT	SVS	SVS	SVS	SVS	PAH	SVS	PAH	SVS	PAH

(# dead:# missing) - A(0:1) B(0:0) C(0:2) D(0:1) E(0:1)

Data Certified By: C. McPherson

Date Certified: Oct 24/96

EVS CONSULTANTS - AMPHIPOD SEDIMENT TOXICITY TESTS
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY

Water Quality Instruments Used

D.O. Meter II-A-1900 #4
pH Meter II-A-26
Salinity II-C-22
Temperature calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9123I-06.3
EVS W.O. No.: 9600632
Day 0: Sept. 27/96
Day 10: Oct. 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: NuLAS (Sept 19/96)

SAMPLE I.D. EVS-22

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	1	0	0	0	-	0	0	18	0	15.0	7.6	30	8.6
B	0	0	0	1	1	0	0	-	0	0	18	0	15.0	7.4	30	8.6
C	0	0	0	0	0	0	0	-	0	0	15	0	15.0	7.0	29	8.7
D	0	0	1	0	0	0	0	-	0	0	20	0	15.0	7.6	30	8.6
E	0	0	0	0	0	1	0	1	0	0	19	0	15.0	7.2	30	8.6
Tech'n			SVS	SVS	SVS	SVS	SVS		ART	SVS	SVS	SVS	PI PAH	SVS PAH	SVS PAH	SVS PAH

(# dead:# missing) - A(0:2) B(0:2) C(5:0) D(0:0) E(0:1)

SAMPLE I.D. EVS-23

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	29	8.1
B	0	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	30	8.1
C	0	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	30	8.1
D	0	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	30	8.1
E	0	0	0	0	0	0	0	-	0	0	20	0	15.0	8.3	30	8.1
Tech'n			SVS	SVS	SVS	SVS	SVS		ART	SVS			PI PAH	SVS PAH	SVS PAH	SVS PAH

(# dead:# missing) - A(0:0) B(0:0) C(0:0) D(0:0) E(0:0)

SAMPLE I.D. EVS-24

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	0	1	1	0	1	0	0	-	0	0	19	0	15.0	7.6	30	8.5
B	0	0	3	0	0	0	0	-	0	0	19	0	15.0	7.6	30	8.5
C	4	0	0	0	0	1	0	-	0	0	17	0	15.0	7.7	30	8.5
D	0	0	0	0	0	0	0	-	0	0	18	0	15.0	7.8	30	8.5
E	0	0	0	0	0	0	0	-	0	0	18	0	PI VT 15.0	7.8	30	8.5
Tech'n			SVS	SVS	SVS	SVS	SVS		ART	SVS			WI PAH	WI PAH	SVS PAH	WI PAH

(# dead:# missing) - A(0:1) B(0:1) C(0:3) D(0:2) E(1:1)

Data Certified By: C. McPherson

Date Certified: Oct 8/96

Test: AM-Amphipod Survival and Avoidance Test
Species: EE-Eohaustorius estuarius
Sample ID: EVS-1 to EVS-26
Start Date: 9/27/96 End Date: 10/7/96

Test ID: EVS3192
Protocol: PSEP 95
Sample Type: SEDIMENT
Lab ID: BCEVS-EVS Enviro.Consultants

Pos	ID	Rep	Group	Survival Day 0	Survival Day 10	Emergence Days 1 to 10	No. Failing to Rebury	Notes
	1	1	EVS-23	20	20	0	0	
	2	2	EVS-23	20	20	0	0	
	3	3	EVS-23	20	20	0	0	
	4	4	EVS-23	20	20	0	0	
	5	5	EVS-23	20	20	0	0	
	6	1	EVS-2	20	19	0	0	
	7	2	EVS-2	20	16	0	0	
	8	3	EVS-2	20	19	0	0	
	9	4	EVS-2	20	20	0	0	
	10	5	EVS-2	20	20	0	0	
	11	1	EVS-16	20	19	0	0	
	12	2	EVS-16	20	20	0	0	
	13	3	EVS-16	20	20	1	0	
	14	4	EVS-16	20	19	1	0	
	15	5	EVS-16	20	18	0	0	
	16	1	EVS-25	20	16	0	1	
	17	2	EVS-25	20	18	1	2	
	18	3	EVS-25	20	20	0	1	
	19	4	EVS-25	20	20	0	0	
	20	5	EVS-25	20	17	1	3	
	21	1	EVS-1	20	19	4	0	
	22	2	EVS-1	20	20	0	0	
	23	3	EVS-1	20	20	1	0	
	24	4	EVS-1	20	20	0	0	
	25	5	EVS-1	20	20	0	0	
	26	1	EVS-3	20	19	2	0	
	27	2	EVS-3	20	20	0	0	
	28	3	EVS-3	20	20	0	0	
	29	4	EVS-3	20	20	0	0	
	30	5	EVS-3	20	20	0	0	
	31	1	EVS-4	20	19	1	0	
	32	2	EVS-4	20	18	0	0	
	33	3	EVS-4	20	18	0	0	
	34	4	EVS-4	20	19	1	0	
	35	5	EVS-4	20	20	2	0	
	36	1	EVS-5	20	18	0	0	
	37	2	EVS-5	20	20	2	0	
	38	3	EVS-5	20	18	2	0	
	39	4	EVS-5	20	19	0	0	
	40	5	EVS-5	20	19	0	0	
	41	1	EVS-6	20	16	0	1	
	42	2	EVS-6	20	20	1	0	
	43	3	EVS-6	20	19	0	0	
	44	4	EVS-6	20	19	0	1	
	45	5	EVS-6	20	18	1	0	
	46	1	EVS-7	20	19	6	0	
	47	2	EVS-7	20	17	2	0	
	48	3	EVS-7	20	17	3	0	
	49	4	EVS-7	20	18	3	0	
	50	5	EVS-7	20	17	2	0	
	51	1	EVS-8	20	18	0	0	
	52	2	EVS-8	20	19	1	0	

Reviewed by: [illegible]

Test: AM-Amphipod Survival and Avoidance Test — Test ID: EVS3192
Species: EE-Eohaustorius estuarius — Protocol: PSEP 95
Sample ID: EVS-1 to EVS-26 — Sample Type: SEDIMENT
Start Date: 9/27/96 — End Date: 10/7/96 — Lab ID: BCEVS-EVS Enviro.Consultants

	107	2	EVS-20	20	20	0	0	
	108	3	EVS-20	20	20	1	0	
	109	4	EVS-20	20	20	1	0	
	110	5	EVS-20	20	20	0	0	
	111	1	EVS-21	20	18	0	0	
	112	2	EVS-21	20	17	1	0	
	113	3	EVS-21	20	17	0	0	
	114	4	EVS-21	20	18	0	0	
	115	5	EVS-21	20	19	6	0	
	116	1	EVS-22	20	18	1	0	
	117	2	EVS-22	20	18	2	0	
	118	3	EVS-22	20	15	0	0	
	119	4	EVS-22	20	20	1	0	
	120	5	EVS-22	20	19	2	0	
	121	1	EVS-24	20	19	3	0	
	122	2	EVS-24	20	19	3	0	
	123	3	EVS-24	20	17	5	0	
	124	4	EVS-24	20	18	0	0	
	125	5	EVS-24	20	18	0	0	
	126	1	EVS-26	20	17	0	0	
	127	2	EVS-26	20	19	3	0	
	128	3	EVS-26	20	15	0	0	
	129	4	EVS-26	20	16	0	0	
	130	5	EVS-26	20	19	0	0	

Comments: Hart Crowser 9/231-06.3; 9600632

Reviewed by: Oct 24

Amphipod Survival and Avoidance Test-10d Survival			
Start Date: 9/27/96	Test ID: EVS3192	Sample ID:	EVS-1 to EVS-26
End Date: 10/7/96	Lab ID: BCEVS-EVS Enviro.Consult	Sample Type:	SEDIMENT
Sample Date:	Protocol: PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments: Hart Crowser 9/231-06.3; 9600632			
Equality of variance cannot be confirmed			
Hypothesis Test (1-tail, 0.05)			
Heteroscedastic t Test indicates significant differences			

* References compared to Negative Control

- References are EVS-2, EVS-16 and EVS-25

Amphipod Survival and Avoidance Test-10d Survival

Start Date:	9/27/96	Test ID:	EVS3192	Sample ID:	EVS-1 to EVS-26
End Date:	10/7/96	Lab ID:	BCEVS-EVS Enviro.Consult	Sample Type:	SEDIMENT
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	Hart Crowser 9/231-06.3; 9600632				

Equality of variance cannot be confirmed		
The control means are not significantly different (p = 0.14)	1:63299	2.30601
Hypothesis Test (1-tail, 0.05)		
Heteroscedastic t Test indicates no significant differences		

* Samples compared to EVS-2

Amphipod Survival and Avoidance Test-10d Survival					
Start Date:	9/27/96	Test ID:	EVS3192	Sample ID:	EVS-1 to EVS-26
End Date:	10/7/96	Lab ID:	BCEVS-EVS Enviro.Consult	Sample Type:	SEDIMENT
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	Hart Crowser 9/231-06.3; 9600632				

Equality of variance cannot be confirmed		
The control means are not significantly different (p = 0.06)	2.13809	2.30601
Hypothesis Test (1-tail, 0.05)		
Heteroscedastic t Test indicates significant differences		

* Samples compared to EVS-16

Reviewed by: CdM Oct 31/96

Amphipod Survival and Avoidance Test-10d Survival

Start Date:	9/27/96	Test ID:	EVS3192	Sample ID:	EVS-1 to EVS-26
End Date:	10/7/96	Lab ID:	BCEVS-EVS Enviro.Consult	Sample Type:	SEDIMENT
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	Hart Crowser 9/231-06.3; 9600632				

Equality of variance cannot be confirmed		
The control means are significantly different (p = 0.05)	2.25	2.30601
Hypothesis Test (1-tail, 0.05)		
Heteroscedastic t Test indicates no significant differences		

* Samples compared to EVS-25

Amphipod Survival and Avoidance Test-Reburial

Start Date:	9/27/96	Test ID:	EVS3192	Sample ID:	EVS-1 to EVS-26
End Date:	10/7/96	Lab ID:	BCEVS-EVS Enviro.Consult	Sample Type:	SEDIMENT
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	Hart Crowser 9/231-06.3; 9600632				

Conc-mg/L	1	2	3	4	5
EVS-23	100.00	100.00	100.00	100.00	100.00
EVS-2	100.00	100.00	100.00	100.00	100.00
EVS-16	100.00	100.00	100.00	100.00	100.00
EVS-25	93.75	88.89	95.00	100.00	82.35
EVS-1	100.00	100.00	100.00	100.00	100.00
EVS-3	100.00	100.00	100.00	100.00	100.00
EVS-4	100.00	100.00	100.00	100.00	100.00
EVS-5	100.00	100.00	100.00	100.00	100.00
EVS-6	93.75	100.00	100.00	94.74	100.00
EVS-7	100.00	100.00	100.00	100.00	100.00
EVS-8	100.00	100.00	100.00	94.44	100.00
EVS-9	100.00	94.12	100.00	100.00	100.00
EVS-10	100.00	100.00	100.00	100.00	100.00
EVS-11	100.00	100.00	100.00	100.00	100.00
EVS-12	100.00	100.00	100.00	100.00	100.00
EVS-13	93.75	93.75	100.00	100.00	94.44
EVS-14	100.00	100.00	100.00	100.00	100.00
EVS-15	100.00	100.00	100.00	100.00	100.00
EVS-17	100.00	100.00	100.00	91.67	95.00
EVS-18	100.00	100.00	100.00	100.00	100.00
EVS-19	100.00	100.00	100.00	100.00	100.00
EVS-20	100.00	100.00	100.00	100.00	100.00
EVS-21	100.00	100.00	100.00	100.00	100.00
EVS-22	100.00	100.00	100.00	100.00	100.00
EVS-24	100.00	100.00	100.00	100.00	100.00
EVS-26	100.00	100.00	100.00	100.00	100.00

			Transform: Untransformed				
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N
EVS-23	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-2	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-16	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-25	92.00	6.69	92.00	82.35	100.00	7.267	5
EVS-1	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-3	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-4	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-5	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-6	97.70	3.17	97.70	93.75	100.00	3.247	5
EVS-7	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-8	98.89	2.48	98.89	94.44	100.00	2.512	5
EVS-9	98.82	2.63	98.82	94.12	100.00	2.662	5
EVS-10	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-11	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-12	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-13	96.39	3.31	96.39	93.75	100.00	3.433	5
EVS-14	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-15	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-17	97.33	3.84	97.33	91.67	100.00	3.942	5
EVS-18	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-19	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-20	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-21	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-22	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-24	100.00	0.00	100.00	100.00	100.00	0.000	5
EVS-26	100.00	0.00	100.00	100.00	100.00	0.000	5

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	4.76293	1.035	-1.1179	12.2827

Reviewed by: BM Oct 24

EVS CONSULTANTS
SEDIMENT DESCRIPTION AND CHARACTERIZATION

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS W.O. No.: 9600632

Test Species: Eohaustorius estuarius
Test Type/Duration: 10 day - LC50
Day 0: Sept. 27/96

Sample I.D.	Colour	Grain Size	Smell	Shells/ Debris	Other Observations	Tech. Initial
EVS 15	DK. BROWN	SILT	NONE	NONE		
EVS 18	brown	silt	none	none	removed 3 small starfish (~3cm long) (dead)	
EVS 20	brown	silt	none	none	removed 4 starfish (~3 cm long) (dead)	
EVS 24	dark brown	silt/sand	sulphur	shells (~2cm) wood (~3cm)		
EVS 8	brown	silt	none	twigs (~3cm)	small crabs (dead) ~ 2cm	
EVS 12	dark brown	silt/sand	none	none	small black crabs (dead) ~ 2cm	
EVS 1	brown	silt	none	twigs (~3-5 cm)		
EVS 13	dark brown	silt/sand	sulphur	thin twigs (~3-5 cm)	light blue-white film on surface	
EVS 21	brown	silt	none	none	small starfish (~3cm) (dead)	
EVS 11	dark brown	sand/silt	none	assorted wood (~5cm)		

Be descriptive when you characterize the sediments. Colour and grain size information must be complete. If the sediment has an odour, describe the type of smell. Note any shells or debris that are present. Be sure to record anything else in the Observations section.

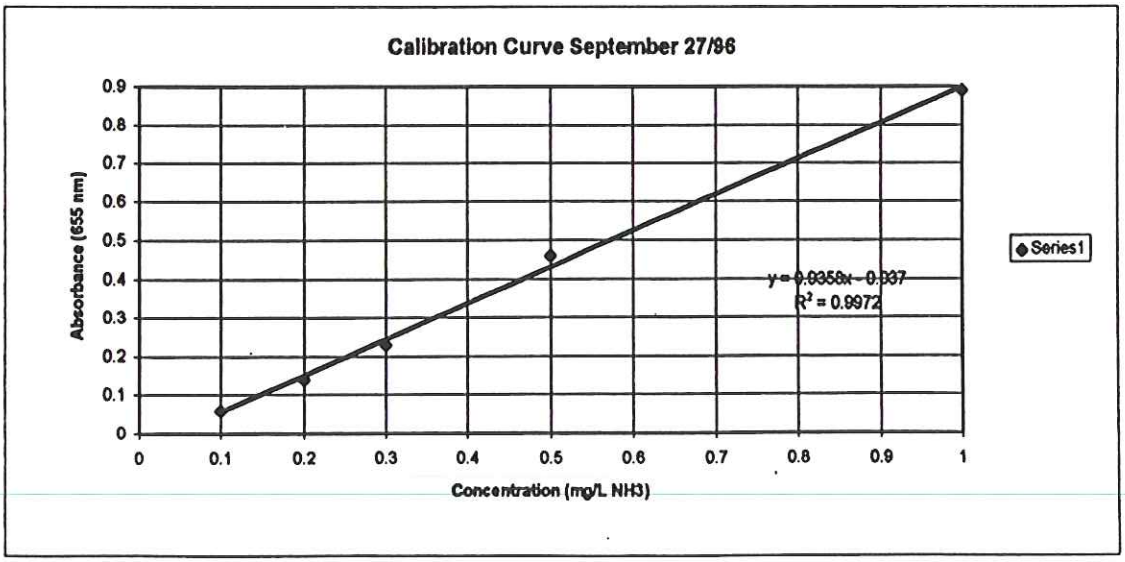
Data Certified By: C. McPherson Date Certified: Oct 29/96

Ammonia Measurements - September 27, 1996 (Day 0)

Client: Hart Crowser
Project No.: 9/231-06.3
Work Order No: 9600632

Test Type: 10-d Sediment Toxicity Test
Test Species: *Eohaustorius estuarius*
Date Initiated: 27-Sep-96
Date Terminated: 7-Oct-96

Standard Concentrations (mg/L NH3)	Absorbance of standards	Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
		Interstitial water			
0.1	0.06	EVS-1	0.24	25.00	7.4
0.2	0.14	EVS-2	0.53	50.00	30.0
0.3	0.23	EVS-3	0.4	25.00	11.6
0.5	0.46	EVS-4	0.73	25.00	20.3
1	0.89	EVS-5	0.41	25.00	11.9
		EVS-6	0.14	50.00	9.6
		EVS-7	0.33	25.00	9.8
		EVS-8	0.23	50.00	14.3
		EVS-9	0.14	50.00	9.6
		EVS-10	0.18	50.00	11.7
		EVS-11	0.22	50.00	13.8
		EVS-12	0.26	50.00	15.9
		EVS-13	0.26	50.00	15.9
		EVS-14	0.18	50.00	11.7
		EVS-15	0.2	50.00	12.7
		EVS-16	0.36	50.00	21.1
		EVS-17	0.28	50.00	16.9
		EVS-18	0.14	50.00	9.6
		EVS-19	0.16	50.00	10.6
		EVS-20	0.12	50.00	8.5
		EVS-21	0.15	50.00	10.1
		EVS-22	0.14	50.00	9.6
		EVS-23	0.1	2.27	0.3
		EVS-24	0.4	50.00	23.2
		EVS-25	0.35	125.00	51.5
		EVS-26	0.31	50.00	18.5



CdM Oct 24/96

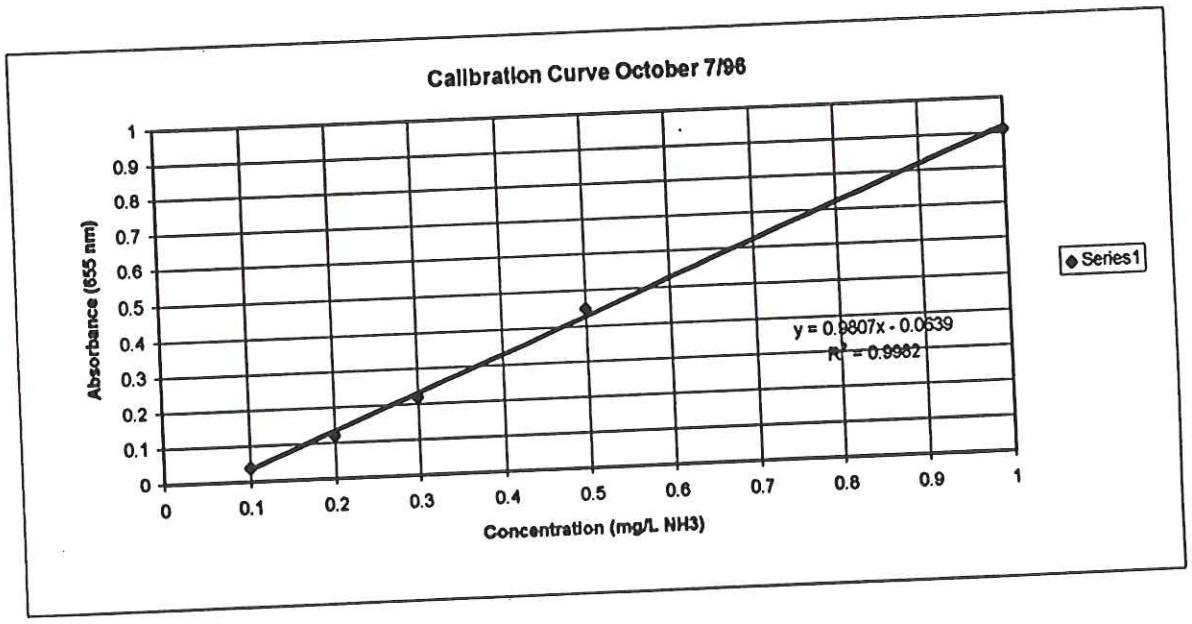
Ammonia Measurements - October 7, 1996 (Day 10)

Client: Hart Crowser
Project No.: 9/231-06.3
Work Order No: 9600632

Test Type: 10-d Sediment Toxicity Test
Test Species: *Eohaustorius estuarius*
Date Initiated: 27-Sep-96
Date Terminated: 7-Oct-96

Standard Concentrations (mg/L NH3)	Absorbance of standards
0.1	0.04
0.2	0.12
0.3	0.22
0.5	0.45
1	0.91

Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
Interstitial water			
EVS-2	0.06	125.00	13.5
EVS-4	0.1	50.00	7.5
EVS-5	0.06	50.00	5.4
EVS-8	0.05	50.00	4.9
EVS-15	0.05	25.00	2.4
EVS-17	0.12	50.00	8.5
EVS-19	0.1	25.00	3.7
EVS-20	0.07	25.00	3.0
EVS-26	0.07	50.00	5.9



CdM Oct 24/96

SALINITY DATA SHEET

(Interstitial)

CLIENT: Hart Crowser
PROJECT #: 9/231-06.3
W.O. #: 9600632
TEST INITIATION DATE: September ~~24~~ 27, 1996

Sample I.D.	Salinity (ppt) Day 0	Technician	Salinity (ppt) Day 5	Technician	Salinity (ppt) Day 10	Technician
EVS -1	30	BW	30	[illegible]	30	BW
EVS - 2	30		30		30	
EVS -3	28		28		30	
EVS -4	30		28		30	
EVS -5	27		28		30	
EVS -6	30		28		30	
EVS -7	28		28		31	
EVS -8	30		29		30	
EVS -9	28		27		30	
EVS -10	27		30		31	
EVS -11	28		30		30	
EVS -12	28		29		29	
EVS -13	28		29		30	
EVS -14	29		28		31	
EVS -15	27		28		30	
EVS -16	30		29		30	
EVS -17	28		30		31	
EVS -18	27		29		30	
EVS -19	28		29		30	
EVS -20	28		27		30	
EVS -21	30		29		30	
EVS -22	28		28		30	
EVS -23	28		28		30	
EVS -24	28		28		30	
EVS -25	30		29		30	
EVS -26	30	↓	29	↓	30	↓
CONTROL	28	BW	29	[illegible]	30	BW
31.2 mg/L	28		29		30	
62.5 mg/L	29		29		30	
125 mg/L	27		29		30	
250mg/L	30		30		30	
500 mg/L	30	↓	29	↓	30	↓

CAM Oct 31/96

RESULTS OF ANALYSIS - Water

File No. G5507

	Sulphide S
EVS-3 Day 0 1996 Sep 27	<0.02
EVS-4 Day 0 1996 Sep 27	<0.02
EVS-5 Day 0 1996 Sep 27	<0.02
EVS-6 Day 0 1996 Sep 27	0.04
EVS-7 Day 0 1996 Sep 27	0.06
EVS-8 Day 0 1996 Sep 27	0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G5507

Water	EVS-21 Day 0 96 09 27 11:00	EVS-21 Day 0 QC # 74101
Inorganic Parameters		
Sulphide S	<0.02	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water

File No. G5877

Day 10

	Sulphide S
EVS-1 Day 10 1996 Oct 7	<0.02
EVS-2 Day 10 1996 Oct 7	<0.02
EVS-3 Day 10 1996 Oct 7	0.02
EVS-4 Day 10 1996 Oct 7	0.02
EVS-5 Day 10 1996 Oct 7	0.02
EVS-6 Day 10 1996 Oct 7	<0.02
EVS-7 Day 10. 1996 Oct 7	<0.02
EVS-8 Day 10 1996 Oct 7	<0.02
EVS-9 Day 10 1996 Oct 7	<0.02
EVS-10 Day 10 1996 Oct 7	<0.02
EVS-11 Day 10 1996 Oct 7	<0.02
EVS-12 Day 10 1996 Oct 7	<0.02
EVS-13 Day 10 1996 Oct 7	<0.02
EVS-14 Day 10 1996 Oct 7	<0.02
EVS-15 Day 10 1996 Oct 7	<0.02
EVS-16 Day 10 1996 Oct 7	<0.02
EVS-17 Day 10 1996 Oct 7	<0.02
EVS-18 Day 10 1996 Oct 7	0.02
EVS-19 Day 10 1996 Oct 7	<0.02
EVS-20 Day 10 1996 Oct 7	

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G5877

Water	EVS-7 Day 10	EVS-7 Day 10
	96 10 07	QC # 74858
Inorganic Parameters		
Sulphide S	<0.02	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G5877

Water	EVS-26 Day 10	EVS-26 Day 10
	96 10 07	QC # 74860
Inorganic Parameters		
Sulphide S	<0.02	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

EVS CONSULTANTS
ACUTE LETHALITY TOXICITY TEST DATA

Sample I.D.: Cadmium Reference Toxicant (Stock #96C004)
Date ~~Collected~~ Prepared: September 27/96
Test Date/Time: September 27/96 (1400h)
No. Organisms/Test Volume: 10/1L

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS W.O. No.: 9600632
Test Species: Eohaustorius estuarius
Sources and Batch: Northwest Aq. Sciences (Sept 19/96)

Concentration mg/L Cd	Percent Survival (1 to 96 hours)							Dissolved Oxygen (mg/L)					Temperture (°C)					pH					Salinity (ppt)	
	1	2	4	24	48	72	(2) 96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
18				100	(1) 90	90	~~80~~ 20	8.2	8.1	8.2	8.3	8.1	15.0	15.5	15.5	15.0	15.0	7.8	7.9	7.9	7.7	7.8	30	30
10				100	100	100	~~100~~ 60	8.3	8.1	8.2	8.3	8.1	15.0	15.5	15.5	15.0	15.0	7.6	7.9	7.9	7.7	7.8	30	30
5.6				100	90	90	~~90~~ 80	8.2	8.1	8.2	8.3	8.0	15.0	15.5	15.5	15.0	15.0	7.6	7.9	7.9	7.7	7.8	30	30
3.2				100	100	100	90	8.3	8.1	8.2	8.3	8.0	15.0	15.5	15.5	15.0	15.0	7.7	7.9	7.9	7.7	7.8	30	30
1.8				100	100	100	~~90~~ 80	8.3	8.2	8.2	8.3	8.0	15.0	15.5	15.5	15.0	15.0	7.7	7.9	7.9	7.7	7.8	30	30
1.0				100	100	100	100	8.3	8.1	8.1	8.3	8.0	15.0	15.5	15.5	15.0	15.0	7.7	7.9	7.9	7.7	7.8	30	30
0.56				100	100	100	~~100~~ 90	8.3	8.1	8.0	8.3	8.0	15.0	15.5	15.5	15.0	15.0	7.7	7.9	7.9	7.7	7.8	30	29
Control				100	90	90	90	8.3	8.1	7.9	8.2	8.0	15.0	15.5	15.5	15.0	15.0	7.7	7.9	7.9	7.7	7.7	30	29
Technician				[illegible]	[illegible]	SVS	[illegible]	[illegible]	[illegible]	[illegible]	SVS	SVS	[illegible]	[illegible]	[illegible]	SVS	SVS	[illegible]	[illegible]	[illegible]	SVS	SVS	[illegible]	SVS

WQ Instruments Used: Temp. calibrated thermometer pH II-A-26 DO II-A-19 DO#4 Salinity II-C-22

Sample Description:

Comments: (1) two animals weak (2) animals rechecked under microscope

Test Set Up By: MKL

Date Certified By: C. McPherson

Date Certified: Oct 24/96

Forms\Lab\Datasbts\96HLC50.SW

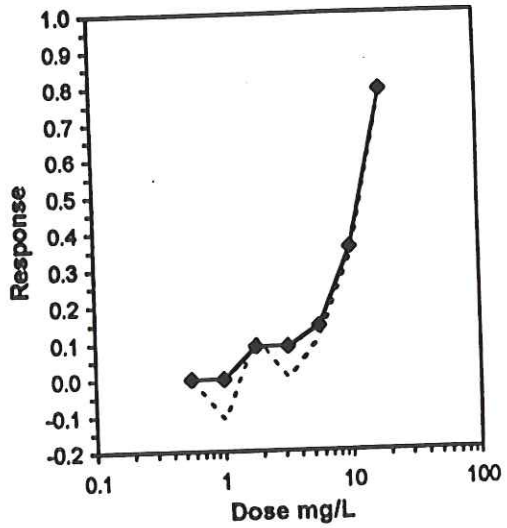
Amphipod Survival and Avoidance Test-10d Survival

Start Date:	9/27/96 14:00	Test ID:	RTEECD9	Sample ID:	REF-Ref Toxicant
End Date:	10/1/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	CDCL-Cadmium chloride
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	HART CROWSER 9/231-06.3; 9600632				

Conc-mg/L	1
D-Control	0.9000
0.56	0.9000
1	1.0000
1.8	0.8000
3.2	0.9000
5.6	0.8000
10	0.6000
18	0.2000

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-21.4%	11.878	8.317	16.964



EVS CONSULTANTS
10-d AMPHIPOD SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Water Quality Instruments Used:

D.O. Meter: II-A-19 DO #4
pH Meter: II-A-26
Salinity: II-C-22
Temperature: Calib. thermometer

Client: Hart Crowser
EVS Project No.: 91231-06.3
EVS Work Order No.: 9600632
Day 0: Sept-27/96
Day 10: Oct-7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: Northwest Aquatic Sciences (Sept 19/96)

SAMPLE I.D.	TEMPERATURE (°C)											DISSOLVED OXYGEN (mg/L)										
	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	.6	7	8	9	10
500mg/L NH_3	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	7.7	7.7	8.1	7.9	7.8	7.9	8.2	8.1	8.1	8.4	7.8
250mg/L NH_3	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	6.3 ①	8.0	8.4	8.2	8.0	7.9	8.2	7.8 8.3	8.2	8.4	8.4
125mg/L NH_3	15.0	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	7.8	7.7	8.2	8.0	7.5	8.0	8.1	8.0	8.2	8.3	8.0
62.5mg/L NH_3	15.5	15.0	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.1	8.1	8.3	8.0	7.9	7.9	8.2	8.3	8.3	8.3	8.2
31.2 mg/L NH_3	15.5	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	8.1	8.0	8.3	8.1	8.1	8.1	8.2	8.1 8.2	8.2	8.3	8.2
Control	15.5	15.0	15.5	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	7.7	8.0	8.2	8.1	8.0	8.0	8.2	8.2	8.2	8.1	8.1
Technician's Initials	JF	JF	JM	SVS	SVS	SVS	SVS	SVS	JF	ART	SVS	JF	JF	JM	SVS	SVS	SVS	SVS JF	SVS	JF	ART	SVS

COMMENTS: ① Aeration stopped - readjusted JF

Data Certified By: C. McPherson

Date Certified: Nov 6/96

EVS CONSULTANTS - AMPHIPOD SEDIMENT TOXICITY TESTS
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY

Water Quality Instruments Used

D.O. Meter II-A-19 DO#4
pH Meter II-A-26
Salinity II-C-22
Temperature Calibrated thermometer

Client: Hart Crowser
EVS Project No.: 9123I-06.3
EVS W.O. No.: 9600632
Day 0: September 27/96
Day 10: & October 7/96
Test Species: Eohaustorius estuarius
Source/Collection Date: Northwest Aq. Sources (Sept. 19/96)

SAMPLE I.D. Control

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	30	8.1
B	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.1	30	8.1
C	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	30	8.1
D	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.2	30	8.1
F	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.3	30	8.1
Tech'n	JL	AL	SVS	SVS	SVS	SVS	SVS	JL	ART	SVS	ART	ART	NS PH	SVS PH	NS PH	SVS PH

(# dead:# missing) - A(0:0) B(0:0) C(0:0) D(0:0) E(0:0)

SAMPLE I.D. 31.2 mg/L NH_3

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.1	30	8.0
B	-	1	1	1	0	0	0	-	0	0	19	0	15.0	8.2	30	8.1
C	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.1	30	8.1
D	-	0	0	0	0	0	0	-	0	0	20	0	15.0	~~8.2~~ PH	30	8.1
E	-	0	0	0	1	0	0	-	0	0	19	0	15.0	8.1	30	8.1
Tech'n	JL	AL	SVS	SVS	SVS	SVS	SVS	JL	ART	SVS	ART	ART	NS PH	AS PH	NS PH	SVS PH

(# dead:# missing) - A(0:0) B(0:1) C(0:0) D(0:0) E(0:1)

SAMPLE I.D. 62.5 mg/L NH_3

Rep.	Number of Amphipods Emerged From Sediments at Days 1-10										Number Alive at Day 10	Number Failing to Rebury	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10			Temp. (°C)	D.O. (mg/L)	Sal. (ppt)	pH
A	-	0	0	0	0	0	0	1	0	0	20	0	15.0	7.9	30	8.1
B	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.1	30	8.1
C	-	0	0	0	1	1	1	1	1	1	19	0	15.0	8.0	30	8.0
D	-	0	0	0	0	0	0	-	0	0	20	0	15.0	8.1	30	8.0
E	-	0	~~2~~ 0	0	0	0	0	-	0	0	20	0	15.0	8.1	30	8.0
Tech'n	JL	AL	SVS	SVS	SVS	SVS	SVS	JL	ART	SVS	ART	ART	NS PH	SVS PH	NS PH	SVS PH

(# dead:# missing) - A(0:0) B(0:0) C(0:1) D(0:0) E(0:0)

Data Certified By: C. McPherson Date Certified: Nov 6/96

Test: AM-Amphipod Survival and Avoidance Test Test ID: RTEENS11
Species: EE-Eohaustorius estuarius Protocol: PSEP 95
Sample ID: REF-Ref Toxicant Sample Type: AMMONIUM C
Start Date: 9/27/96 End Date: 10/7/96 Lab ID: BCEVS-EVS Enviro.Consultants

Pos	ID	Rep	Group	Survival Day 0	Survival Day 10	Emergence Days 1 to 10	No. Failing to Rebury	Notes
	1	1	D-Control	20	20	0	0	
	2	2	D-Control	20	20	0	0	
	3	3	D-Control	20	20	0	0	
	4	4	D-Control	20	20	0	0	
	5	5	D-Control	20	20	0	0	
	6	1	31	20	20	0	0	
	7	2	31	20	19	3	0	
	8	3	31	20	20	0	0	
	9	4	31.2	20	20	0	0	
	10	5	31.2	20	19	1	0	
	11	1	62.5	20	20	1	0	
	12	2	62.5	20	20	0	0	
	13	3	62.5	20	19	6	0	
	14	4	62.5	20	20	0	0	
	15	5	62.5	20	20	0	0	
	16	1	125.0	20	20	8	0	
	17	2	125.0	20	20	0	0	
	18	3	125.0	20	20	0	0	
	19	4	125.0	20	20	0	0	
	20	5	125.0	20	20	0	0	
	21	1	250.0	20	2	35	2	
	22	2	250.0	20	1	52	0	
	23	3	250.0	20	3	46	0	
	24	4	250.0	20	3	54	1	
	25	5	250.0	20	4	37	2	
	26	1	500.0	20	0	200	0	
	27	2	500.0	20	0	192	0	
	28	3	500.0	20	0	197	0	
	29	4	500.0	20	0	190	0	
	30	5	500.0	20	0	190	0	

Comments: Hart Crowser 9/231-06.3; 9600632

Reviewed by Oct 24

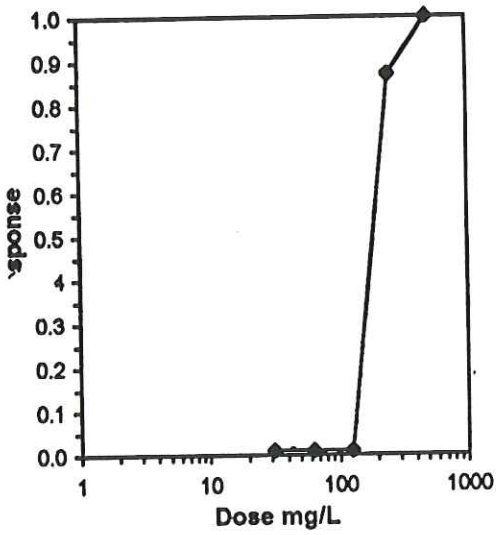
Amphipod Survival and Avoidance Test-10d Survival

Start Date:	9/27/96	Test ID:	RTEENS11	Sample ID:	REF-Ref Toxicant
End Date:	10/7/96	Lab ID:	BCEVS-EVS Enviro.Consult	Sample Type:	AMMONIUM C
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	Hart Crowser 9/231-06.3; 9600632				

Conc-mg/L	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
31.2	1.0000	0.9500	1.0000	1.0000	0.9500
62.5	1.0000	1.0000	0.9500	1.0000	1.0000
125	1.0000	1.0000	1.0000	1.0000	1.0000
250	0.1000	0.0500	0.1500	0.1500	0.2000
500	0.0000	0.0000	0.0000	0.0000	0.0000

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%	188.55	179.61	197.92
10.0%	186.01	178.37	193.97
20.0%	185.54	179.76	191.50
Auto-1.0%	191.81	182.83	201.23



Reviewed by: Oct 24/96

Amphipod Survival and Avoidance Test-Reburial

Start Date:	9/27/96	Test ID:	RTEENS11	Sample ID:	REF-Ref Toxicant
End Date:	10/7/96	Lab ID:	BCEVS-EVS Enviro.Consult	Sample Type:	AMMONIUM C
Sample Date:		Protocol:	PSEP 95	Test Species:	EE-Eohaustorius estuarius
Comments:	Hart Crowser 9/231-06.3; 9600632				

Conc-mg/L	1	2	3	4	5
D-Control	100.00	100.00	100.00	100.00	100.00
31.2	100.00	100.00	100.00	100.00	100.00
62.5	100.00	100.00	100.00	100.00	100.00
125	100.00	100.00	100.00	100.00	100.00
250	0.00	100.00	100.00	66.67	50.00

			Transform: Untransformed					Rank	1-Tailed
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
D-Control	100.00	0.00	100.00	100.00	100.00	0.000	5		
31.2	100.00	0.00	100.00	100.00	100.00	0.000	5	27.50	17.00
62.5	100.00	0.00	100.00	100.00	100.00	0.000	5	27.50	17.00
125	100.00	0.00	100.00	100.00	100.00	0.000	5	27.50	17.00
250	63.33	41.50	63.33	0.00	100.00	65.526	5	20.00	17.00

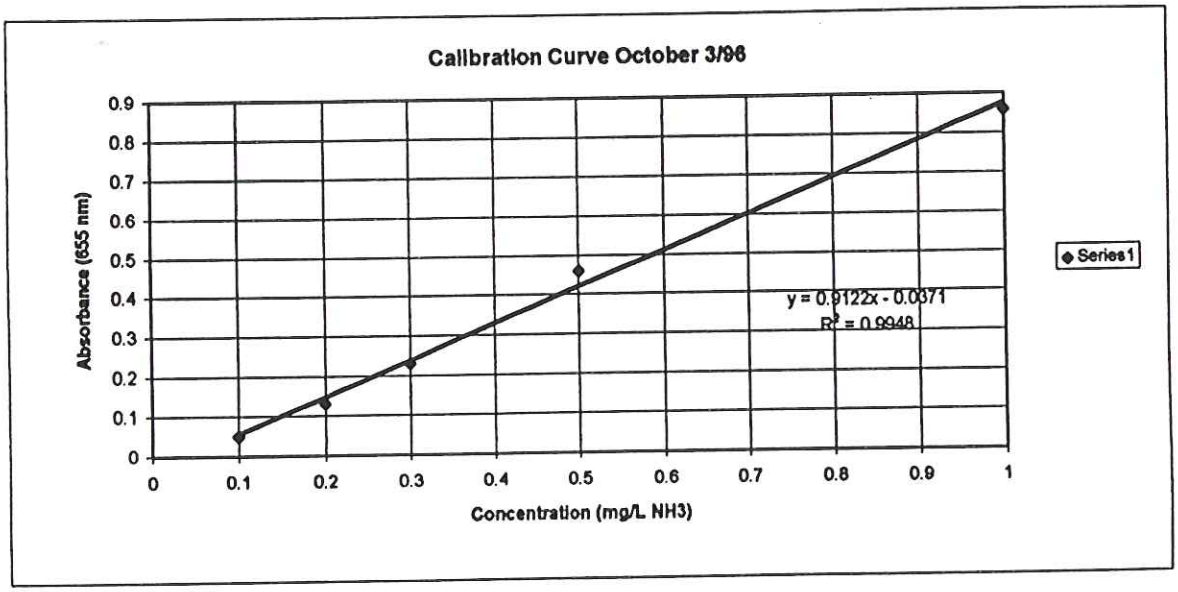
Auxiliary Tests					Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)					0.53472	0.888	-1.4694	9.40623
Equality of variance cannot be confirmed								
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**				
Steel's Many-One Rank Test	250	>250						

Reviewed by: Oct 24/96

Ammonia Measurements - October 2, 1996 (Day 5)

Client:	Hart Crowser	Test Type:	Ammonium Chloride (Spiked Sediment)
Project No.:	9/231-06.3	Test Species:	*Eohaustorius estuarius*
Work Order No:	9600632	Date Initiated:	27-Sep-96
		Date Terminated:	7-Oct-96

Standard Concentrations (mg/L NH3)	Absorbance of standards	Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
		Interstitial water			
0.1	0.05	Control	0.18	25.00	5.8
0.2	0.13	31.2 mg/L	0.23	100.00	28.6
0.3	0.23	62.5 mg/L	0.18	250.00	58.4
0.5	0.46	125 mg/L	0.35	250.00	103.0
1	0.86	250 mg/L	0.33	500.00	195.5
		500 mg/L	0.31	1000.00	369.9



CAH Oct 24/96

RESULTS OF ANALYSIS - Water

File No. G5877

	Ammonia Nitrogen N	Sulphide S
	-	
	-	
	-	
	-	
	-	
	-	
Control Ammonia 1996 Oct 7	2.14	
31.2 mg/L 1996 Oct 7	19.1	-
62.5 mg/L 1996 Oct 7	61.3	-
125 mg/L 1996 Oct 7	102	-
250 mg/L 1996 Oct 7	268	-
500 mg/L 1996 Oct 7	520	-

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

APPENDIX D

20-d *N. arenaceodentata* Sediment Toxicity Test Raw Data

BIOASSAY QA CHECKLIST

Project Name/No. 9/231-06.3

Staff SVS, EFV, LJS, JGK, PAH, AWD, EJT, BSJ MKL, CEB, ECC, ART

Date Oct. 24, 1996

NOTE: White cell denotes required data

NEANTHES 20-DAY GROWTH TEST		Each Batch	Test Sediment	Reference Sediment	Control Sediment
Starting age (in days post-emergence)		✓			
Food type		Tetra Marin			
Quantity (mg/beaker/interval)		40 mg/jar			
Feeding interval (hours)		48 h			
Biomass and Mortality:	Start date	Oct. 4, 1996			
	Initial counts and weights (mg dry weight)	0.79 mg/worm			
	Number of survivors and final weights (mg dry weight)		✓	✓	✓
Positive Control:	Toxicant used	Cadmium chloride			
	Toxicant concentrations	32, 5.6, 10.0, 18.0, 32			
	Exposure time	96 h			
	LC50	13.4 mg/L			
	LC50 method of calculation	Trimmed Spearman-Karber			
	Start date	Oct. 4, 1996			
	Survival data	Oct. 8, 1996			
Water Quality Measurement Methods:	Dissolved oxygen	✓			
	Ammonia	✓			
	Interstitial salinity	✓			
	Sulfide	✓			
	Water salinity	✓			
Water Quality:	Temperature (days 0, 3, 6, 9, 12, 15, 18, 20)		✓	✓	✓
	pH (days 0, 3, 6, 9, 12, 15, 18, 20)		✓	✓	✓
	Dissolved oxygen (days 0, 3, 6, 9, 12, 15, 18, 20)		✓	✓	✓
	Water salinity (days 0, 3, 6, 9, 12, 15, 18, 20)		✓	✓	✓
	Interstitial water salinity (day 0)		✓	✓	✓
	Sulfide (initial and final)		✓	✓	✓
	Ammonia (initial and final)		✓	✓	✓

EVS CONSULTANTS
SEDIMENT TOXICITY TEST DATA SUMMARY

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS Work Order No.: 9600631

EVS Analyst(s) SVS, EFV, LJS, JGK, PAH, AWD, EJT, BSJ, MKL, CEB, KEC, ART
Test Type 20-d Growth and Survival
Test Initiation Date October 4, 1996

SAMPLE
Identification EVS-1 to EVS-26
Amount Received 5 x 2 L each
Date Collected September 3 to 9
Date Received September 4 to 9

TEST SPECIES INFORMATION
Organism Neanthes arenaceodentata
Source Don Reish
Date Received 1st September, October 30, 1996
Initial Dry Weight 0.79 mg / worm
Reference Toxicant 96-h Cd Reftox / 20-d NH_3 spiked Rel
Current Reference Toxicant Result 13.4 mg/L Cd / 141.4 mg/L NH_3
Laboratory Range for Reference Toxicant (mean ± 2SD) 8.2 ± 3.8 mg/L Cd
Lab. mean for NH_3 can not be generated yet because insufficient data points.

DILUTION AND CONTROL MEDIUM
Water UV Sterilized Filtered Sea Water (Burrard Inlet)
Temperature (°C) 20.0
pH 7.8
Dissolved Oxygen (mg/L) 7.9
Salinity (ppt) 29
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a
Other: n/a

TEST CONDITIONS
Temperature Range (°C) 19.0 - 20.5
pH Range 7.3 - 8.4
Dissolved Oxygen Range (mg/L) 4.9 - 7.6
Salinity Range (ppt) 27 - 30
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a

Other:	Day 0	Day 10	Day 20
Sulphides (mg/L S):	<0.02-0.05	2.4-18.5	<0.02
Interstitial NH_3 (mg/L NH_3):	6.3-39.5	48	1.2-11.7
Interstitial salinity (ppt):	26-42	30-31	30-33

Sample ID	Mean ± SD	
	Survival (%)	Dry Weight (mg)
EVS-1 Δ	100.0 ± 0	9.4 ± 3.1
EVS-2	100.0 ± 0	10.3 ± 2.1
EVS-3	100.0 ± 0	11.6 ± 2.1
EVS-4	96.0 ± 8.9	10.7 ± 3.3
EVS-5 □Δ	100.0 ± 0	9.4 ± 1.5
EVS-6 *+□Δ	100.0 ± 0	8.3 ± 0.9
EVS-7	96.0 ± 8.9	12.4 ± 2.5
EVS-8 □Δ	100.0 ± 0	9.7 ± 2.0

Asterisk (*) indicates significant difference in comparing samples to Control sediment (EVS-23) w/ respect to dry wt.

Data Certified By: R Lande
Date Certified: 28/11/96

Crosses (+) indicates significant difference in comparing samples to EVS-2 w/ respect to dry wt.
Square (□) indicates significant difference in comparing samples to EVS-16 w/ respect to dry wt.
Triangle (Δ) indicates significant difference in comparing samples to EVS-25 w/ respect to dry wt.

EVS CONSULTANTS
SEDIMENT TOXICITY TEST DATA SUMMARY

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS Work Order No.: 9600631

EVS Analyst(s) SVS, EFV, LJS, JGK, PAH, AWD, EJT, BSJ, MKL, CEB, ECC, ART
Test Type 20-d Growth and Survival
Test Initiation Date October 4, 1996

SAMPLE
Identification EVS-1 to EVS-26
Amount Received 5 x 2 L each
Date Collected September 3 to 9
Date Received September 4 to 9

TEST SPECIES INFORMATION
Organism Neanthes arenoceodentata
Source Don Reish
Date Received 16+ September 30, 1996 October 1
Initial Dry Weight 0.79 mg / worm
Reference Toxicant 96-h Cd Reftox / 20-d NH_3 spiked Ref
Current Reference Toxicant Result 13.4 mg/L Cd / 14.9 mg/L NH_3
Laboratory Range for Reference Toxicant (mean ± 2SD) 8.2 ± 3.8 mg/L Cd
Lab mean for NH_3 can not be generated yet because insufficient data points.

DILUTION AND CONTROL MEDIUM
Water UV Sterilized Filtered Sea Water (Burrard Inlet)
Temperature (°C) 20.0
pH 7.8
Dissolved Oxygen (mg/L) 7.9
Salinity (ppt) 29
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a
Other: n/a

TEST CONDITIONS
Temperature Range (°C) 19.0 - 20.5
pH Range 7.3 - 8.4
Dissolved Oxygen Range (mg/L) 4.9 - 7.6
Salinity Range (ppt) 27 - 30
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a

Other:	Day 0	Day 10	Day 20
Sulphides (mg/L S):	<0.02-0.05		<0.02
Interstitial NH_3 (mg/L NH_3):	6.3-39.5	2.1-18.5	1.2-11.7
Interstitial salinity (ppt):	26-42	30-31	30-33

Sample ID	Mean ± SD	
	Survival (%)	Dry Weight (mg)
EVS-9	100.0 ± 0	10.1 ± 2.4
EVS-10	100.0 ± 0	10.1 ± 2.4
EVS-11	100.0 ± 0	12.3 ± 2.3
EVS-12	100.0 ± 0	13.0 ± 0.8
EVS-13	100.0 ± 0	11.8 ± 1.3
EVS-14 * □ △	100.0 ± 0	8.6 ± 1.7
EVS-15 △	100.0 ± 0	10.8 ± 0.7
EVS-16	100.0 ± 0	12.0 ± 1.4

Asterisk (*) indicates significant difference in comparing samples to Control sediment (EVS-23) w/ respect to dry wt.

Data Certified By: RLandel Date Certified: 28/11/96

Crosses (+) indicates significant difference in comparing samples to EVS-2 w/ respect to dry wt.
Square (□) indicates significant difference in comparing samples to EVS-16 w/ respect to dry wt.
Triangle (△) indicates significant difference in comparing samples to EVS-25 w/ respect to dry wt.

EVS CONSULTANTS
SEDIMENT TOXICITY TEST DATA SUMMARY

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS Work Order No.: 9600631

EVS Analyst(s): SVS, EFV, LJS, JGK, PAH, AWD, EJT, BSJ, MKL, CEB, ECC, ART
Test Type: 20-d Growth and Survival
Test Initiation Date: October 4, 1996

SAMPLE
Identification: EVS-1 to EVS-26
Amount Received: 5 X 2 L each
Date Collected: September 3 to 9
Date Received: September 4 to 9

TEST SPECIES INFORMATION
Organism: Neanthes arenoceodentata
Source: Don Reish
Date Received: ~~September~~ October 1 ~~30~~, 1996
Initial Dry Weight: 0.79 mg/worm
Reference Toxicant: 96-h Cd Reftox / 20-d NH_3 spiked Ref
Current Reference Toxicant Result: 13.4 mg/L Cd / 141.4 mg/L NH_3
Laboratory Range for Reference Toxicant (mean ± 2SD): 8.2 ± 3.8 mg/L Cd
Lab mean for NH_3 cannot be generated yet because insufficient data points

DILUTION AND CONTROL MEDIUM
Water: UV/Sterilized Filtered Sea Water (Burrard Inlet)
Temperature (°C): 20.0
pH: 7.8
Dissolved Oxygen (mg/L): 7.9
Salinity (ppt): 29
Conductivity (μmhos/cm): n/a
Hardness (mg/L as $CaCO_3$): n/a
Alkalinity (mg/L as $CaCO_3$): n/a
Other: n/a

TEST CONDITIONS
Temperature Range (°C): 19.0 - 20.5
pH Range: 7.3 - 8.4
Dissolved Oxygen Range (mg/L): ~~4.9~~ 4.8 - 7.6
Salinity Range (ppt): 27 - 30
Conductivity (μmhos/cm): n/a
Hardness (mg/L as $CaCO_3$): n/a
Alkalinity (mg/L as $CaCO_3$): n/a
Other:

	Day 0	Day 10	Day 20
Sulphides (mg/L S)	<0.02-0.05	2.4-18.5	<0.02
Interstitial NH_3 (mg/L NH_3)	6.3-39.5	~~tcs~~	1.2-11.7
Interstitial salinity (ppt)	26-42	~~tcs~~ 30-31	30-33

Sample ID	Mean ± SD Survival (%)	Mean ± SD Dry Weight (mg)
EVS-25	100.0 ± 0	12.4 ± 1.6
EVS-26 Δ	100.0 ± 0	8.2 ± 4.7

Asterisk (*) indicates significant difference in comparing samples to Control sediment (EVS-23) w/ respect to dry wt.

Data Certified By: [signature]   Date Certified: 28/11/96

Crosses (+) indicates significant difference in comparing samples to EVS-2 w/ respect to dry wt.
Square (□) indicates significant difference in comparing samples to EVS-1 w/ respect to dry wt.
Triangle (Δ) indicates significant difference in comparing samples to EVS-25 w/ respect to dry wt.

EVS CONSULTANTS - *Neanthes* 20-d SEDIMENT TOXICITY TEST
DAILY WATER QUALITY MONITORING

Client: Hart Crowser
EVS Project No.: 9/231-02.3 3
EVS W.O. No.: 9600631
Day 0: Oct. 4, 1996
Day 20: Oct. 24, 1996
Test Species: Neanthes arenaceodentata
Source/Collection Date: D. Reish / Sept. 30, 1996

Water Quality Instruments Used

D.O. Meter: II-A-19
pH Meter: II-A-26
Salinity: II-C-22
Temperature: Calibrated Hg thermometer

Temperature (°C)

Sample I.D.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EVS-12	20	20	20.0	20.0	20.0	20.0	20.0	20.0	19.5	20.0	19.5	19.5	19.5	19.5	19.5	20	20	20.0	19.5	20.0	20.0
EVS-13	20	20	20.0	20.0	20.0	20.0	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	20	19.5	20.0	19.5	20.0
EVS-14	20	20	20.0	20.0	20.0	20.0	20.0	19.5	19.5	19.5	19.5	19.5	20.0	19.5	19.5	20	20	20.0	19.5	20.0	20.0
EVS-15	20	20.5	20.5	20.0	20.0	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20	20	20.5	20	20.0	20.0	20.0	20.5
EVS-16	20	20	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	20	19.5	19.5	19.5	19.5
EVS-17	20	20	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	20	19.5	19.5	19.5	20.5
EVS-18	20	20	19.5	19.5	20.0	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	19.5	19.5	19.5	19.5	19.5
EVS-19	20	20	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	19.5	19.5	19.5	19.5	19.5
EVS-20	20	20	20.0	20.0	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	19.5	19.5	19.5	19.5	19.5
EVS-21	20	20	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	20	19.5	19.5	19.5	19.5	19.5
EVS-22	20	20	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.0	19.5	19.5	20	19.5	19.5	19.5	19.5	19.5
Technician's Initials	SVS/BSJ	EFV	JF	JGL	JGL	JGL	JF	JGL	JGL	JGL	JGL	JGL	JGL/PAH	EN	EN	EN	BSJ	JGL	M	JGL	JGL/TEB

Dissolved Oxygen (mg/L)

Sample I.D.	0	3	6	9	12	15	18	20
EVS-12	7.4	6.7	7.1	6.6	6.7	6.9	6.6	7.1
EVS-13	7.5	6.3	6.9	6.2	6.4	6.9	7.4	6.8
EVS-14	7.2	6.8	6.9	6.8	6.5	7.0	7.1	7.1
EVS-15	7.2	6.3	7.1	6.7	6.3	7.3	7.1	6.8
EVS-16	7.2	6.6	7.1	6.8	6.7	7.2	7.0	6.9
EVS-17	7.4	6.5	6.9	6.5	6.4	7.1	7.1	7.0
EVS-18	7.4	6.6	6.7	6.2	6.7	7.1	6.8	7.2
EVS-19	7.4	6.4	7.0	6.3	6.6	6.9	6.3	7.1
EVS-20	7.4	6.6	6.9	6.6	6.8	7.2	6.9	7.1
EVS-21	7.3	6.8	6.9	6.4	6.7	7.1	6.9	7.1
EVS-22	7.4	6.7	7.2	6.4	6.4	7.2	7.3	7.1
Technician's Initials	SVS/BSJ	SVS	JF	DWS/M	DGL/PAH	EN	M	JGL/TEB

Comments/Adjustments Made: On day 16 aeration stopped in two jars (EVS-14-E and EVS-19-C), aeration fixed in both jars. BSJ

Data Certified By: [signature]

Date Certified: 27/11/96

EVS CONSULTANTS - *Neanthes* 20-d SEDIMENT TOXICITY TEST
DAILY WATER QUALITY MONITORING

Client: Hart Crowser
EVS Project No.: 9123I-06.3
EVS W.O. No.: 9600631
Day 0: Oct. 4, 1996
Day 20: Oct. 24, 1996
Test Species: *Neanthes arenaceodentata*
Source/Collection Date: D. Reish / Sept 30, 1996

Water Quality Instruments Used

D.O. Meter II-A-19
pH Meter II-A-26
Salinity II-C-22
Temperature Calibrated Hg thermometer

Sample I.D.	Salinity (ppt)								pH							
	0	3	6	9	12	15	18	20	0	3	6	9	12	15	18	20
EVS-1	28	28	27	29	29	29	29	29	7.8	7.8	7.9	7.8	7.9	8.1	7.9	7.9
EVS-2	29	29	27	29	29	29	29	28	7.9	7.9	8.1	8.0	8.1	8.2	8.0	7.9
EVS-3	27	28	27	28	29	29	29	30	7.9	7.8	8.0	7.9	8.1	8.2	8.1	8.0
EVS-4	27	28	27	29	29	29	30	29	7.9	7.9	7.9	8.0	8.0	8.2	8.0	8.0
EVS-5	28	29	27	29	29	29	30	29	7.9	7.9	8.3	7.6	8.1	8.2	7.9	7.6
EVS-6	27	28	27	29	29	29	30	29	7.8	7.9	7.7	7.9	7.9	8.1	8.0	7.9
EVS-7	28	27	28	28	30	30	28	30	7.8	8.0	8.3	8.1	8.1	8.3	8.1	8.1
EVS-8	28	28	29	29	30	29	29	29	7.9	7.9	8.0	8.1	8.2	8.3	8.1	8.1
EVS-9	28	29	29	29	29	29	29	29	7.9	7.9	8.2	8.1	8.2	8.3	8.1	8.1
EVS-10	28	28	27	29	29	28	29	29	7.9	8.1	8.1	8.0	8.1	8.2	8.0	8.0
EVS-11	27	28	29	29	30	29	30	29	7.8	7.9	8.1	8.1	8.1	8.2	8.0	8.0
Technician's Initials	SVS	SVS	JGH	JGH	JGH TAH	EM	M	JGH CEB	SVS	SVS	JGH	JGH	JGH TAH	EM	M	JGH CEB

Comments/Adjustments Made: (1) JGH II-A-29 pH meter used

Data Certified By: Sanchez

Date Certified: 27/11/96

EVS CONSULTANTS - *Neanthes* 20-d SEDIMENT TOXICITY TEST
DAILY WATER QUALITY MONITORING

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS W.O. No.: 9600631
Day 0: Oct. 4, 1996
Day 20: Oct 24, 1996
Test Species: Neanthes arenaceodentata
Source/Collection Date: D. Reish / Sept 30, 1996

Water Quality Instruments Used

D.O. Meter: II-A-19
pH Meter: II-A-26
Salinity: II-C-22
Temperature: Calibrated Hg thermometer

Sample I.D.	Salinity (ppt)								pH							
	0	3	6	9	12	15	18	20	0	① 3	6	9	12	①15	18	20
EVS-23	29	28	28	28	29	29	29	29	7.9	8.1 7.8	8.0	7.9	8.0	8.1	8.0	7.9
EVS-24	27	28	27	29	29	29	30	30	7.9	8.0	8.3	8.3	8.3	8.4	8.3	8.1
EVS-25	27	~~27~~ 28	28	28	29	30	28	29	7.9	~~8.1~~ 7.9	7.9	7.9	8.0	8.2	8.0	7.9
EVS-26	27	28	27	28	29	29	29	29	7.9	~~8.0~~ 7.9	8.0	7.5	8.0	8.2	7.9	7.9
Technician's Initials	SVS/BSS	SFA	JF	JGL	JGL/PAH	EJ	M	JGL/CES	SVS/BSS	SFA/JGL	JF	JGL	JGL/PAH	EM	M	JGL/CES

Comments/Adjustments Made:
① 3rd ① used II-A-29 pH meter

Data Certified By: [signature]

Date Certified: 27/11/96

EVS CONSULTANTS
SEDIMENT TOXICITY TESTS - SURVIVAL AND FINAL WATER QUALITY DATA

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. No.: 9600631

Test Type: 20 day Growth + Survival
Test Species: Neanthes arenaceodentata
Start Date (Day 0): Oct. 4, 1996
End Date: Oct 24, 1996

Setup #1

Sample I.D.	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	D.O. (mg/L)	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☑
EVS-4	A	16	5	0	5	0	[illegible]	7.0	20.5	8.0	29
	B	17	5	0	5	0	[illegible]	7.1	20.0	8.0	30
	C	18	5	0	5	0	[illegible]	7.1	20.5	8.0	30
	D	19	5	0	5	0	[illegible]	7.1	20.0	8.0	29
	E	20	4	1	5	0	[illegible]	7.0	20.5	8.0	29
EVS-5 ①	A	21	5	0	5	0	EN	6.8	20.5	7.7	30
	B	22	5	0	5	0	EN	7.1	20.5	7.8	30
	C	23	5	0	5	0	EN	7.2	20.5	7.8	30
	D	24	5	0	5	0	EN	7.4	20.5	7.8	30
	E	25	5	0	5	0	EN	7.4	20.5	7.9	30
EVS-6	A	26	5	0	5	0	[illegible]	7.1	20.5	7.8	30
	B	27	5	0	5	0	[illegible]	7.2	20.5	7.8	30
	C	28	5	0	5	0	[illegible]	7.3	20.5	7.9	30
	D	29	5	0	5	0	[illegible]	7.3	20.5	7.9	30
	E	30	5	0	5	0	[illegible]	7.4	20.5	7.9	30
							Technician's Initials	CEB	CEB	CEB	CEB

① Orange particulate on surface of sediment.

W.Q. Instruments Used: Temperature Calibrated Hg. thermometer pH II-A-26 DO II-A-19 ~~Cond.~~/Sal. II-C-22

Data Certified By: [signature] Date Certified: 27/11/96

EVS CONSULTANTS
SEDIMENT TOXICITY TESTS - SURVIVAL AND FINAL WATER QUALITY DATA

Client: Hart Crowser
EVS Project Number: 9/231-06.3
EVS W.O. No.: 9600631

Test Type: 20 day Growth + Survival
Test Species: Neanthes arenaceodentata
Start Date (Day 0): Oct. 4, 1996
End Date: Oct. 24, 1996

setup #1

Sample I.D.	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	D.O. (mg/L)	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☑
EVS-10	A	46	5	0	5	0	EN	6.6	20.5	7.8	30
	B	47	5	0	5	0	CM	7.2	20.5	8.0	30
	C	48	5	0	5	0	EN	7.2	20.5	7.9	30
	D	49	5	0	5	0	EN	7.3	20.5	7.8	30
	E	50	5	0	5	0	EN	7.2	20.5	8.0	30
EVS-11	A	51	5	0	5	0	[illegible]	7.1	20.5	8.0	30
	B	52	5	0	5	0	[illegible]	7.2	20.5	8.0	30
	C	53	5	0	5	0	[illegible]	7.2	20.5	8.0	30
	D	54	5	0	5	0	[illegible]	7.3	20.5	8.0	30
	E	55	5	0	5	0	[illegible]	7.3	20.5	8.0	30
EVS-12	A	56	5	0	5	0	[illegible]	7.3	20.5	8.0	30
	B	57	5	0	5	0	[illegible]	7.2	20.5	8.1	30
	C	58	5	0	5	0	[illegible]	7.2	20.5	8.1	30
	D	59	5	0	5	0	[illegible]	7.2	20.5	8.1	30
	E	60	5	0	5	0	[illegible]	7.3	20.5	8.0	30
							Technician's Initials	CEB	CEB	CEB	CEB

W.Q. Instruments Used: Temperature Calibrated Hg thermometer pH II-A-26 DO II-A-19 ~~Cond.~~/Sal. II-C-22

Data Certified By: B. Lindel Date Certified: 27/11/96

EVS CONSULTANTS
SEDIMENT TOXICITY TESTS - SURVIVAL AND FINAL WATER QUALITY DATA

Client: Upper Crowsen
EVS Project Number: 9231-06.3
EVS W.O. No.: 9600631

Test Type: 20 day Growth + Survival
Test Species: Neanthes arenaceodentata
Start Date (Day 0): Oct. 4, 1996
End Date: Oct 24, 1996

Subq #1

Sample I.D.	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	D.O. (mg/L)	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☑
EVS-16	A	76	5	0	5	0		7.1	20.0	8.0	30
	B	77	5	0	5	0		7.1	20.5	7.9	29
	C	78	5	0	5	0		7.2	20.5	8.0	28
	D	79	5	0	5	0		7.0	20.5	7.8	28
	E	80	5	0	5	0		6.0	20.5	7.8	29
EVS-17	A ②	81	5	0	5	0		7.1	20.5	8.1	29
	B	82	5	0	5	0		5.4 ①	20.5	8.0	29
	C	83	5	0	5	0		7.0	20.5	8.1	28
	D	84	5	0	5	0		7.2	20.5	8.1	29
	E	85	5	0	5	0		7.1	20.5	8.1	29
EVS-18	A	86	5	0	5	0	GH	7.0	20.5	7.8	30
	B	87	5	0	5	0	GH	7.2	20.5	7.8	30
	C	88	5	0	5	0	GH	7.0	20.5	7.8	30
	D	89	5	0	5	0	GH	7.2	20.0	7.9	30
	E	90	5	0	5	0	GH	7.3	20.0	7.8	30
						Technician's Initials		CEB	CEB	CEB	CEB

① Confirmed, recalibrated meter
② Orange particulate at sediment surface

W.Q. Instruments Used: Temperature Calibrated Hg thermometer pH IL-A-26 DO IL-A-19 ~~Cond./~~Sal. IL-C-23

Data Certified By: R Carder Date Certified: 27/11/96

EVS CONSULTANTS
SEDIMENT TOXICITY TESTS - SURVIVAL AND FINAL WATER QUALITY DATA

Client: Hart Crowser (JGH)
EVS Project Number: 9/231-06.3
EVS W.O. No.: 9600631

Test Type: 20 day Growth + Survival
Test Species: Neanthes arenaceodentata
Start Date (Day 0): Oct. 4, 1996
End Date: Oct. 24, 1996

Setup #1

Sample I.D.	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	D.O. (mg/L)	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☑
EVS-22 ①*	A	106	5	0	5	0		6.9	20.0	7.7	30
	B	107	4	1	5	0		6.9	20.5	7.8	30
	C	108	5	0	5	0		7.0	20.5	7.8	30
	D	109	5	0	5	0		6.9	20.5	7.7	30
	E	110	5	0	5	0		6.9	20.5	7.8	30
EVS-23	A	111	5	0	5	0	JGH	② 5.27	20.5	~~7.4~~ 7.3 ②	29
	B	112	5	0	5	0	JGH	6.8	20.0	7.8	30
	C	113	5	0	5	0	JGH	6.9	20.5	7.8	29
	D	114	5	0	5	0	JGH	6.9	20.5	7.8	29
	E	115	5	0	5	0	JGH	6.9	20.5	7.8	29
EVS-24 ①	A	116	5	0	5	0	AVO	7.2	20.0	8.2	30
	B	117	5	0	5	0	AVO	7.1	20.5	8.1	30
	C	118	5	0	5	0	AVO	7.1	20.5	8.1	30
	D	119	5	0	5	0	AVO	7.2	20.5	8.2	30
	E	120	5	0	5	0	AVO	7.3	20.5	8.2	30
							Technician's Initials	CEB	CEB	CEB	CEB

① orange particulate on sediment surface.
* ① - covers most of the surface.

W.Q. Instruments Used: Temperature Cal-Brated Hg. Thermometer pH IL-A-26 DO IL-A-19 ~~Cond.~~/Sal. IL-C-22
Data Certified By: Rlarde Date Certified: 27/11/96

② Re-calibrated meter, reconfirmed.

Test: PW-Polychaete Worm Growth and Survival Test
Species: NA-Neanthes arenaceodentata
Sample ID: EVS
Start Date: 04/10/96 End Date: 24/10/96

Test ID: EVS 3130
Protocol: PSEP 95
Sample Type: SEDIMENT1-Marine
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Survival Start	Survival Day 20	# of Worms Weighed	Pan Weight (g)	Pan + Worms (g)
	1	1	23.000	5	5	5	0.9629	1.0169
	2	2	23.000	5	5	5	0.9654	1.0162
	3	3	23.000	5	5	5	0.9678	1.0114
	4	4	23.000	5	5	5	0.9639	1.03
	5	5	23.000	5	5	5	0.9613	1.0317
	6	1	1.000	5	5	5	1.0077	1.0629
	7	2	1.000	5	5	5	1.0073	1.0437
	8	3	1.000	5	5	5	1.0067	1.0774
	9	4	1.000	5	5	5	1.0038	1.0392
	10	5	1.000	5	5	5	1.0098	1.0466
	11	1	2.000	5	5	5	1.0085	1.0536
	12	2	2.000	5	5	5	1.0068	1.0688
	13	3	2.000	5	5	5	1.0102	1.0467
	14	4	2.000	5	5	5	1.0024	1.0592
	15	5	2.000	5	5	5	1.0063	1.0635
	16	1	3.000	5	5	5	1.0003	1.0709
	17	2	3.000	5	5	5	0.9975	1.0586
	18	3	3.000	5	5	5	1.0048	1.0492
	19	4	3.000	5	5	5	1.0054	1.0567
	20	5	3.000	5	5	5	1.0019	1.0655
	21	1	4.000	5	5	5	1.0023	1.0665
	22	2	4.000	5	5	5	1.0048	1.0385
	23	3	4.000	5	5	5	0.9987	1.0362
	24	4	4.000	5	5	5	0.9971	1.0625
	25	5	4.000	5	4	4	0.9996	1.0534
	26	1	5.000	5	5	5	0.9848	1.0236
	27	2	5.000	5	5	5	0.9946	1.0366
	28	3	5.000	5	5	5	0.9812	1.0322
	29	4	5.000	5	5	5	0.9835	1.0299
	30	5	5.000	5	5	5	0.9802	1.0381
	31	1	6.000	5	5	5	0.9789	1.026
	32	2	6.000	5	5	5	0.9808	1.0205
	33	3	6.000	5	5	5	0.9754	1.0176
	34	4	6.000	5	5	5	0.9967	1.0403
	35	5	6.000	5	5	5	0.9929	1.0283
	36	1	7.000	5	5	5	0.9946	1.0403
	37	2	7.000	5	5	5	0.9828	1.0611
	38	3	7.000	5	5	5	0.9805	1.0396
	39	4	7.000	5	5	5	0.9803	1.0492
	40	5	7.000	5	4	4	0.9818	1.0279
	41	1	8.000	5	5	5	0.9975	1.0352
	42	2	8.000	5	5	5	0.9844	1.0378
	43	3	8.000	5	5	5	0.9812	1.0238
	44	4	8.000	5	5	5	0.9785	1.0411
	45	5	8.000	5	5	5	0.9804	1.0264
	46	1	9.000	5	5	5	0.992	1.064
	47	2	9.000	5	5	5	0.9909	1.0373
	48	3	9.000	5	5	5	0.9934	1.0387
	49	4	9.000	5	5	5	0.987	1.0332
	50	5	9.000	5	5	5	0.9897	1.0334
	51	1	10.000	5	5	5	0.9885	1.0561
	52	2	10.000	5	5	5	0.9809	1.0269

ToxCalc 5.0

Reviewed by

Test: PW-Polychaete Worm Growth and Survival Test						Test ID: EVS 3130		
Species: NA-Neanthes arenaceodentata						Protocol: PSEP 95		
Sample ID: EVS						Sample Type: SEDIMENT1-Marine		
Start Date: 04/10/96			End Date: 24/10/96			Lab ID: BCEVS-EVS Environment Consultants		
	107	2	21.000	5	5	5	0.9624	1.0095
	108	3	21.000	5	5	5	0.967	0.998
	109	4	21.000	5	4	4	0.964	0.9977
	110	5	21.000	5	5	5	0.9715	1.0242
	111	1	22.000	5	5	5	0.965	1.0103
	112	2	22.000	5	4	4	0.9661	1.0078
	113	3	22.000	5	5	5	0.9687	1.0178
	114	4	22.000	5	5	5	0.973	1.0361
	115	5	22.000	5	5	5	0.9694	1.0307
	116	1	24.000	5	5	5	0.9649	1.0094
	117	2	24.000	5	5	5	0.9692	1.0187
	118	3	24.000	5	5	5	0.9692	1.0256
	119	4	24.000	5	5	5	0.9674	1.0404
	120	5	24.000	5	5	5	0.967	1.0002
	121	1	25.000	5	5	5	0.9674	1.0195
	122	2	25.000	5	5	5	0.9706	1.0409
	123	3	25.000	5	5	5	0.9688	1.0245
	124	4	25.000	5	5	5	0.9669	1.032
	125	5	25.000	5	5	5	0.964	1.0312
	126	1	26.000	5	5	5	0.9666	1.0253
	127	2	26.000	5	5	5	9648	1.0196
	128	3	26.000	5	5	5	0.9671	1.0111
	129	4	26.000	5	5	5	0.9665	1.0197
	130	5	26.000	5	5	5	0.9727	1.0228

Comments: Hart Crowser 9/231-06.3, Neanthes, 9600631

Reviewed by:

Polychaete Worm Growth and Survival Test-Dry Weight					
Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Hart Crowser 9/231-06.3, Neanthes, 9600631				
Bartlett's Test indicates equal variances (p = 0.82)				0.92827	11.3449
Hypothesis Test (1-tail, 0.05)					
Homoscedastic t Test indicates no significant differences					

Compares negative control with the 3 reference sediments.

Reviewed by: RCS 3/11/97

Polychaete Worm Growth and Survival Test-20 d Survival

Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata

Comments: Hart Crowser 9/231-06.3, Neanthes, 9600631

Equality of variance cannot be confirmed

Hypothesis Test (1-tail, 0.05)

Heteroscedastic t Test indicates no significant differences

Compared reference sediment (EVS-2) to test samples.

Reviewed by: RES 27/11/96

Polychaete Worm Growth and Survival Test-Dry Weight					
Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	. Hart Crowser 9/231-06.3, Neanthes, 9600631				
Bartlett's Test indicates equal variances (p = 0.25)				28.152466	42.9798
Hypothesis Test (1-tail, 0.05)					
Homoscedastic t Test indicates significant differences					

Compares reference sediment (EVS-2) to test samples.

Reviewed by: BCD Nov. 26 '97

Polychaete Worm Growth and Survival Test-20 d Survival					
Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Hart Crowser 9/231-06.3, Neanthes, 9600631				

Equality of variance cannot be confirmed

Hypothesis Test (1-tail, 0.05)

Heteroscedastic t Test indicates no significant differences

Compares reference sediment (EVS-16) to test sediments.

Reviewed by: BA 10/26/96

Polychaete Worm Growth and Survival Test-Dry Weight					
Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Hart Crowser 9/231-06.3, Neanthes, 9600631				
Bartlett's Test indicates equal variances (p = 0.25)				28.152466	42.9798
Hypothesis Test (1-tail, 0.05)					
Homoscedastic t Test indicates significant differences					

Compared reference sediment (EVS-16) to test sediments.

Reviewed by: JM 11/26/96

Polychaete Worm Growth and Survival Test-20 d Survival					
Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Hart Crowser 9/231-06.3, Neanthes, 9600631				

Equality of variance cannot be confirmed

Hypothesis Test (1-tail, 0.05)

Heteroscedastic t Test indicates no significant differences

(compared reference sediment (EVS-25) to test sediments.

NOV 26 '96

Reviewed by: DSA

Polychaete Worm Growth and Survival Test-Dry Weight					
Start Date:	10/4/96	Test ID:	EVS 3130	Sample ID:	EVS-1 to EVS-26
End Date:	10/24/96	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Hart Crowser 9/231-06.3, Neanthes, 9600631				
Bartlett's Test indicates equal variances (p = 0.25)				28.152466	42.9798
Hypothesis Test (1-tail, 0.05)					
Homoscedastic t Test indicates significant differences					

Compares reference sediment (EVS-25) to test sediments.

NOV 26/96

Reviewed by: PSA

EVS CONSULTANTS
SEDIMENT DESCRIPTION AND CHARACTERIZATION

Client: Hart Crowser

EVS Project No.: 9/231-06.3

EVS W.O. No.: 96 00632

Test Species: Eohaustorius estuarius

Test Type/Duration: 10 day - LC50

Day 0: Sept. 27/96

Save samples for Heather

Sample I.D.	Colour	Grain Size	Smell	Shells/ Debris	Other Observations	Tech. Initial
EVS 5	DK BROWN	SILT	SULFIDE	NONE	some worms present	SVS
EVS 19	DK BROWN	SILT	H2S	some shells		SVS
EVS 22	DK BROWN	SILT	NONE	NONE		SVS
EVS 14	DK BROWN	SILT	NONE	NONE		SVS
EVS 3	Dark brown	sandy	slight H2S	small shells		
EVS 9	DK. Grey	Silt.	none	small rocks		
EVS 6	DK GREY	SILT	none	NONE		SVS
EVS 16	DK. Grey	Silt.	none	none		
EVS 25	DK GREY	SANDY	STRONG MARINE	NONE		SVS
EVS 2	Dk grey	clay	strong marine smell	none		

Be descriptive when you characterize the sediments. Colour and grain size information must be complete. If the sediment has an odour, describe the type of smell. Note any shells or debris that are present. Be sure to record anything else in the Observations section.

Data Certified By: C. McPherson

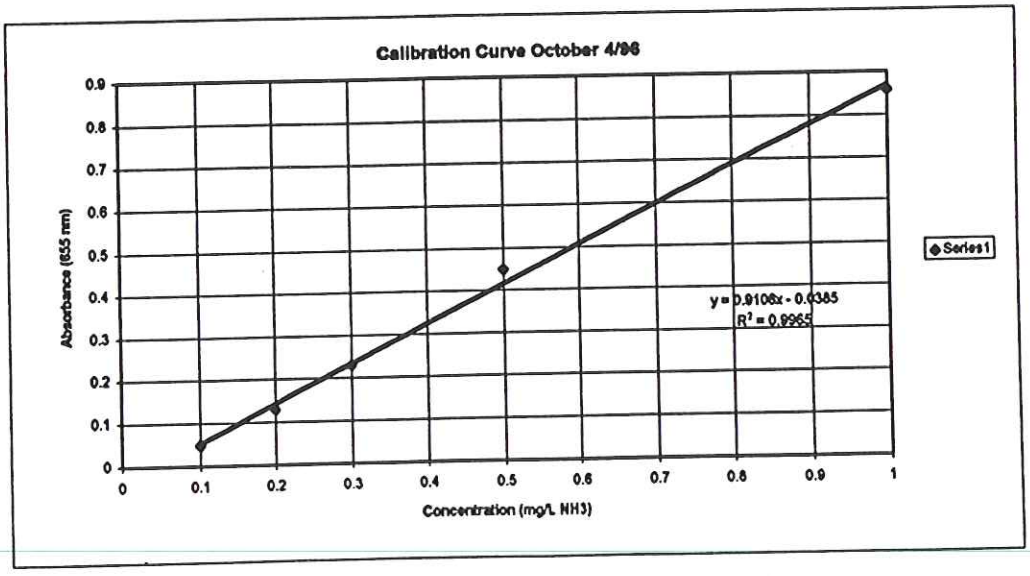
Date Certified: Oct 31/96

Ammonia Measurements - October 4, 1996 (Day 0)

Client:	Hart Crowser	Test Type:	20-d Sediment Toxicity Test
Project No.:	9231-06.3	Test Species:	*Neanthes arenaceodentata*
Work Order No:	9600631	Date Initiated:	4-Oct-96
		Date Terminated:	24-Oct-96

Standard Concentrations (mg/L NH3)	Absorbance of standards
0.1	0.05
0.2	0.13
0.3	0.23
0.5	0.45
1	0.86

Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
Interstitial water			
Silica Control	0.06	2.50	0.3
EVS-1	0.31	25.00	9.6
EVS-2	0.55	50.00	32.3
EVS-3	0.42	25.00	12.6
EVS-4	0.28	50.00	17.5
EVS-5	0.50	25.00	14.8
EVS-6	0.32	25.00	9.8
EVS-7	0.36	25.00	10.9
EVS-8	0.45	25.00	13.4
EVS-9	0.45	25.00	13.4
EVS-10	0.32	25.00	9.8
EVS-11	0.25	50.00	15.8
EVS-12	0.55	25.00	16.2
EVS-13	0.25	50.00	15.8
EVS-14	0.31	25.00	9.6
EVS-15	0.39	25.00	11.8
EVS-16	0.46	50.00	27.4
EVS-17	0.29	50.00	18.0
EVS-18	0.30	25.00	9.3
EVS-19	0.34	25.00	10.4
EVS-20	0.26	25.00	8.2
EVS-21	0.19	25.00	6.3
EVS-22	0.40	25.00	12.0
EVS-23	0.06	250.00	27.0
EVS-24	0.39	50.00	23.5
EVS-25	0.68	50.00	39.5
EVS-26	0.43	25.00	12.9

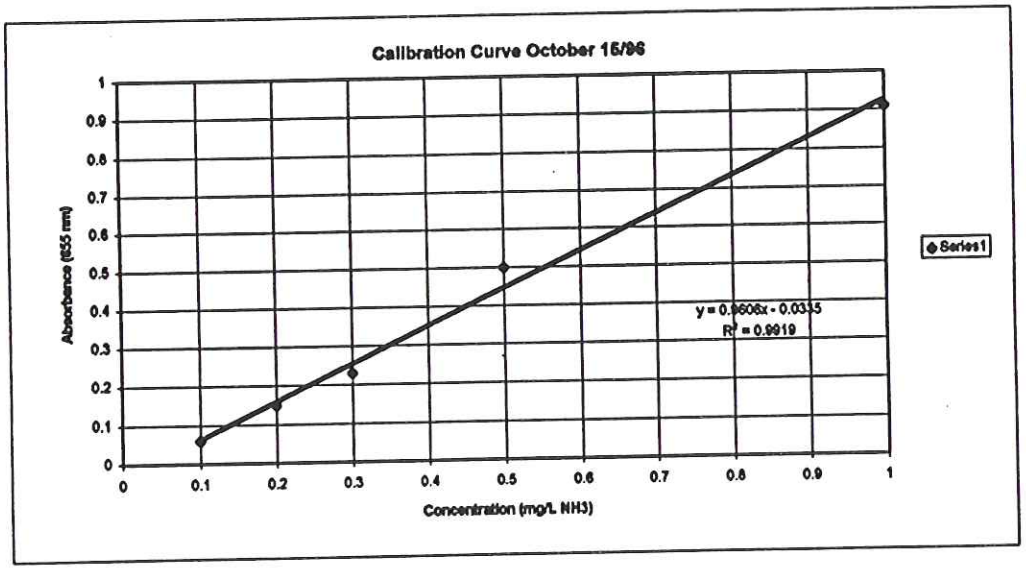


PSA
NOV 26 1996

Ammonia Measurements - October 15, 1996 (Day 10)

Client:	Hart Crowser	Test Type:	20-d Sediment Toxicity Test
Project No.:	9231-06.3	Test Species:	*Neanthes arenaceodentata*
Work Order No:	9600631	Date Initiated:	4-Oct-96
		Date Terminated:	24-Oct-96

Standard Concentrations (mg/L NH3)	Absorbance of standards	Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
		Interstitial water			
0.1	0.06	EVS-2	0.22	50.00	13.2
0.2	0.15	EVS-6	0.26	12.50	3.8
0.3	0.23	EVS-7	0.44	12.50	6.2
0.5	0.50	EVS-9	0.45	12.50	6.3
1	0.91	EVS-14	0.34	12.50	4.9
		EVS-14 rep	0.25	12.50	3.7
		EVS-16	0.36	25.00	10.2
		EVS-18	0.33	12.50	4.7
		EVS-20	0.21	12.50	3.2
		EVS-21	0.28	12.50	4.1
		EVS-25	0.18	83.33	18.5



Certified: PSA 10/26/96

SALINITY DATA SHEET (Interstitial)

CLIENT: Hart Crowser

PROJECT #: 9/231-06.3

W.O. #:9600631

TEST INITIATION TEST: October 4,1996

Sample I.D.	Salinity (ppt) Day 0	Technician	Salinity (ppt) Day 10	Technician	Salinity (ppt) Day 20	Technician
EVS - 1	28	BWY	30	SVS	30	BWY
EVS - 2	27	↓	30	↓	30	↓
EVS - 3	26		30		33	
EVS - 4	28		30		32	
EVS - 5	30		30		30	
EVS - 6	28		30		30	
EVS - 7	28		30		32	
EVS - 8	27		31		30	
EVS - 9	30		30		30	
EVS - 10	26		30		30	
EVS - 11	30		30		31	
EVS - 12	35		30		30	
EVS - 13	28		30		32	
EVS - 14	26		30		30	
EVS - 15	28		30		30	
EVS - 16	28		30		30	
EVS - 17	28		30		30	
EVS - 18	30		30		30	
EVS - 19	30		30		30	
EVS - 20	28		30		30	
EVS - 21	30		30		30	
EVS - 22	30		30		32	
EVS - 23	30		36		30	
EVS - 24	26		30		32	
EVS - 25	42		30		32	
EVS - 26	28		30		30	
CONTROL	30		30		30	
25.0 mg/L NH_3	26		30		30	
50.0 mg/L NH_3	27		30		30	
100 mg/L NH_3	28		30		30	
200 mg/L NH_3	26		30		30	
400 mg/L NH_3	28	↓	30	↓	30	↓

RESULTS OF ANALYSIS - Water

File No. G5784

	Sulphide S
EVS 21 Day 0 1996 Oct 4	0.03
EVS 22 Day 0 1996 Oct 4	0.03
EVS 23 Day 0 1996 Oct 4	<0.02
EVS 24 Day 0 1996 Oct 4	<0.02
EVS 25 Day 0 1996 Oct 4	0.03
EVS 26 Day 0 1996 Oct 4	0.03

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G5784

Water	EVS 11 Day 0 96 10 04	EVS 11 Day 0 QC # 74597
Inorganic Parameters		
Sulphide S	0.02	0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water File No. G6473

	Sulphide S
EVS-21 Day 20 1996 Oct 24	<0.02
EVS-22 Day 20 1996 Oct 24	<0.02
EVS-23 Day 20 1996 Oct 24	<0.02
EVS-24 Day 20 1996 Oct 24	<0.02
EVS-25 Day 20 1996 Oct 24	<0.02
EVS-26 Day 20 1996 Oct 24	<0.02
Silica Control Day 20 1996 Oct 24	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G6473

Water	EVS-19 Day 20	EVS-19 Day 20
	96 10 24	QC # 76163
Inorganic Parameters		
Sulphide S	<0.02	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

EVS CONSULTANTS
SEDIMENT TOXICITY TEST DATA SUMMARY

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS Work Order No.: 9600631

EVS Analyst(s) JGa, LyS, EFV
Test Type 96h Acute
Test Initiation Date Oct. 4, 1996

SAMPLE
Identification 1,000 mg/L Cd (lot# 96C004)
Amount ~~Received~~ Prepared 1 L
Date ~~Collected~~ Prepared July 26, 1996
Date Received

TEST SPECIES INFORMATION
Organism Neanthes arenaceodentata
Source Don Reish
Date Received ~~Sept. 30th 1996~~ Oct. 1, 1996
Initial Dry Weight 0.79 mg/worm
Reference Toxicant Cadmium Chloride
Current Reference Toxicant Result 13.4 mg/L
Laboratory Range for Reference Toxicant (mean ± 2SD) 8.2 ± 3.8 mg/L Cd

DILUTION AND CONTROL MEDIUM
Water UV Sterilized Filtered sea water
Temperature (°C) 19.5
pH 7.6
Dissolved Oxygen (mg/L) 8.1
Salinity (ppt) 27
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a
Other: n/a

TEST CONDITIONS
Temperature Range (°C) 19.0 - 19.5
pH Range 7.7 - 8.1
Dissolved Oxygen Range (mg/L) 7.4 - 8.0
Salinity Range (ppt) 26 - 28
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a
Other: n/a
~~Day 0 Day 10 Day 20 ea.~~

Sample ID mg/L Cd	Mean ± SD	
	Survival (%)	Dry Weight (mg)
32.0	0	n/a
18.0	20.0 ± 3.8	↓
10.0	80.0 ± 3.8	
5.6	100.0	
3.2	100.0	
CONTROL S.W.	100.0	

Data Certified By: [signature]
Date Certified: NOV 27/96

Test: PW-Polychaete Worm Growth and Survival Test
Species: NA-Neanthes arenaceodentata
Sample ID: REF-Ref Toxicant
Start Date: 4/10/96 End Date: 8/10/96

Test ID: RTNACD5
Protocol: PSEP 95
Sample Type: CDCL-Cadmium chloride
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-control	10				10	
	2	1	3.2	10				10	
	3	1	5.6	10				10	
	4	1	10.0	10				8	
	5	1	18.0	10				2	
	6	1	32.0	10				0	

Comments: Hart Crowser, 9/231-06.3, 9600631

NW 26/96
Reviewed by: PJA

EVS CONSULTANTS
SEDIMENT TOXICITY TEST DATA SUMMARY

JGA, SVS, BJS, EFV, LJS, PAH, EJT

Client: Hart Crowser
EVS Project No.: 9/231-06.3
EVS Work Order No.: 9600631

EVS Analyst(s) MKL, CEB
Test Type 20-d Growth and Survival
Test Initiation Date Oct. 4, 1996

SAMPLE
Identification 10,000 mg/L NH_3 (lot#96008)
Amount ~~Received~~ Prepared 4L
Date ~~Collected~~ prepared July 14, 1996
Date Received n/a

TEST SPECIES INFORMATION
Organism Neanthes arenaceodentata
Source Don Reish
Date Received ~~Sept. 30, 1996~~ October 1, 1996
Initial Dry Weight 0.79 mg/chamber
Reference Toxicant NH_3 spiked sediment
Current Reference Toxicant Result 141.4 mg/L NH_3
Laboratory Range for Reference Toxicant (mean ± 2SD) No Lab. Mean Generated yet
Two previous values of: 138.4 mg/L NH_3 and 176.2 mg/L NH_3

DILUTION AND CONTROL MEDIUM
Water UV Sterilized, Filtered Sea Water
Temperature (°C) ~~19.5~~ 20.0
pH ~~7.8~~ 7.8
Dissolved Oxygen (mg/L) ~~8.4~~ 7.9
Salinity (ppt) ~~27~~ 29
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a
Other: n/a

TEST CONDITIONS
Temperature Range (°C) 19.5 – 20.5
pH Range 7.7 – 8.1
Dissolved Oxygen Range (mg/L) 6.4 – 7.3
Salinity Range (ppt) 28 – 30
Conductivity (µmhos/cm) n/a
Hardness (mg/L as $CaCO_3$) n/a
Alkalinity (mg/L as $CaCO_3$) n/a
Other: n/a

	Day 0	Day 10	Day 20
Interstitial NH_3 (mg/L NH_3)	29.6-297.6	15.3-100.6	15.5-54.5
Interstitial salinity (ppt)	26-28	30	30

Sample ID mg/L NH_3	Mean ± SD	
	Survival (%)	Dry Weight (mg)
400	0	0
200	0	0
100	100.0	6.3 ± 1.1*
50	100.0	10.9 ± 1.3
25	100.0	11.4 ± 2.2
CONTROL	100.0	11.4 ± 2.2

Asterisks (*) indicate the sample is significantly different from the control

Data Certified By: PSA
Date Certified: NOV 27 96

	Survival	Growth
IC 25	125.0	75.8
IC 50	150.8	>100.0
EC 50	141.4	
LOEC	200.0	100.0
NOEC	100.0	50.0

EVS CONSULTANTS - *Neanthes* 20-d SEDIMENT TOXICITY TEST
DAILY WATER QUALITY MONITORING

Client: Hart Crowser
EVS Project No.: 9123I-06.3
EVS W.O. No.: 9600631
Day 0: Oct. 4, 1996
Day 20: Oct. 24, 1996
Test Species: Neanthes arenaceodentata
Source/Collection Date: D. Reish / Sept 30, 1996

Water Quality Instruments Used

D.O. Meter II-A-19
pH Meter II-A-26
Salinity II-C-22
Temperature Calibrated Hg thermometer

Sample I.D. mg/L NH_3	Salinity (ppt) 0	3	6	9	12	15	18	20	pH 0	3	6	9	12	15	18	20
400	30	28 29	29	28	29	29	29	29	7.8	7.9 7.7	7.8	7.7	7.8	8.0	7.9	7.9
200	29	28 29	29	29	29	29	29	28	7.8	8.0	7.8	7.8	7.9	8.0	7.9	7.9
100	30	29	29	29	29	29	29	29	7.9	7.9 7.8	7.8	7.8	7.9	8.1	7.9	7.9
50	28	28	29	28	29	28	29	28	7.9	8.0 7.8	7.7	7.8	7.9	8.0	7.8	7.9
25	29	28 29	29	28	29	29	29	29	7.9	8.1 7.8	7.7	7.8	7.9	8.1	7.8	7.8
Technician's Initials	SVS PSA	SVS JGH	JB	JGH	JGH PAH	EM	M	JGH CEB	SVS PSA	SVS JGH	JB	JGH	JGH PAH	EM	M	JGH CEB

Comments/Adjustments Made:
II-A-29 pH meter used

Data Certified By: PSA

Date Certified: 10/29/96

EVS CONSULTANTS
SEDIMENT TOXICITY TESTS - SURVIVAL AND FINAL WATER QUALITY DATA

Client: Hart Crowser
EVS Project Number: 91231-06.3
EVS W.O. No.: 9600631

Test Type: 20 Day Survival + Growth
Test Species: Neanthes arenaceod
Start Date (Day 0): Oct. 4, 1996
End Date: Oct. 24, 1996

Sample I.D.	Rep.	Pan No.	No. Alive	No. Dead *	Total Recovered	No. Missing	Tech. Init.	D.O. (mg/L)	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☑
200 mg/L	A	156	0		0	5	CEB	5.5	20.5	7.8	29
	B	157	0		0	5	CEB	6.5	20.5	7.8	29
	C	158	0		0	5	CEB	7.0	20.5	8.0	30
	D	159	0		0	5	CEB	7.4	20.5	8.0	30
	E	160	0		0	5	CEB	7.4	20.5	8.0	30
400 mg/L	A	161	0		0	5	CEB	7.2	20.0	7.8	30
	B	162	0		0	5	CEB	7.3	20.0	7.9	30
	C	163	0		0	5	CEB	7.0	20.5	7.9	30
	D	164	0		0	5	CEB	7.1	20.5	7.9	30
	E	165	0		0	5	CEB	7.3	20.5	8.0	30
					Technician's Initials			CEB	CEB	CEB	CEB

W.Q. Instruments Used: Temperature Calibrated Hg thermometer pH 11-A-26 DO 9 Cond./Sal. 11-C-22
Data Certified By: TSA Date Certified: NOV 28 196

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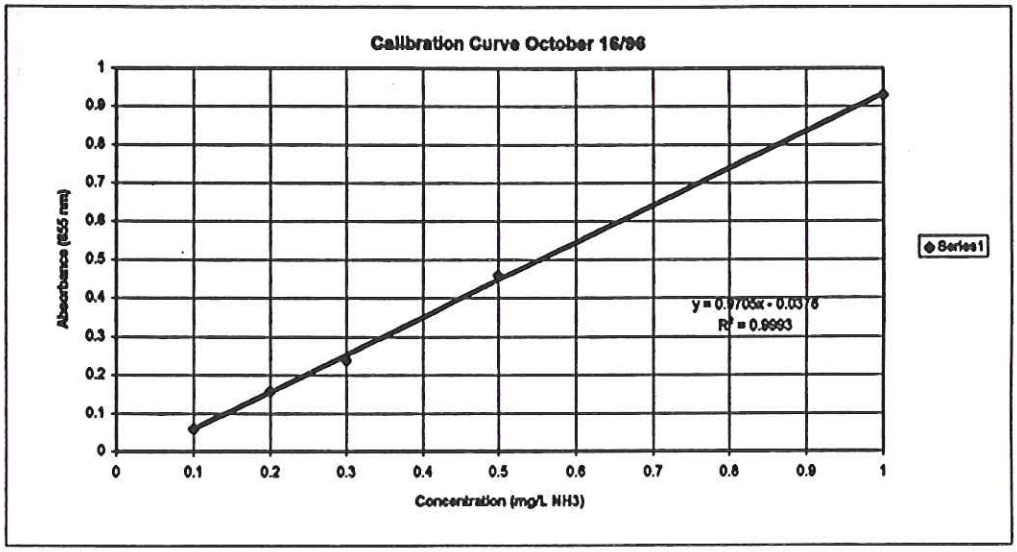
* Number dead = total number missing worms

Ammonia Measurements - October 16, 1996 (Day 10)

Client:	Hart Crowser	Test Type:	20-d Sediment Toxicity Test
Project No.:	9231-06.3	Test Species:	*Neanthes arenaceodentata*
Work Order No:	9600631	Date Initiated:	4-Oct-96
		Date Terminated:	24-Oct-96

Standard Concentrations (mg/L NH3)	Absorbance of standards	Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
		Interstitial water			
0.1	0.06	25 mg/L	0.26	50.00	15.3
0.2	0.16	50 mg/L	0.19	100.00	23.5
0.3	0.24	100 mg/L	0.11	250.00	38.0
0.5	0.46	100 mg/L rep	0.13	250.00	43.2
1	0.93	200 mg/L	0.08	500.00	60.6
		400 mg/L	0.06	1000.00	100.6



PSA
NV 27/96

APPENDIX E

48-h *M. edulis* Larvae Sediment Toxicity Test Raw Data

BIOASSAY QA CHECKLIST

Project Name/No: Hart Crowser 9/231-06.3 Staff ART Date October 30, 1996

NOTE: White cell denotes required data

SEDIMENT LARVAL MORTALITY AND ABNORMALITY			Each Batch	Test Sediment	Reference Sediment	Control ~~Sediment~~ seawater
Species Name			M. edulis			
Bioassay Parameters:	Inoculation time (hours)		1800 h			
	Exposure time (hours)		48 h			
	Stocking beaker density (#/mL)		~8200 per mL			
	Stocking aliquot size (mL)		4 mL			
	Aeration (yes/no)		NO			
Mortality and Abnormality:	Start date		Oct 30/96			
	Initial count (minimum of five 10-mL aliquots)		364 per 10mL			
	Final Count:	Aliquot size (mL)		10 mL	10 mL	10 mL
		Number normal per aliquot		✓	✓	✓
		Number abnormal per aliquot		✓	✓	✓
Water Quality Measurement Methods:	Dissolved oxygen		✓			
	Ammonia		✓			
	Sulfide		✓			
	Water salinity		✓			
Water Quality:	Temperature (daily)			✓	✓	✓
	pH (daily)			✓	✓	✓
	Dissolved oxygen (daily)			✓	✓	✓
	Water salinity (daily)			✓	✓	✓
	Sulfide (initial and final)			✓	✓	✓
	Ammonia (initial and final)			✓	✓	✓
Positive Control:	Toxicant used		SDS, NH_3			
	Toxicant concentrations		1.0-10, 1.25-40 mg/L			
	Exposure time		48h			
	EC50		3.8 mg/L SDS, 15.9 mg/L NH_3			
	EC50 method of calculation		~~Spearman~~-Karber			
	Start date		Oct 30/96			
	Normal/abnormal counts		✓			

Sample ID	Normal Development (%)	Survival (%)	Survival/Normal Development (%)
EVS-1	90.1 ± 1.2 □	67.2 ± 6.5 *	60.6 ± 5.7 *
EVS-2	86.2 ± 1.5 * □ △	66.0 ± 8.4 * ✗ AT	56.9 ± 7.1 * □
EVS-3	90.4 ± 1.5	58.1 ± 10.6 * □	52.5 ± 9.6 * □
EVS-4	89.8 ± 0.8 □	70.4 ± 7.1 *	63.2 ± 6.1 *
EVS-5 61.4 ± 18.2	~~63.0 ± 16.7~~ * + □ △ BG 56.8 ± 15.8	~~58.2 ± 13.6~~ * ✗ AT BG 36.7 ± 19.4	~~38.0 ± 17.8~~ * + □ BG
EVS-6	94.0 ± 1.6	75.8 ± 12.3	71.4 ± 12.5
EVS-7	71.2 ± 3.9 * + □ △	54.4 ± 7.7 * + □ ✗ AT	38.9 ± 6.3 * + □
EVS-8	90.4 ± 2.6	71.0 ± 5.0 *	64.2 ± 4.6 *
EVS-9 77.0 ± 11.9	~~77.5 ± 11.6~~ * □ △ BG 65.1 ± 14	~~68.5 ± 10.4~~ * ✗ AT BG 51.3 ± 8.5	~~54.1 ± 16.1~~ * ✗ AT BG
EVS-10	62.6 ± 10.8 * + □ △	66.9 ± 6.3 * ✗ AT	42.2 ± 9.8 * + □
EVS-11	66.5 ± 5.9 * + □ △	63.3 ± 9.5 * ✗ AT	42.2 ± 8.5 * + □
EVS-12	69.1 ± 30.3	70.5 ± 6.0 *	49.9 ± 23.2 *
EVS-13	78.1 ± 2.4 * + □ △	50.8 ± 6.4 * + □ △	39.7 ± 5.8 * + □
EVS-14	88.0 ± 4.8	66.4 ± 7.5 *	58.7 ± 9.3 *
EVS-15	91.7 ± 1.1	62.8 ± 5.8 * □	57.5 ± 4.8 * □
EVS-16	91.7 ± 1.0	70.9 ± 2.9 *	65.0 ± 3.2 *
EVS-17	74.2 ± 6.3 * + □ △	46.4 ± 28.3 * ✗ AT	35.3 ± 23.1 * □
EVS-18	86.2 ± 5.6	64.2 ± 5.4 * □	55.6 ± 8.1 * □
EVS-19 69.9 ± 7.9	~~68.8 ± 10.2~~ * + □ △ BG 60.8 ± 16.3	~~62.0 ± 13.7~~ * ✗ AT BG 46.5 ± 14.5	~~43.7 ± 15.4~~ * □ BG
EVS-20	93.4 ± 0.5	67.4 ± 8.4 *	63.0 ± 8.0 *
EVS-21	94.1 ± 1.1	78.1 ± 8.7 AT	73.6 ± 8.5
EVS-22	71.9 ± 11.8 * + □ △	46.4 ± 15.4 * + □ ✗ AT	34.1 ± 14.7 * + □
EVS-23	89.0 ± 2.0 □	83.6 ± 3.5 AT 74.4	~~40.7~~ ± ~~7.2~~ 4.6
EVS-24	80.5 ± 5.6 * + □ △	50.6 ± 8.2 * + □ ✗ AT 40.7	~~55.9~~ ± 7.8 7.2 * □
EVS-25	91.6 ± 1.9	60.9 ± 8.0 * □	AT ~~55.9~~ ± 7.8 * □
EVS-26	82.7 ± 4.0 * □ △	72.9 ± 5.9 * △	60.1 ± 3.0 * □

Asterisks (*) indicate significant difference compared to the Control Seawater (EVS-23).
Crosses (+) indicate significant difference compared to EVS-2.
Squares (□) indicate significant difference compared to EVS-16.
Triangles (△) indicate significant difference compared to EVS-25

Jessica Ribas 27 Nov 96

EVS CONSULTANTS
48-h LARVAL DEVELOPMENT TOXICITY TEST - DAILY WATER QUALITY DATA

Client Name: Hart Crowser
EVS Project Number: 9(231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99

Test Species: Mytilus edulis
Test Start (Day 0): October 30, 1996
Test End: November 1, 1996

Sample I.D.	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
	0	24	48	0	24	48	0	24	48	0	24	48
EVS-15	16.5	16.0	16.5	7.6	7.6	7.5	28	28	28	6.6	6.7	6.8
10	16.5	16.0	16.5	7.5	7.4	7.4	28	28	27	7.4	6.7	7.1
7	16.5	16.0	16.5	7.6	7.6	7.6	28	28	27	7.2	7.1	7.4
14	16.5	16.0	16.5	7.6	7.6	7.6	28	28	27	6.6	6.4	6.8
12	16.5	16.0	16.5	7.7	7.6	7.6	28	28	28	6.6	6.4	6.9
17	16.5	16.0	16.5	7.6	7.6	7.5	28	28	27	6.8	6.0	6.5
11	16.5	16.0	16.5	7.7	7.6	7.6	28	28	27	7.0	6.8	7.0
13	16.5	16.0	16.5	7.6	7.6	7.5	28	28	27	7.4	7.0	7.3
5	16.5	16.0	16.5	7.8	7.7	7.6	28	28	27	6.4	6.2	6.9
24	16.5	16.0	16.5	7.7	7.7	7.6	28	28	27	6.6	6.6	7.5
Technician Initials — Analyst	BJ	"	AH	RST	"	PH	BSJ	"	PH	BSJ	"	PH
Technician Initials — Recorder	BJ	"	AH	JGL	"	PH	JGL	"	PH	JGL	"	PH

WQ Instruments Used: Temp. Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Comments:

Data Certified by: [signature] Date Certified: 27 Nov 96

EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - FINAL WATER QUALITY

Client: Hart Crowser
EVS Project Number: 9123I-06.3
W.O. Number: 9600633
Logbook: 8 Page: 94-99

Date Initiated: October 30, 1996
Date Terminated: November 1, 1996
Test Species: Mytilus edulis
Test Duration: 48 h

Sample I.D.	Conc/Rep	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
EVS 1	A	16.5	7.5	28	6.4	
	B	16.5	7.6	28	6.7	
	C	16.5	7.6	28	6.8	
	D	17.0	7.6	28	6.9	
	E	17.0	7.6	28	6.8	
EVS 2	A	17.0	7.6	28	6.7	
	B	17.0	7.6	28	6.5	
	C	17.0	7.6	28	6.9	
	D	17.0	7.6	28	6.9	
	E	17.0	7.6	28	6.9	
EVS 3	A	17.0	7.6	28	7.2	
	B	17.0	7.6	28	7.2	
	C	16.5	7.6	28	7.2	
	D	16.5	7.6	28	7.2	
	E	16.5	7.6	28	7.2	
Technician Initials	Analyst	SVS	SXC	MK	SXC	
	Recorder	SVS	SXC	MK	SXC	

WQ Instruments Used: Temp Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Data Certified by: Jarida Richey Date Certified: 27NOV96

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EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - FINAL WATER QUALITY

Client: Hart Crowser
EVS Project Number: 91231-06.3
W.O. Number: 9600633
Logbook: 8 Page: 94-99

Date Initiated: October 30, 1996
Date Terminated: November 1, 1996
Test Species: Mytilus edulis
Test Duration: 48h

Sample I.D.	Conc/Rep	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
EVS 7	A	16.5	7.6	28	6.4	
	B	17.0	7.6	28	6.5	
	C	17.0	7.6	28	6.4	
	D	16.5	7.6	28	6.0	
	E	17.0	7.6	28	6.5	
EVS 8	A	~~16.5~~ 16.5	7.5	28	6.2	
	B	16.5	7.5	28	6.6	
	C	16.5	7.6	28	6.7	
	D	16.5	7.6	28	6.9	
	E	16.5	7.6	28	6.9	
EVS 9	A	16.5	7.6	28	6.4	
	B	16.5	7.6	28	6.4	
	C	16.5	7.6	28	6.2	
	D	16.5	7.6	28	6.3	
	E	16.5	7.6	28	6.4	
Technician Initials	Analyst	SVS	SXC	JAK	ART	
	Recorder	SVS	SXC	JAK	ART	

WQ Instruments Used: Temp Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Data Certified by: [signature] Date Certified: 27NOV96

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EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - FINAL WATER QUALITY

Client: Hart Crowser
EVS Project Number: 9123I-06.3
W.O. Number: 9600633
Logbook: 8 Page: 94-99

Date Initiated: October 30, 1996
Date Terminated: November 1, 1996
Test Species: Mytilus edulis
Test Duration: 48 h

Sample I.D.	Conc/Rep	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
EVS 13	A	16.5	7.5	28	6.3	
	B	16.5	7.6	28	6.3	
	C	16.5	7.5	28	6.3	
	D	16.5	7.6	28	6.4	
	E	16.5	7.6	28	6.4	
EVS 14	A	17.0	7.6	28	6.7	
	B	17.0	7.6	28	6.7	
	C	17.0	7.6	28	6.7	
	D	17.0	7.6	28	6.7	
	E	17.0	7.6	28	6.7	
EVS 15	A	16.5	7.5	28	6.7	
	B	16.5	7.6	28	6.8	
	C	16.5	7.6	28	6.4	
	D	16.5	7.6	28	6.6	
	E	16.5	7.5	28	6.7	
Technician Initials	Analyst	SVS	SXC	JHK	ART	
	Recorder	SVS	SXC	JHK	ART	

WQ Instruments Used: Temp Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Data Certified by: [signature] Date Certified: 27 Nov 96

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EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - FINAL WATER QUALITY

Client: Hart Crowser
EVS Project Number: 9/231-06.3
W.O. Number: 9600633
Logbook: 8 Page: 94-99

Date Initiated: October 30, 1996
Date Terminated: November 1, 1996
Test Species: Mytilus edulis
Test Duration: 48 h

Sample I.D.	Conc/Rep	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
EVS 19	A	17.0	7.6	28	6.3	
	B	17.0	7.6	28	6.6	
	C	17.0	7.6	28	6.7	
	D	17.0	7.6	28	6.5	
	E	17.0	7.6	28	6.7	
EVS 20	A	17.0	7.5	28	6.8	
	B	17.0	7.5	28	6.6	
	C	17.0	7.5	28	6.7	
	D	17.0	7.5	28	6.9	
	E	17.0	7.5	28	6.6	
EVS 21	A	17.0	7.5	28	7.0	
	B	17.0	7.5	28	7.0	
	C	17.0	7.6	28	7.0	
	D	17.0	7.6	28	7.1	
	E	17.0	7.6	28	6.5	
Technician Initials	Analyst	SVS	SXC	JCM	ART	
	Recorder	SVS	SXC	JCM	ART	

WQ Instruments Used: Temp Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Data Certified by: [signature] Date Certified: 27NOV96

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EVS CONSULTANTS
LARVAL DEVELOPMENT TOXICITY TEST - FINAL WATER QUALITY

Client: Hart Crowser
EVS Project Number: 9231-06.3
W.O. Number: 9600633
Logbook: 8 Page: 94-99

Date Initiated: October 30, 1996
Date Terminated: November 1, 1996
Test Species: Mytilus edulis
Test Duration: 48h

Sample I.D.	Conc/Rep	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
EVS 25	A	16.5	7.6	28	6.8	
	B	16.5	7.6	28	6.8	
	C	16.5	7.6	28	6.8	
	D	16.5	7.6	28	6.9	
	E	16.5	7.6	28	6.4	
EVS 26	A	16.5	7.5	28	6.5	
	B	16.5	7.5	28	6.3	
	C	16.5	7.5	28	6.3	
	D	16.5	7.5	28	6.4	
	E	16.5	7.5	28	6.4	
	A					
	B					
	C					
	D					
	E					
Technician Initials	Analyst	SVS	SKC	JH	ART	
	Recorder	SVS	SKC	JH	ART	

WQ Instruments Used: Temp Thermometer / pH II-C-36 Salinity II-C-22 DO II-A-19

Data Certified by: [signature] Date Certified: 27Nov96

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Test: BV-Bivalve Larval Survival and Development Test — Test ID: EVS3219
Species: ME-Mytilus edulis — Protocol: PSEP 95
Sample ID: VARIOUS — Sample Type: MARINE SED
Start Date: 30/10/96 18:00 — End Date: 01/11/96 20: — Lab ID: BCEVS-EVS Environment Consultants

	53	3	EVS-10	364	246	246	184	
	54	4	EVS-10	364	258	258	177	
	55	5	EVS-10	364	204	204	94	
	56	1	EVS-11	364	265	265	195	
	57	2	EVS-11	364	250	250	166	
	58	3	EVS-11	364	207	207	147	
	59	4	EVS-11	364	182	182	110	
	60	5	EVS-11	364	248	248	151	
	61	1	EVS-12	364	288	288	249	
	62	2	EVS-12	364	254	254	221	
	63	3	EVS-12	364	258	258	229	
	64	4	EVS-12	364	257	257	169	
	65	5	EVS-12	364	226	226	40	
	66	1	EVS-13	364	180	180	136	
	67	2	EVS-13	364	194	194	153	
	68	3	EVS-13	364	218	218	177	
	69	4	EVS-13	364	178	178	135	
	70	5	EVS-13	364	154	154	122	
	71	1	EVS-14	364	283	283	259	
	72	2	EVS-14	364	252	252	229	
	73	3	EVS-14	364	226	226	193	
	74	4	EVS-14	364	212	212	171	
	75	5	EVS-14	364	236	236	216	
	76	1	EVS-15	364	263	263	239	
	77	2	EVS-15	364	218	218	199	
	78	3	EVS-15	364	220	220	203	
	79	4	EVS-15	364	209	209	195	
	80	5	EVS-15	364	233	233	211	
	81	1	EVS-16	364	264	264	240	
	82	2	EVS-16	364	246	246	225	
	83	3	EVS-16	364	255	255	234	
	84	4	EVS-16	364	252	252	229	
	85	5	EVS-16	364	273	273	255	
	86	1	EVS-17	364	65	65	43	
	87	2	EVS-17	364	64	64	47	
	88	3	EVS-17	364	262	262	188	
	89	4	EVS-17	364	278	278	232	
	90	5	EVS-17	364	175	175	133	
	91	1	EVS-18	364	224	224	182	
	92	2	EVS-18	364	205	205	164	
	93	3	EVS-18	364	255	255	238	
	94	4	EVS-18	364	244	244	219	
	95	5	EVS-18	364	241	241	209	
	96	1	✓ EVS-19	364	118	118	67	
	97	2	EVS-19	364	239	239	179	
	98	3	EVS-19	364	258	258	199	
	99	4	EVS-19	364	230	230	161	
	100	5	EVS-19	364	262	262	185	
	101	1	EVS-20	364	227	227	212	
	102	2	EVS-20	364	289	289	270	
	103	3	EVS-20	364	233	233	219	
	104	4	EVS-20	364	214	214	198	
	105	5	EVS-20	364	264	264	247	
	106	1	EVS-21	364	232	232	219	

Reviewed by: 14JAN97

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis
Comments:	Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae				

Conc-	1	2	3	4	5
EVS-23	0.8489	0.8242	0.7995	0.8901	0.8159
EVS-1	0.6209	0.6841	0.7033	0.5962	0.7582
EVS-2	0.6044	0.5467	0.7527	0.7170	0.6813
EVS-3	0.4533	0.6181	0.6319	0.4918	0.7088
EVS-4	0.6758	0.6868	0.6978	0.6374	0.8242
EVS-5	0.3599	0.5852	0.6896	0.4615	0.7418
EVS-6	0.6758	0.8571	0.9066	0.7390	0.6099
EVS-7	0.4505	0.6566	0.5769	0.5220	0.5165
EVS-8	0.7775	0.6538	0.7308	0.7198	0.6676
EVS-9	0.5742	0.4734	0.7912	0.7995	0.6181
EVS-10	0.7170	0.6813	0.6758	0.7088	0.5604
EVS-11	0.7280	0.6868	0.5687	0.5000	0.6813
EVS-12	0.7912	0.6978	0.7088	0.7060	0.6209
EVS-13	0.4945	0.5330	0.5989	0.4890	0.4231
EVS-14	0.7775	0.6923	0.6209	0.5824	0.6484
EVS-15	0.7225	0.5989	0.6044	0.5742	0.6401
EVS-16	0.7253	0.6758	0.7005	0.6923	0.7500
EVS-17	0.1786	0.1758	0.7198	0.7637	0.4808
EVS-18	0.6154	0.5632	0.7005	0.6703	0.6621
EVS-19	0.3242	0.6566	0.7088	0.6319	0.7198
EVS-20	0.6236	0.7940	0.6401	0.5879	0.7253
EVS-21	0.6374	0.8324	0.8077	0.8599	0.7692
EVS-22	0.6016	0.6291	0.2912	0.4698	0.3269
EVS-24	0.6044	0.5522	0.3874	0.4725	0.5110
EVS-25	0.6648	0.5192	0.5440	0.7088	0.6099
EVS-26	0.7775	0.7802	0.6896	0.6456	0.7500

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-23	0.8357	0.0353	1.1553	1.1065	1.2329	4.273	5			
*EVS-1	0.6725	0.0651	0.9630	0.8822	1.0568	7.257	5	5.025	2.132	0.0031
*EVS-2	0.6604	0.0840	0.9508	0.8322	1.0504	9.336	5	4.502	2.132	0.0044
*EVS-3	0.5808	0.1056	0.8680	0.7386	1.0008	12.428	5	5.414	2.132	0.0060
*EVS-4	0.7044	0.0707	0.9987	0.9246	1.1381	8.172	5	3.672	2.132	0.0039
*EVS-5	0.5676	0.1580	0.8558	0.6434	1.0377	18.995	5	3.942	2.132	0.0123
EVS-6	0.7577	0.1234	1.0679	0.8962	1.2602	14.159	5	1.229	2.132	0.0108
*EVS-7	0.5445	0.0770	0.8305	0.7359	0.9447	9.400	5	7.863	2.132	0.0036
*EVS-8	0.7099	0.0501	1.0032	0.9418	1.0795	5.547	5	4.573	2.132	0.0024
*EVS-9	0.6513	0.1416	0.9452	0.7588	1.1065	16.087	5	2.938	2.132	0.0109
*EVS-10	0.6687	0.0630	0.9585	0.8460	1.0099	6.859	5	5.351	2.132	0.0029
*EVS-11	0.6330	0.0950	0.9219	0.7854	1.0222	10.667	5	4.742	2.132	0.0052
*EVS-12	0.7049	0.0604	0.9982	0.9075	1.0962	6.709	5	4.222	2.132	0.0030
*EVS-13	0.5077	0.0645	0.7932	0.7082	0.8850	8.174	5	9.937	2.132	0.0028
*EVS-14	0.6643	0.0749	0.9548	0.8682	1.0795	8.515	5	4.713	2.132	0.0039
*EVS-15	0.6280	0.0578	0.9158	0.8598	1.0160	6.664	5	6.823	2.132	0.0026
*EVS-16	0.7088	0.0291	1.0012	0.9651	1.0472	3.225	5	5.842	2.132	0.0015
*EVS-17	0.4637	0.2829	0.7423	0.4327	1.0632	40.770	5	3.012	2.132	0.0401
*EVS-18	0.6423	0.0537	0.9304	0.8488	0.9918	6.003	5	6.746	2.132	0.0024
*EVS-19	0.6082	0.1629	0.8966	0.6057	1.0130	18.647	5	3.318	2.132	0.0130
*EVS-20	0.6742	0.0838	0.9660	0.8738	1.0996	9.512	5	4.057	2.132	0.0046
EVS-21	0.7813	0.0871	1.0895	0.9246	1.1871	9.341	5	1.301	2.132	0.0055
*EVS-22	0.4637	0.1540	0.7475	0.5700	0.9160	21.035	5	5.532	2.132	0.0116
*EVS-24	0.5055	0.0822	0.7909	0.6718	0.8906	10.471	5	8.452	2.132	0.0040
*EVS-25	0.6093	0.0796	0.8969	0.8046	1.0008	9.169	5	6.024	2.132	0.0039
*EVS-26	0.7286	0.0590	1.0245	0.9331	1.0829	6.418	5	3.556	2.132	0.0029

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.66151	1.035	-0.2163	1.31086

Reviewed by: 14SW

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date: 30/10/96 18:00 Test ID: EVS3219 Sample ID: VARIOUS
End Date: 01/11/96 20:00 Lab ID: BCEVS-EVS Environment C Sample Type: MARINE SED
Sample Date: Protocol: PSEP 95 Test Species: ME-Mytilus edulis
Comments: Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae

Conc-	1	2	3	4	5
EVS-23	0.7473	0.7363	0.6923	0.8187	0.7280
EVS-1	0.5577	0.6291	0.6236	0.5385	0.6786
EVS-2	0.5275	0.4670	0.6401	0.6099	0.6016
EVS-3	0.4176	0.5522	0.5632	0.4396	0.6511
EVS-4	0.6099	0.6209	0.6181	0.5769	0.7363
EVS-5	0.1630	0.2775	0.6016	0.2473	0.5440
EVS-6	0.6319	0.8104	0.8626	0.7060	0.5577
EVS-7	0.3104	0.4643	0.4368	0.3462	0.3846
EVS-8	0.6758	0.5852	0.6786	0.6703	0.5989
EVS-9	0.3654	0.3407	0.7143	0.7088	0.4341
EVS-10	0.4341	0.4286	0.5055	0.4863	0.2582
EVS-11	0.5357	0.4560	0.4038	0.3022	0.4148
EVS-12	0.6841	0.6071	0.6291	0.4643	0.1099
EVS-13	0.3736	0.4203	0.4863	0.3709	0.3352
EVS-14	0.7115	0.6291	0.5302	0.4698	0.5934
EVS-15	0.6566	0.5467	0.5577	0.5357	0.5797
EVS-16	0.6593	0.6181	0.6429	0.6291	0.7005
EVS-17	0.1181	0.1291	0.5165	0.6374	0.3654
EVS-18	0.5000	0.4505	0.6538	0.6016	0.5742
EVS-19	0.1841	0.4918	0.5467	0.4423	0.5082
EVS-20	0.5824	0.7418	0.6016	0.5440	0.6786
EVS-21	0.6016	0.7885	0.7637	0.8159	0.7088
EVS-22	0.3736	0.5495	0.1731	0.3764	0.2308
EVS-24	0.5055	0.4533	0.3297	0.3819	0.3626
EVS-25	0.6154	0.4588	0.5082	0.6511	0.5604
EVS-26	0.6016	0.6484	0.5824	0.5687	0.6044

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-23	0.7445	0.0463	1.0423	0.9828	1.1309	5.238	5			
*EVS-1	0.6055	0.0570	0.8923	0.8239	0.9680	6.560	5	4.190	2.132	0.0027
*EVS-2	0.5692	0.0706	0.8553	0.7524	0.9274	8.331	5	4.657	2.132	0.0034
*EVS-3	0.5247	0.0961	0.8106	0.7026	0.9389	11.973	5	4.653	2.132	0.0053
*EVS-4	0.6324	0.0606	0.9205	0.8626	1.0315	7.015	5	3.221	2.132	0.0030
*EVS-5	0.3667	0.1939	0.6416	0.4156	0.8878	32.053	5	4.211	2.132	0.0193
EVS-6	0.7137	0.1251	1.0143	0.8432	1.1911	14.044	5	0.411	2.132	0.0099
*EVS-7	0.3885	0.0632	0.6721	0.5910	0.7497	9.687	5	9.741	2.132	0.0031
*EVS-8	0.6418	0.0457	0.9296	0.8710	0.9680	5.113	5	3.479	2.132	0.0022
*EVS-9	0.5126	0.1848	0.7998	0.6232	1.0069	23.692	5	2.749	2.132	0.0166
*EVS-10	0.4225	0.0976	0.7057	0.5331	0.7909	14.461	5	6.502	2.132	0.0057
*EVS-11	0.4225	0.0849	0.7066	0.5820	0.8211	12.300	5	7.313	2.132	0.0045
*EVS-12	0.4989	0.2321	0.7742	0.3379	0.9739	33.258	5	2.278	2.132	0.0295
*EVS-13	0.3973	0.0582	0.6814	0.6174	0.7717	8.710	5	10.008	2.132	0.0028
*EVS-14	0.5868	0.0926	0.8740	0.7552	1.0038	10.881	5	3.432	2.132	0.0051
*EVS-15	0.5753	0.0483	0.8613	0.8211	0.9447	5.734	5	5.496	2.132	0.0023
*EVS-16	0.6500	0.0322	0.9381	0.9047	0.9918	3.630	5	3.622	2.132	0.0018
*EVS-17	0.3533	0.2308	0.6188	0.3509	0.9246	41.426	5	3.613	2.132	0.0293
*EVS-18	0.5560	0.0810	0.8421	0.7359	0.9418	9.726	5	4.547	2.132	0.0041
*EVS-19	0.4346	0.1450	0.7148	0.4434	0.8322	21.863	5	4.424	2.132	0.0117
*EVS-20	0.6297	0.0796	0.9182	0.8294	1.0377	9.125	5	2.774	2.132	0.0043
EVS-21	0.7357	0.0847	1.0344	0.8878	1.1274	9.111	5	0.162	2.132	0.0051
*EVS-22	0.3407	0.1467	0.6166	0.4291	0.8349	25.614	5	5.695	2.132	0.0119
*EVS-24	0.4066	0.0715	0.6907	0.6116	0.7909	10.534	5	8.643	2.132	0.0035
*EVS-25	0.5588	0.0779	0.8449	0.7441	0.9389	9.330	5	4.603	2.132	0.0039
*EVS-26	0.6011	0.0302	0.8874	0.8543	0.9360	3.491	5	5.518	2.132	0.0017

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.87846	1.035	-0.4502	1.94772

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis
Comments:	Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae				

Conc-	1	2	3	4	5
EVS-23	0.8803	0.8933	0.8660	0.9198	0.8923
EVS-1	0.8982	0.9197	0.8867	0.9032	0.8949
EVS-2	0.8727	0.8543	0.8504	0.8506	0.8831
EVS-3	0.9212	0.8933	0.8913	0.8939	0.9186
EVS-4	0.9024	0.9040	0.8858	0.9052	0.8933
EVS-5	0.4529	0.4742	0.8725	0.5357	0.7333
EVS-6	0.9350	0.9455	0.9515	0.9554	0.9144
EVS-7	0.6890	0.7071	0.7571	0.6632	0.7447
EVS-8	0.8693	0.8950	0.9286	0.9313	0.8971
EVS-9	0.6364	0.7195	0.9028	0.8866	0.7022
EVS-10	0.6054	0.6290	0.7480	0.6860	0.4608
EVS-11	0.7358	0.6640	0.7101	0.6044	0.6089
EVS-12	0.8646	0.8701	0.8876	0.6576	0.1770
EVS-13	0.7556	0.7887	0.8119	0.7584	0.7922
EVS-14	0.9152	0.9087	0.8540	0.8066	0.9153
EVS-15	0.9087	0.9128	0.9227	0.9330	0.9056
EVS-16	0.9091	0.9146	0.9176	0.9087	0.9341
EVS-17	0.6615	0.7344	0.7176	0.8345	0.7600
EVS-18	0.8125	0.8000	0.9333	0.8975	0.8672
EVS-19	0.5678	0.7490	0.7713	0.7000	0.7061
EVS-20	0.9339	0.9343	0.9399	0.9252	0.9356
EVS-21	0.9440	0.9472	0.9456	0.9489	0.9214
EVS-22	0.6210	0.8734	0.5943	0.8012	0.7059
EVS-24	0.8364	0.8209	0.8511	0.8081	0.7097
EVS-25	0.9256	0.8836	0.9343	0.9186	0.9189
EVS-26	0.7739	0.8310	0.8446	0.8809	0.8059

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-23	0.8903	0.0198	1.2343	1.1960	1.2836	2.625	5			
EVS-1	0.9006	0.0123	1.2504	1.2275	1.2834	1.670	5	-0.937	2.132	0.0006
*EVS-2	0.8622	0.0149	1.1909	1.1736	1.2218	1.835	5	2.484	2.132	0.0007
EVS-3	0.9037	0.0149	1.2559	1.2348	1.2863	2.040	5	-1.171	2.132	0.0007
EVS-4	0.8982	0.0083	1.2462	1.2261	1.2578	1.093	5	-0.756	2.132	0.0005
*EVS-5	0.6137	0.1821	0.9106	0.7383	1.2057	22.061	5	3.558	2.132	0.0177
EVS-6	0.9404	0.0164	1.3258	1.2739	1.3580	2.533	5	-4.383	2.132	0.0009
*EVS-7	0.7122	0.0389	1.0053	0.9516	1.0555	4.279	5	9.510	2.132	0.0012
EVS-8	0.9042	0.0259	1.2583	1.2008	1.3056	3.510	5	-0.981	2.132	0.0013
*EVS-9	0.7695	0.1186	1.0822	0.9235	1.2537	13.733	5	2.236	2.132	0.0099
*EVS-10	0.6258	0.1075	0.9149	0.7461	1.0449	12.177	5	6.155	2.132	0.0057
*EVS-11	0.6647	0.0589	0.9543	0.8906	1.0310	6.575	5	8.866	2.132	0.0021
EVS-12	0.6914	0.3026	1.0010	0.4342	1.2289	33.653	5	1.542	2.132	0.0488
*EVS-13	0.7814	0.0240	1.0847	1.0536	1.1222	2.678	5	7.688	2.132	0.0008
EVS-14	0.8800	0.0484	1.2218	1.1155	1.2754	5.884	5	0.356	2.132	0.0027
EVS-15	0.9166	0.0112	1.2783	1.2585	1.3090	1.618	5	-2.561	2.132	0.0006
EVS-16	0.9168	0.0103	1.2787	1.2639	1.3111	1.510	5	-2.633	2.132	0.0006
*EVS-17	0.7416	0.0633	1.0401	0.9499	1.1519	7.126	5	5.369	2.132	0.0028
EVS-18	0.8621	0.0563	1.1965	1.1071	1.3096	7.060	5	0.934	2.132	0.0035
*EVS-19	0.6988	0.0790	0.9921	0.8534	1.0722	8.521	5	5.981	2.132	0.0035
EVS-20	0.9338	0.0053	1.3107	1.2938	1.3231	0.811	5	-5.010	2.132	0.0005
EVS-21	0.9414	0.0113	1.3271	1.2867	1.3427	1.730	5	-5.226	2.132	0.0007
*EVS-22	0.7192	0.1182	1.0202	0.8803	1.2070	13.462	5	3.392	2.132	0.0085
*EVS-24	0.8052	0.0558	1.1164	1.0018	1.1746	6.054	5	3.518	2.132	0.0024
EVS-25	0.9162	0.0193	1.2785	1.2226	1.3117	2.624	5	-2.118	2.132	0.0009
*EVS-26	0.8272	0.0403	1.1442	1.0752	1.2184	4.709	5	3.206	2.132	0.0017

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.78518	1.035	-1.5292	13.1472

Reviewed by: 14SA

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	30/10/96 18:00	Test ID: EVS3219	Sample ID: VARIOUS
End Date:	01/11/96 20:00	Lab ID: BCEVS-EVS Environment C	Sample Type: MARINE SED
Sample Date:		Protocol: PSEP 95	Test Species: ME-Mytilus edulis
Comments:	Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae		

Conc-	1	2	3	4	5
EVS-2	0.6044	0.5467	0.7527	0.7170	0.6813
EVS-1	0.6209	0.6841	0.7033	0.5962	0.7582
EVS-3	0.4533	0.6181	0.6319	0.4918	0.7088
EVS-4	0.6758	0.6868	0.6978	0.6374	0.8242
EVS-5	0.3599	0.5852	0.6896	0.4615	0.7418
EVS-6	0.6758	0.8571	0.9066	0.7390	0.6099
EVS-7	0.4505	0.6566	0.5769	0.5220	0.5165
EVS-8	0.7775	0.6538	0.7308	0.7198	0.6676
EVS-9	0.5742	0.4734	0.7912	0.7995	0.6181
EVS-10	0.7170	0.6813	0.6758	0.7088	0.5604
EVS-11	0.7280	0.6868	0.5687	0.5000	0.6813
EVS-12	0.7912	0.6978	0.7088	0.7060	0.6209
EVS-13	0.4945	0.5330	0.5989	0.4890	0.4231
EVS-14	0.7775	0.6923	0.6209	0.5824	0.6484
EVS-15	0.7225	0.5989	0.6044	0.5742	0.6401
EVS-16	0.7253	0.6758	0.7005	0.6923	0.7500
EVS-17	0.1786	0.1758	0.7198	0.7637	0.4808
EVS-18	0.6154	0.5632	0.7005	0.6703	0.6621
EVS-19	0.3242	0.6566	0.7088	0.6319	0.7198
EVS-20	0.6236	0.7940	0.6401	0.5879	0.7253
EVS-21	0.6374	0.8324	0.8077	0.8599	0.7692
EVS-22	0.6016	0.6291	0.2912	0.4698	0.3269
EVS-23	0.8489	0.8242	0.7995	0.8901	0.8159
EVS-24	0.6044	0.5522	0.3874	0.4725	0.5110
EVS-25	0.6648	0.5192	0.5440	0.7088	0.6099
EVS-26	0.7775	0.7802	0.6896	0.6456	0.7500

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-2	0.6604	0.0840	0.9508	0.8322	1.0504	9.336	5			
EVS-1	0.6725	0.0651	0.9630	0.8822	1.0568	7.257	5	-0.242	2.132	0.0054
EVS-3	0.5808	0.1056	0.8680	0.7386	1.0008	12.428	5	1.325	2.132	0.0083
EVS-4	0.7044	0.0707	0.9987	0.9246	1.1381	8.172	5	-0.888	2.132	0.0062
EVS-5	0.5676	0.1580	0.8558	0.6434	1.0377	18.995	5	1.147	2.132	0.0146
EVS-6	0.7577	0.1234	1.0679	0.8962	1.2602	14.159	5	-1.493	2.132	0.0131
*EVS-7	0.5445	0.0770	0.8305	0.7359	0.9447	9.400	5	2.276	2.132	0.0060
EVS-8	0.7099	0.0501	1.0032	0.9418	1.0795	5.547	5	-1.118	2.132	0.0047
EVS-9	0.6513	0.1416	0.9452	0.7588	1.1065	16.087	5	0.071	2.132	0.0132
EVS-10	0.6687	0.0630	0.9585	0.8460	1.0099	6.859	5	-0.157	2.132	0.0052
EVS-11	0.6330	0.0950	0.9219	0.7854	1.0222	10.667	5	0.487	2.132	0.0075
EVS-12	0.7049	0.0604	0.9982	0.9075	1.0962	6.709	5	-0.954	2.132	0.0053
*EVS-13	0.5077	0.0645	0.7932	0.7082	0.8850	8.174	5	3.207	2.132	0.0052
EVS-14	0.6643	0.0749	0.9548	0.8682	1.0795	8.515	5	-0.075	2.132	0.0062
EVS-15	0.6280	0.0578	0.9158	0.8598	1.0160	6.664	5	0.727	2.132	0.0049
EVS-16	0.7088	0.0291	1.0012	0.9651	1.0472	3.225	5	-1.193	2.132	0.0038
EVS-17	0.4637	0.2829	0.7423	0.4327	1.0632	40.770	5	1.479	2.132	0.0424
EVS-18	0.6423	0.0537	0.9304	0.8488	0.9918	6.003	5	0.435	2.132	0.0047
EVS-19	0.6082	0.1629	0.8966	0.6057	1.0130	18.647	5	0.640	2.132	0.0153
EVS-20	0.6742	0.0838	0.9660	0.8738	1.0996	9.512	5	-0.267	2.132	0.0070
EVS-21	0.7813	0.0871	1.0895	0.9246	1.1871	9.341	5	-2.296	2.132	0.0078
*EVS-22	0.4637	0.1540	0.7475	0.5700	0.9160	21.035	5	2.517	2.132	0.0139
EVS-23	0.8357	0.0353	1.1553	1.1065	1.2329	4.273	5	-4.502	2.132	0.0044
*EVS-24	0.5055	0.0822	0.7909	0.6718	0.8906	10.471	5	2.946	2.132	0.0063
EVS-25	0.6093	0.0796	0.8969	0.8046	1.0008	9.169	5	0.996	2.132	0.0062
EVS-26	0.7286	0.0590	1.0245	0.9331	1.0829	6.418	5	-1.492	2.132	0.0052

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.66151	1.035	-0.2163	1.31086

Reviewed by: 1/15/97

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	30/10/96 18:00	Test ID:	EVS3219
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C
Sample Date:		Protocol:	PSEP 95
Sample ID:	VARIOUS		
Sample Type:	MARINE SED		
Test Species:	ME-Mytilus edulis		

Comments: Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae

Conc-	1	2	3	4	5
EVS-2	0.8727	0.8543	0.8504	0.8506	0.8831
EVS-1	0.8982	0.9197	0.8867	0.9032	0.8949
EVS-3	0.9212	0.8933	0.8913	0.8939	0.9186
EVS-4	0.9024	0.9040	0.8858	0.9052	0.8933
EVS-5	0.4529	0.4742	0.8725	0.5357	0.7333
EVS-6	0.9350	0.9455	0.9515	0.9554	0.9144
EVS-7	0.6890	0.7071	0.7571	0.6632	0.7447
EVS-8	0.8693	0.8950	0.9286	0.9313	0.8971
EVS-9	0.6364	0.7195	0.9028	0.8866	0.7022
EVS-10	0.6054	0.6290	0.7480	0.6860	0.4608
EVS-11	0.7358	0.6640	0.7101	0.6044	0.6089
EVS-12	0.8646	0.8701	0.8876	0.6576	0.1770
EVS-13	0.7556	0.7887	0.8119	0.7584	0.7922
EVS-14	0.9152	0.9087	0.8540	0.8066	0.9153
EVS-15	0.9087	0.9128	0.9227	0.9330	0.9056
EVS-16	0.9091	0.9146	0.9176	0.9087	0.9341
EVS-17	0.6615	0.7344	0.7176	0.8345	0.7600
EVS-18	0.8125	0.8000	0.9333	0.8975	0.8672
EVS-19	0.5678	0.7490	0.7713	0.7000	0.7061
EVS-20	0.9339	0.9343	0.9399	0.9252	0.9356
EVS-21	0.9440	0.9472	0.9456	0.9489	0.9214
EVS-22	0.6210	0.8734	0.5943	0.8012	0.7059
EVS-23	0.8803	0.8933	0.8660	0.9198	0.8923
EVS-24	0.8364	0.8209	0.8511	0.8081	0.7097
EVS-25	0.9256	0.8836	0.9343	0.9186	0.9189
EVS-26	0.7739	0.8310	0.8446	0.8809	0.8059

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-2	0.8622	0.0149	1.1909	1.1736	1.2218	1.835	5			
EVS-1	0.9006	0.0123	1.2504	1.2275	1.2834	1.670	5	-4.406	2.132	0.0004
EVS-3	0.9037	0.0149	1.2559	1.2348	1.2863	2.040	5	-4.319	2.132	0.0005
EVS-4	0.8982	0.0083	1.2462	1.2261	1.2578	1.093	5	-4.801	2.132	0.0003
*EVS-5	0.6137	0.1821	0.9106	0.7383	1.2057	22.061	5	3.102	2.132	0.0174
EVS-6	0.9404	0.0164	1.3258	1.2739	1.3580	2.533	5	-7.527	2.132	0.0007
*EVS-7	0.7122	0.0389	1.0053	0.9516	1.0555	4.279	5	8.602	2.132	0.0010
EVS-8	0.9042	0.0259	1.2583	1.2008	1.3056	3.510	5	-3.061	2.132	0.0010
EVS-9	0.7695	0.1186	1.0822	0.9235	1.2537	13.733	5	1.618	2.132	0.0096
*EVS-10	0.6258	0.1075	0.9149	0.7461	1.0449	12.177	5	5.436	2.132	0.0055
*EVS-11	0.6647	0.0589	0.9543	0.8906	1.0310	6.575	5	7.962	2.132	0.0019
EVS-12	0.6914	0.3026	1.0010	0.4342	1.2289	33.653	5	1.258	2.132	0.0486
*EVS-13	0.7814	0.0240	1.0847	1.0536	1.1222	2.678	5	6.533	2.132	0.0006
EVS-14	0.8800	0.0484	1.2218	1.1155	1.2754	5.884	5	-0.919	2.132	0.0024
EVS-15	0.9166	0.0112	1.2783	1.2585	1.3090	1.618	5	-6.498	2.132	0.0004
EVS-16	0.9168	0.0103	1.2787	1.2639	1.3111	1.510	5	-6.735	2.132	0.0004
*EVS-17	0.7416	0.0633	1.0401	0.9499	1.1519	7.126	5	4.364	2.132	0.0025
EVS-18	0.8621	0.0563	1.1965	1.1071	1.3096	7.060	5	-0.144	2.132	0.0032
*EVS-19	0.6988	0.0790	0.9921	0.8534	1.0722	8.521	5	5.090	2.132	0.0033
EVS-20	0.9338	0.0053	1.3107	1.2938	1.3231	0.811	5	-11.025	2.132	0.0003
EVS-21	0.9414	0.0113	1.3271	1.2867	1.3427	1.730	5	-9.611	2.132	0.0004
*EVS-22	0.7192	0.1182	1.0202	0.8803	1.2070	13.462	5	2.744	2.132	0.0082
EVS-23	0.8903	0.0198	1.2343	1.1960	1.2836	2.625	5	-2.484	2.132	0.0007
*EVS-24	0.8052	0.0558	1.1164	1.0018	1.1746	6.054	5	2.345	2.132	0.0022
EVS-25	0.9162	0.0193	1.2785	1.2226	1.3117	2.624	5	-4.892	2.132	0.0007
EVS-26	0.8272	0.0403	1.1442	1.0752	1.2184	4.709	5	1.797	2.132	0.0014

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.78518	1.035	-1.5292	13.1472

Reviewed by: 14SAN

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis
Comments:	Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae				

Conc-	1	2	3	4	5
EVS-2	0.5275	0.4670	0.6401	0.6099	0.6016
EVS-1	0.5577	0.6291	0.6236	0.5385	0.6786
EVS-3	0.4176	0.5522	0.5632	0.4396	0.6511
EVS-4	0.6099	0.6209	0.6181	0.5769	0.7363
EVS-5	0.1630	0.2775	0.6016	0.2473	0.5440
EVS-6	0.6319	0.8104	0.8626	0.7060	0.5577
EVS-7	0.3104	0.4643	0.4368	0.3462	0.3846
EVS-8	0.6758	0.5852	0.6786	0.6703	0.5989
EVS-9	0.3654	0.3407	0.7143	0.7088	0.4341
EVS-10	0.4341	0.4286	0.5055	0.4863	0.2582
EVS-11	0.5357	0.4560	0.4038	0.3022	0.4148
EVS-12	0.6841	0.6071	0.6291	0.4643	0.1099
EVS-13	0.3736	0.4203	0.4863	0.3709	0.3352
EVS-14	0.7115	0.6291	0.5302	0.4698	0.5934
EVS-15	0.6566	0.5467	0.5577	0.5357	0.5797
EVS-16	0.6593	0.6181	0.6429	0.6291	0.7005
EVS-17	0.1181	0.1291	0.5165	0.6374	0.3654
EVS-18	0.5000	0.4505	0.6538	0.6016	0.5742
EVS-19	0.1841	0.4918	0.5467	0.4423	0.5082
EVS-20	0.5824	0.7418	0.6016	0.5440	0.6786
EVS-21	0.6016	0.7885	0.7637	0.8159	0.7088
EVS-22	0.3736	0.5495	0.1731	0.3764	0.2308
EVS-23	0.7473	0.7363	0.6923	0.8187	0.7280
EVS-24	0.5055	0.4533	0.3297	0.3819	0.3626
EVS-25	0.6154	0.4588	0.5082	0.6511	0.5604
EVS-26	0.6016	0.6484	0.5824	0.5687	0.6044

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-2	0.5692	0.0706	0.8553	0.7524	0.9274	8.331	5			
EVS-1	0.6055	0.0570	0.8923	0.8239	0.9680	6.560	5	-0.896	2.132	0.0036
EVS-3	0.5247	0.0961	0.8106	0.7026	0.9389	11.973	5	0.832	2.132	0.0062
EVS-4	0.6324	0.0606	0.9205	0.8626	1.0315	7.015	5	-1.515	2.132	0.0039
*EVS-5	0.3667	0.1939	0.6416	0.4156	0.8878	32.053	5	2.196	2.132	0.0202
EVS-6	0.7137	0.1251	1.0143	0.8432	1.1911	14.044	5	-2.231	2.132	0.0108
*EVS-7	0.3885	0.0632	0.6721	0.5910	0.7497	9.687	5	4.244	2.132	0.0040
EVS-8	0.6418	0.0457	0.9296	0.8710	0.9680	5.113	5	-1.940	2.132	0.0031
EVS-9	0.5126	0.1848	0.7998	0.6232	1.0069	23.692	5	0.613	2.132	0.0175
*EVS-10	0.4225	0.0976	0.7057	0.5331	0.7909	14.461	5	2.688	2.132	0.0066
*EVS-11	0.4225	0.0849	0.7066	0.5820	0.8211	12.300	5	2.959	2.132	0.0054
EVS-12	0.4989	0.2321	0.7742	0.3379	0.9739	33.258	5	0.679	2.132	0.0304
*EVS-13	0.3973	0.0582	0.6814	0.6174	0.7717	8.710	5	4.194	2.132	0.0037
EVS-14	0.5868	0.0926	0.8740	0.7552	1.0038	10.881	5	-0.351	2.132	0.0060
EVS-15	0.5753	0.0483	0.8613	0.8211	0.9447	5.734	5	-0.155	2.132	0.0032
EVS-16	0.6500	0.0322	0.9381	0.9047	0.9918	3.630	5	-2.342	2.132	0.0027
EVS-17	0.3533	0.2308	0.6188	0.3509	0.9246	41.426	5	1.988	2.132	0.0302
EVS-18	0.5560	0.0810	0.8421	0.7359	0.9418	9.726	5	0.272	2.132	0.0050
EVS-19	0.4346	0.1450	0.7148	0.4434	0.8322	21.863	5	1.830	2.132	0.0126
EVS-20	0.6297	0.0796	0.9182	0.8294	1.0377	9.125	5	-1.279	2.132	0.0052
EVS-21	0.7357	0.0847	1.0344	0.8878	1.1274	9.111	5	-3.389	2.132	0.0060
*EVS-22	0.3407	0.1467	0.6166	0.4291	0.8349	25.614	5	3.080	2.132	0.0128
EVS-23	0.7445	0.0463	1.0423	0.9828	1.1309	5.238	5	-4.657	2.132	0.0034
*EVS-24	0.4066	0.0715	0.6907	0.6116	0.7909	10.534	5	3.615	2.132	0.0044
EVS-25	0.5588	0.0779	0.8449	0.7441	0.9389	9.330	5	0.219	2.132	0.0048
EVS-26	0.6011	0.0302	0.8874	0.8543	0.9360	3.491	5	-0.922	2.132	0.0026

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.87846	1.035	-0.4502	1.94772

Reviewed by: JDD 14 Nov

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	30/10/96 18:00	Test ID: EVS3219	Sample ID: VARIOUS
End Date:	01/11/96 20:00	Lab ID: BCEVS-EVS Environment C	Sample Type: MARINE SED
Sample Date:		Protocol: PSEP 95	Test Species: ME-Mytilus edulis

Comments: Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae

Conc-	1	2	3	4	5
EVS-16	0.7253	0.6758	0.7005	0.6923	0.7500
EVS-1	0.6209	0.6841	0.7033	0.5962	0.7582
EVS-2	0.6044	0.5467	0.7527	0.7170	0.6813
EVS-3	0.4533	0.6181	0.6319	0.4918	0.7088
EVS-4	0.6758	0.6868	0.6978	0.6374	0.8242
EVS-5	0.3599	0.5852	0.6896	0.4615	0.7418
EVS-6	0.6758	0.8571	0.9066	0.7390	0.6099
EVS-7	0.4505	0.6566	0.5769	0.5220	0.5165
EVS-8	0.7775	0.6538	0.7308	0.7198	0.6676
EVS-9	0.5742	0.4734	0.7912	0.7995	0.6181
EVS-10	0.7170	0.6813	0.6758	0.7088	0.5604
EVS-11	0.7280	0.6868	0.5687	0.5000	0.6813
EVS-12	0.7912	0.6978	0.7088	0.7060	0.6209
EVS-13	0.4945	0.5330	0.5989	0.4890	0.4231
EVS-14	0.7775	0.6923	0.6209	0.5824	0.6484
EVS-15	0.7225	0.5989	0.6044	0.5742	0.6401
EVS-17	0.1786	0.1758	0.7198	0.7637	0.4808
EVS-18	0.6154	0.5632	0.7005	0.6703	0.6621
EVS-19	0.3242	0.6566	0.7088	0.6319	0.7198
EVS-20	0.6236	0.7940	0.6401	0.5879	0.7253
EVS-21	0.6374	0.8324	0.8077	0.8599	0.7692
EVS-22	0.6016	0.6291	0.2912	0.4698	0.3269
EVS-23	0.8489	0.8242	0.7995	0.8901	0.8159
EVS-24	0.6044	0.5522	0.3874	0.4725	0.5110
EVS-25	0.6648	0.5192	0.5440	0.7088	0.6099
EVS-26	0.7775	0.7802	0.6896	0.6456	0.7500

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-16	0.7088	0.0291	1.0012	0.9651	1.0472	3.225	5			
EVS-1	0.6725	0.0651	0.9630	0.8822	1.0568	7.257	5	1.109	2.132	0.0025
EVS-2	0.6604	0.0840	0.9508	0.8322	1.0504	9.336	5	1.193	2.132	0.0038
*EVS-3	0.5808	0.1056	0.8680	0.7386	1.0008	12.428	5	2.644	2.132	0.0054
EVS-4	0.7044	0.0707	0.9987	0.9246	1.1381	8.172	5	0.064	2.132	0.0033
EVS-5	0.5676	0.1580	0.8558	0.6434	1.0377	18.995	5	1.962	2.132	0.0117
EVS-6	0.7577	0.1234	1.0679	0.8962	1.2602	14.159	5	-0.964	2.132	0.0102
*EVS-7	0.5445	0.0770	0.8305	0.7359	0.9447	9.400	5	4.518	2.132	0.0030
EVS-8	0.7099	0.0501	1.0032	0.9418	1.0795	5.547	5	-0.069	2.132	0.0018
EVS-9	0.6513	0.1416	0.9452	0.7588	1.1065	16.087	5	0.805	2.132	0.0103
EVS-10	0.6687	0.0630	0.9585	0.8460	1.0099	6.859	5	1.302	2.132	0.0023
EVS-11	0.6330	0.0950	0.9219	0.7854	1.0222	10.667	5	1.712	2.132	0.0046
EVS-12	0.7049	0.0604	0.9982	0.9075	1.0962	6.709	5	0.089	2.132	0.0024
*EVS-13	0.5077	0.0645	0.7932	0.7082	0.8850	8.174	5	6.422	2.132	0.0022
EVS-14	0.6643	0.0749	0.9548	0.8682	1.0795	8.515	5	1.185	2.132	0.0033
*EVS-15	0.6280	0.0578	0.9158	0.8598	1.0160	6.664	5	2.767	2.132	0.0020
EVS-17	0.4637	0.2829	0.7423	0.4327	1.0632	40.770	5	1.902	2.132	0.0395
*EVS-18	0.6423	0.0537	0.9304	0.8488	0.9918	6.003	5	2.453	2.132	0.0018
EVS-19	0.6082	0.1629	0.8966	0.6057	1.0130	18.647	5	1.373	2.132	0.0124
EVS-20	0.6742	0.0838	0.9660	0.8738	1.0996	9.512	5	0.807	2.132	0.0040
EVS-21	0.7813	0.0871	1.0895	0.9246	1.1871	9.341	5	-1.849	2.132	0.0049
*EVS-22	0.4637	0.1540	0.7475	0.5700	0.9160	21.035	5	3.533	2.132	0.0110
EVS-23	0.8357	0.0353	1.1553	1.1065	1.2329	4.273	5	-5.842	2.132	0.0015
*EVS-24	0.5055	0.0822	0.7909	0.6718	0.8906	10.471	5	5.291	2.132	0.0034
*EVS-25	0.6093	0.0796	0.8969	0.8046	1.0008	9.169	5	2.640	2.132	0.0033
EVS-26	0.7286	0.0590	1.0245	0.9331	1.0829	6.418	5	-0.712	2.132	0.0023

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.66151	1.035	-0.2163	1.31086

Reviewed by: JSB 14/5/97

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis

Comments: Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae

Conc-	1	2	3	4	5
EVS-16	0.9091	0.9146	0.9176	0.9087	0.9341
EVS-1	0.8982	0.9197	0.8867	0.9032	0.8949
EVS-2	0.8727	0.8543	0.8504	0.8506	0.8831
EVS-3	0.9212	0.8933	0.8913	0.8939	0.9186
EVS-4	0.9024	0.9040	0.8858	0.9052	0.8933
EVS-5	0.4529	0.4742	0.8725	0.5357	0.7333
EVS-6	0.9350	0.9455	0.9515	0.9554	0.9144
EVS-7	0.6890	0.7071	0.7571	0.6632	0.7447
EVS-8	0.8693	0.8950	0.9286	0.9313	0.8971
EVS-9	0.6364	0.7195	0.9028	0.8866	0.7022
EVS-10	0.6054	0.6290	0.7480	0.6860	0.4608
EVS-11	0.7358	0.6640	0.7101	0.6044	0.6089
EVS-12	0.8646	0.8701	0.8876	0.6576	0.1770
EVS-13	0.7556	0.7887	0.8119	0.7584	0.7922
EVS-14	0.9152	0.9087	0.8540	0.8066	0.9153
EVS-15	0.9087	0.9128	0.9227	0.9330	0.9056
EVS-17	0.6615	0.7344	0.7176	0.8345	0.7600
EVS-18	0.8125	0.8000	0.9333	0.8975	0.8672
EVS-19	0.5678	0.7490	0.7713	0.7000	0.7061
EVS-20	0.9339	0.9343	0.9399	0.9252	0.9356
EVS-21	0.9440	0.9472	0.9456	0.9489	0.9214
EVS-22	0.6210	0.8734	0.5943	0.8012	0.7059
EVS-23	0.8803	0.8933	0.8660	0.9198	0.8923
EVS-24	0.8364	0.8209	0.8511	0.8081	0.7097
EVS-25	0.9256	0.8836	0.9343	0.9186	0.9189
EVS-26	0.7739	0.8310	0.8446	0.8809	0.8059

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-16	0.9168	0.0103	1.2787	1.2639	1.3111	1.510	5			
*EVS-1	0.9006	0.0123	1.2504	1.2275	1.2834	1.670	5	2.222	2.132	0.0003
*EVS-2	0.8622	0.0149	1.1909	1.1736	1.2218	1.835	5	6.735	2.132	0.0004
EVS-3	0.9037	0.0149	1.2559	1.2348	1.2863	2.040	5	1.588	2.132	0.0004
*EVS-4	0.8982	0.0083	1.2462	1.2261	1.2578	1.093	5	3.078	2.132	0.0002
*EVS-5	0.6137	0.1821	0.9106	0.7383	1.2057	22.061	5	4.079	2.132	0.0174
EVS-6	0.9404	0.0164	1.3258	1.2739	1.3580	2.533	5	-2.716	2.132	0.0006
*EVS-7	0.7122	0.0389	1.0053	0.9516	1.0555	4.279	5	12.967	2.132	0.0009
EVS-8	0.9042	0.0259	1.2583	1.2008	1.3056	3.510	5	0.945	2.132	0.0010
*EVS-9	0.7695	0.1186	1.0822	0.9235	1.2537	13.733	5	2.933	2.132	0.0096
*EVS-10	0.6258	0.1075	0.9149	0.7461	1.0449	12.177	5	7.195	2.132	0.0055
*EVS-11	0.6647	0.0589	0.9543	0.8906	1.0310	6.575	5	11.049	2.132	0.0018
EVS-12	0.6914	0.3026	1.0010	0.4342	1.2289	33.653	5	1.841	2.132	0.0485
*EVS-13	0.7814	0.0240	1.0847	1.0536	1.1222	2.678	5	12.437	2.132	0.0005
EVS-14	0.8800	0.0484	1.2218	1.1155	1.2754	5.884	5	1.711	2.132	0.0024
EVS-15	0.9166	0.0112	1.2783	1.2585	1.3090	1.618	5	0.031	2.132	0.0003
*EVS-17	0.7416	0.0633	1.0401	0.9499	1.1519	7.126	5	6.967	2.132	0.0025
EVS-18	0.8621	0.0563	1.1965	1.1071	1.3096	7.060	5	2.121	2.132	0.0032
*EVS-19	0.6988	0.0790	0.9921	0.8534	1.0722	8.521	5	7.390	2.132	0.0032
EVS-20	0.9338	0.0053	1.3107	1.2938	1.3231	0.811	5	-3.245	2.132	0.0002
EVS-21	0.9414	0.0113	1.3271	1.2867	1.3427	1.730	5	-3.607	2.132	0.0004
*EVS-22	0.7192	0.1182	1.0202	0.8803	1.2070	13.462	5	4.168	2.132	0.0082
*EVS-23	0.8903	0.0198	1.2343	1.1960	1.2836	2.625	5	2.633	2.132	0.0006
*EVS-24	0.8052	0.0558	1.1164	1.0018	1.1746	6.054	5	5.164	2.132	0.0021
EVS-25	0.9162	0.0193	1.2785	1.2226	1.3117	2.624	5	0.013	2.132	0.0006
*EVS-26	0.8272	0.0403	1.1442	1.0752	1.2184	4.709	5	5.257	2.132	0.0014

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.78518	1.035	-1.5292	13.1472

ToxCalc v5.0

Reviewed by: 14JAN

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	30/10/96 18:00	Test ID: EVS3219	Sample ID: VARIOUS
End Date:	01/11/96 20:00	Lab ID: BCEVS-EVS Environment C	Sample Type: MARINE SED
Sample Date:		Protocol: PSEP 95	Test Species: ME-Mytilus edulis
Comments:	Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae		

Conc-	1	2	3	4	5
EVS-16	0.6593	0.6181	0.6429	0.6291	0.7005
EVS-1	0.5577	0.6291	0.6236	0.5385	0.6786
EVS-2	0.5275	0.4670	0.6401	0.6099	0.6016
EVS-3	0.4176	0.5522	0.5632	0.4396	0.6511
EVS-4	0.6099	0.6209	0.6181	0.5769	0.7363
EVS-5	0.1630	0.2775	0.6016	0.2473	0.5440
EVS-6	0.6319	0.8104	0.8626	0.7060	0.5577
EVS-7	0.3104	0.4643	0.4368	0.3462	0.3846
EVS-8	0.6758	0.5852	0.6786	0.6703	0.5989
EVS-9	0.3654	0.3407	0.7143	0.7088	0.4341
EVS-10	0.4341	0.4286	0.5055	0.4863	0.2582
EVS-11	0.5357	0.4560	0.4038	0.3022	0.4148
EVS-12	0.6841	0.6071	0.6291	0.4643	0.1099
EVS-13	0.3736	0.4203	0.4863	0.3709	0.3352
EVS-14	0.7115	0.6291	0.5302	0.4698	0.5934
EVS-15	0.6566	0.5467	0.5577	0.5357	0.5797
EVS-17	0.1181	0.1291	0.5165	0.6374	0.3654
EVS-18	0.5000	0.4505	0.6538	0.6016	0.5742
EVS-19	0.1841	0.4918	0.5467	0.4423	0.5082
EVS-20	0.5824	0.7418	0.6016	0.5440	0.6786
EVS-21	0.6016	0.7885	0.7637	0.8159	0.7088
EVS-22	0.3736	0.5495	0.1731	0.3764	0.2308
EVS-23	0.7473	0.7363	0.6923	0.8187	0.7280
EVS-24	0.5055	0.4533	0.3297	0.3819	0.3626
EVS-25	0.6154	0.4588	0.5082	0.6511	0.5604
EVS-26	0.6016	0.6484	0.5824	0.5687	0.6044

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-16	0.6500	0.0322	0.9381	0.9047	0.9918	3.630	5			
EVS-1	0.6055	0.0570	0.8923	0.8239	0.9680	6.560	5	1.511	2.132	0.0020
*EVS-2	0.5692	0.0706	0.8553	0.7524	0.9274	8.331	5	2.342	2.132	0.0027
*EVS-3	0.5247	0.0961	0.8106	0.7026	0.9389	11.973	5	2.772	2.132	0.0045
EVS-4	0.6324	0.0606	0.9205	0.8626	1.0315	7.015	5	0.538	2.132	0.0023
*EVS-5	0.3667	0.1939	0.6416	0.4156	0.8878	32.053	5	3.180	2.132	0.0185
EVS-6	0.7137	0.1251	1.0143	0.8432	1.1911	14.044	5	-1.163	2.132	0.0091
*EVS-7	0.3885	0.0632	0.6721	0.5910	0.7497	9.687	5	8.093	2.132	0.0023
EVS-8	0.6418	0.0457	0.9296	0.8710	0.9680	5.113	5	0.322	2.132	0.0015
EVS-9	0.5126	0.1848	0.7998	0.6232	1.0069	23.692	5	1.605	2.132	0.0158
*EVS-10	0.4225	0.0976	0.7057	0.5331	0.7909	14.461	5	4.829	2.132	0.0049
*EVS-11	0.4225	0.0849	0.7066	0.5820	0.8211	12.300	5	5.544	2.132	0.0037
EVS-12	0.4989	0.2321	0.7742	0.3379	0.9739	33.258	5	1.411	2.132	0.0288
*EVS-13	0.3973	0.0582	0.6814	0.6174	0.7717	8.710	5	8.388	2.132	0.0020
EVS-14	0.5868	0.0926	0.8740	0.7552	1.0038	10.881	5	1.418	2.132	0.0044
*EVS-15	0.5753	0.0483	0.8613	0.8211	0.9447	5.734	5	2.860	2.132	0.0015
*EVS-17	0.3533	0.2308	0.6188	0.3509	0.9246	41.426	5	2.761	2.132	0.0285
*EVS-18	0.5560	0.0810	0.8421	0.7359	0.9418	9.726	5	2.418	2.132	0.0034
*EVS-19	0.4346	0.1450	0.7148	0.4434	0.8322	21.863	5	3.121	2.132	0.0109
EVS-20	0.6297	0.0796	0.9182	0.8294	1.0377	9.125	5	0.490	2.132	0.0035
EVS-21	0.7357	0.0847	1.0344	0.8878	1.1274	9.111	5	-2.150	2.132	0.0043
*EVS-22	0.3407	0.1467	0.6166	0.4291	0.8349	25.614	5	4.448	2.132	0.0111
EVS-23	0.7445	0.0463	1.0423	0.9828	1.1309	5.238	5	-3.622	2.132	0.0018
*EVS-24	0.4066	0.0715	0.6907	0.6116	0.7909	10.534	5	6.885	2.132	0.0028
*EVS-25	0.5588	0.0779	0.8449	0.7441	0.9389	9.330	5	2.426	2.132	0.0031
*EVS-26	0.6011	0.0302	0.8874	0.8543	0.9360	3.491	5	2.462	2.132	0.0009

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.87846	1.035	-0.4502	1.94772

Reviewed by: [illegible]

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis

Comments: Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae

Conc-	1	2	3	4	5
EVS-25	0.6648	0.5192	0.5440	0.7088	0.6099
EVS-1	0.6209	0.6841	0.7033	0.5962	0.7582
EVS-2	0.6044	0.5467	0.7527	0.7170	0.6813
EVS-3	0.4533	0.6181	0.6319	0.4918	0.7088
EVS-4	0.6758	0.6868	0.6978	0.6374	0.8242
EVS-5	0.3599	0.5852	0.6896	0.4615	0.7418
EVS-6	0.6758	0.8571	0.9066	0.7390	0.6099
EVS-7	0.4505	0.6566	0.5769	0.5220	0.5165
EVS-8	0.7775	0.6538	0.7308	0.7198	0.6676
EVS-9	0.5742	0.4734	0.7912	0.7995	0.6181
EVS-10	0.7170	0.6813	0.6758	0.7088	0.5604
EVS-11	0.7280	0.6868	0.5687	0.5000	0.6813
EVS-12	0.7912	0.6978	0.7088	0.7060	0.6209
EVS-13	0.4945	0.5330	0.5989	0.4890	0.4231
EVS-14	0.7775	0.6923	0.6209	0.5824	0.6484
EVS-15	0.7225	0.5989	0.6044	0.5742	0.6401
EVS-16	0.7253	0.6758	0.7005	0.6923	0.7500
EVS-17	0.1786	0.1758	0.7198	0.7637	0.4808
EVS-18	0.6154	0.5632	0.7005	0.6703	0.6621
EVS-19	0.3242	0.6566	0.7088	0.6319	0.7198
EVS-20	0.6236	0.7940	0.6401	0.5879	0.7253
EVS-21	0.6374	0.8324	0.8077	0.8599	0.7692
EVS-22	0.6016	0.6291	0.2912	0.4698	0.3269
EVS-23	0.8489	0.8242	0.7995	0.8901	0.8159
EVS-24	0.6044	0.5522	0.3874	0.4725	0.5110
EVS-26	0.7775	0.7802	0.6896	0.6456	0.7500

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-25	0.6093	0.0796	0.8969	0.8046	1.0008	9.169	5			
EVS-1	0.6725	0.0651	0.9630	0.8822	1.0568	7.257	5	-1.370	2.132	0.0050
EVS-2	0.6604	0.0840	0.9508	0.8322	1.0504	9.336	5	-0.996	2.132	0.0062
EVS-3	0.5808	0.1056	0.8680	0.7386	1.0008	12.428	5	0.476	2.132	0.0078
EVS-4	0.7044	0.0707	0.9987	0.9246	1.1381	8.172	5	-1.965	2.132	0.0057
EVS-5	0.5676	0.1580	0.8558	0.6434	1.0377	18.995	5	0.505	2.132	0.0141
EVS-6	0.7577	0.1234	1.0679	0.8962	1.2602	14.159	5	-2.221	2.132	0.0126
EVS-7	0.5445	0.0770	0.8305	0.7359	0.9447	9.400	5	1.309	2.132	0.0055
EVS-8	0.7099	0.0501	1.0032	0.9418	1.0795	5.547	5	-2.394	2.132	0.0042
EVS-9	0.6513	0.1416	0.9452	0.7588	1.1065	16.087	5	-0.625	2.132	0.0127
EVS-10	0.6687	0.0630	0.9585	0.8460	1.0099	6.859	5	-1.309	2.132	0.0047
EVS-11	0.6330	0.0950	0.9219	0.7854	1.0222	10.667	5	-0.437	2.132	0.0070
EVS-12	0.7049	0.0604	0.9982	0.9075	1.0962	6.709	5	-2.136	2.132	0.0048
*EVS-13	0.5077	0.0645	0.7932	0.7082	0.8850	8.174	5	2.215	2.132	0.0047
EVS-14	0.6643	0.0749	0.9548	0.8682	1.0795	8.515	5	-1.120	2.132	0.0057
EVS-15	0.6280	0.0578	0.9158	0.8598	1.0160	6.664	5	-0.412	2.132	0.0045
EVS-16	0.7088	0.0291	1.0012	0.9651	1.0472	3.225	5	-2.640	2.132	0.0033
EVS-17	0.4637	0.2829	0.7423	0.4327	1.0632	40.770	5	1.103	2.132	0.0419
EVS-18	0.6423	0.0537	0.9304	0.8488	0.9918	6.003	5	-0.754	2.132	0.0042
EVS-19	0.6082	0.1629	0.8966	0.6057	1.0130	18.647	5	0.003	2.132	0.0148
EVS-20	0.6742	0.0838	0.9660	0.8738	1.0996	9.512	5	-1.254	2.132	0.0065
EVS-21	0.7813	0.0871	1.0895	0.9246	1.1871	9.341	5	-3.291	2.132	0.0073
EVS-22	0.4637	0.1540	0.7475	0.5700	0.9160	21.035	5	1.882	2.132	0.0134
EVS-23	0.8357	0.0353	1.1553	1.1065	1.2329	4.273	5	-6.024	2.132	0.0039
EVS-24	0.5055	0.0822	0.7909	0.6718	0.8906	10.471	5	2.031	2.132	0.0058
EVS-26	0.7286	0.0590	1.0245	0.9331	1.0829	6.418	5	-2.711	2.132	0.0047

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.66151	1.035	-0.2163	1.31086

Reviewed by: 1/15/97

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis

Comments: Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae

Conc-	1	2	3	4	5
EVS-25	0.9256	0.8836	0.9343	0.9186	0.9189
EVS-1	0.8982	0.9197	0.8867	0.9032	0.8949
EVS-2	0.8727	0.8543	0.8504	0.8506	0.8831
EVS-3	0.9212	0.8933	0.8913	0.8939	0.9186
EVS-4	0.9024	0.9040	0.8858	0.9052	0.8933
EVS-5	0.4529	0.4742	0.8725	0.5357	0.7333
EVS-6	0.9350	0.9455	0.9515	0.9554	0.9144
EVS-7	0.6890	0.7071	0.7571	0.6632	0.7447
EVS-8	0.8693	0.8950	0.9286	0.9313	0.8971
EVS-9	0.6364	0.7195	0.9028	0.8866	0.7022
EVS-10	0.6054	0.6290	0.7480	0.6860	0.4608
EVS-11	0.7358	0.6640	0.7101	0.6044	0.6089
EVS-12	0.8646	0.8701	0.8876	0.6576	0.1770
EVS-13	0.7556	0.7887	0.8119	0.7584	0.7922
EVS-14	0.9152	0.9087	0.8540	0.8066	0.9153
EVS-15	0.9087	0.9128	0.9227	0.9330	0.9056
EVS-16	0.9091	0.9146	0.9176	0.9087	0.9341
EVS-17	0.6615	0.7344	0.7176	0.8345	0.7600
EVS-18	0.8125	0.8000	0.9333	0.8975	0.8672
EVS-19	0.5678	0.7490	0.7713	0.7000	0.7061
EVS-20	0.9339	0.9343	0.9399	0.9252	0.9356
EVS-21	0.9440	0.9472	0.9456	0.9489	0.9214
EVS-22	0.6210	0.8734	0.5943	0.8012	0.7059
EVS-23	0.8803	0.8933	0.8660	0.9198	0.8923
EVS-24	0.8364	0.8209	0.8511	0.8081	0.7097
EVS-26	0.7739	0.8310	0.8446	0.8809	0.8059

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-25	0.9162	0.0193	1.2785	1.2226	1.3117	2.624	5			
EVS-1	0.9006	0.0123	1.2504	1.2275	1.2834	1.670	5	1.586	2.132	0.0007
*EVS-2	0.8622	0.0149	1.1909	1.1736	1.2218	1.835	5	4.892	2.132	0.0007
EVS-3	0.9037	0.0149	1.2559	1.2348	1.2863	2.040	5	1.195	2.132	0.0008
EVS-4	0.8982	0.0083	1.2462	1.2261	1.2578	1.093	5	1.995	2.132	0.0006
*EVS-5	0.6137	0.1821	0.9106	0.7383	1.2057	22.061	5	4.040	2.132	0.0177
EVS-6	0.9404	0.0164	1.3258	1.2739	1.3580	2.533	5	-2.227	2.132	0.0010
*EVS-7	0.7122	0.0389	1.0053	0.9516	1.0555	4.279	5	11.199	2.132	0.0013
EVS-8	0.9042	0.0259	1.2583	1.2008	1.3056	3.510	5	0.812	2.132	0.0013
*EVS-9	0.7695	0.1186	1.0822	0.9235	1.2537	13.733	5	2.881	2.132	0.0099
*EVS-10	0.6258	0.1075	0.9149	0.7461	1.0449	12.177	5	6.987	2.132	0.0058
*EVS-11	0.6647	0.0589	0.9543	0.8906	1.0310	6.575	5	10.188	2.132	0.0022
EVS-12	0.6914	0.3026	1.0010	0.4342	1.2289	33.653	5	1.833	2.132	0.0489
*EVS-13	0.7814	0.0240	1.0847	1.0536	1.1222	2.678	5	9.765	2.132	0.0008
EVS-14	0.8800	0.0484	1.2218	1.1155	1.2754	5.884	5	1.599	2.132	0.0027
EVS-15	0.9166	0.0112	1.2783	1.2585	1.3090	1.618	5	0.009	2.132	0.0007
EVS-16	0.9168	0.0103	1.2787	1.2639	1.3111	1.510	5	-0.013	2.132	0.0006
*EVS-17	0.7416	0.0633	1.0401	0.9499	1.1519	7.126	5	6.552	2.132	0.0028
EVS-18	0.8621	0.0563	1.1965	1.1071	1.3096	7.060	5	2.017	2.132	0.0035
*EVS-19	0.6988	0.0790	0.9921	0.8534	1.0722	8.521	5	7.040	2.132	0.0035
EVS-20	0.9338	0.0053	1.3107	1.2938	1.3231	0.811	5	-2.048	2.132	0.0005
EVS-21	0.9414	0.0113	1.3271	1.2867	1.3427	1.730	5	-2.674	2.132	0.0007
*EVS-22	0.7192	0.1182	1.0202	0.8803	1.2070	13.462	5	4.085	2.132	0.0085
EVS-23	0.8903	0.0198	1.2343	1.1960	1.2836	2.625	5	2.118	2.132	0.0009
*EVS-24	0.8052	0.0558	1.1164	1.0018	1.1746	6.054	5	4.804	2.132	0.0024
*EVS-26	0.8272	0.0403	1.1442	1.0752	1.2184	4.709	5	4.732	2.132	0.0017

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.78518	1.035	-1.5292	13.1472

Reviewed by: 145ANT1

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	30/10/96 18:00	Test ID:	EVS3219	Sample ID:	VARIOUS
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	MARINE SED
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis
Comments:	Hart & Crowser, 9/231-06.3, 9600633; Bivalve Larvae				

Conc-	1	2	3	4	5
EVS-25	0.6154	0.4588	0.5082	0.6511	0.5604
EVS-1	0.5577	0.6291	0.6236	0.5385	0.6786
EVS-2	0.5275	0.4670	0.6401	0.6099	0.6016
EVS-3	0.4176	0.5522	0.5632	0.4396	0.6511
EVS-4	0.6099	0.6209	0.6181	0.5769	0.7363
EVS-5	0.1630	0.2775	0.6016	0.2473	0.5440
EVS-6	0.6319	0.8104	0.8626	0.7060	0.5577
EVS-7	0.3104	0.4643	0.4368	0.3462	0.3846
EVS-8	0.6758	0.5852	0.6786	0.6703	0.5989
EVS-9	0.3654	0.3407	0.7143	0.7088	0.4341
EVS-10	0.4341	0.4286	0.5055	0.4863	0.2582
EVS-11	0.5357	0.4560	0.4038	0.3022	0.4148
EVS-12	0.6841	0.6071	0.6291	0.4643	0.1099
EVS-13	0.3736	0.4203	0.4863	0.3709	0.3352
EVS-14	0.7115	0.6291	0.5302	0.4698	0.5934
EVS-15	0.6566	0.5467	0.5577	0.5357	0.5797
EVS-16	0.6593	0.6181	0.6429	0.6291	0.7005
EVS-17	0.1181	0.1291	0.5165	0.6374	0.3654
EVS-18	0.5000	0.4505	0.6538	0.6016	0.5742
EVS-19	0.1841	0.4918	0.5467	0.4423	0.5082
EVS-20	0.5824	0.7418	0.6016	0.5440	0.6786
EVS-21	0.6016	0.7885	0.7637	0.8159	0.7088
EVS-22	0.3736	0.5495	0.1731	0.3764	0.2308
EVS-23	0.7473	0.7363	0.6923	0.8187	0.7280
EVS-24	0.5055	0.4533	0.3297	0.3819	0.3626
EVS-26	0.6016	0.6484	0.5824	0.5687	0.6044

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
EVS-25	0.5588	0.0779	0.8449	0.7441	0.9389	9.330	5			
EVS-1	0.6055	0.0570	0.8923	0.8239	0.9680	6.560	5	-1.079	2.132	0.0041
EVS-2	0.5692	0.0706	0.8553	0.7524	0.9274	8.331	5	-0.219	2.132	0.0048
EVS-3	0.5247	0.0961	0.8106	0.7026	0.9389	11.973	5	0.614	2.132	0.0067
EVS-4	0.6324	0.0606	0.9205	0.8626	1.0315	7.015	5	-1.659	2.132	0.0044
EVS-5	0.3667	0.1939	0.6416	0.4156	0.8878	32.053	5	2.064	2.132	0.0207
EVS-6	0.7137	0.1251	1.0143	0.8432	1.1911	14.044	5	-2.326	2.132	0.0113
*EVS-7	0.3885	0.0632	0.6721	0.5910	0.7497	9.687	5	3.779	2.132	0.0045
EVS-8	0.6418	0.0457	0.9296	0.8710	0.9680	5.113	5	-2.058	2.132	0.0036
EVS-9	0.5126	0.1848	0.7998	0.6232	1.0069	23.692	5	0.491	2.132	0.0180
*EVS-10	0.4225	0.0976	0.7057	0.5331	0.7909	14.461	5	2.413	2.132	0.0071
*EVS-11	0.4225	0.0849	0.7066	0.5820	0.8211	12.300	5	2.635	2.132	0.0059
EVS-12	0.4989	0.2321	0.7742	0.3379	0.9739	33.258	5	0.587	2.132	0.0309
*EVS-13	0.3973	0.0582	0.6814	0.6174	0.7717	8.710	5	3.706	2.132	0.0042
EVS-14	0.5868	0.0926	0.8740	0.7552	1.0038	10.881	5	-0.527	2.132	0.0065
EVS-15	0.5753	0.0483	0.8613	0.8211	0.9447	5.734	5	-0.395	2.132	0.0037
EVS-16	0.6500	0.0322	0.9381	0.9047	0.9918	3.630	5	-2.426	2.132	0.0031
EVS-17	0.3533	0.2308	0.6188	0.3509	0.9246	41.426	5	1.885	2.132	0.0307
EVS-18	0.5560	0.0810	0.8421	0.7359	0.9418	9.726	5	0.054	2.132	0.0055
EVS-19	0.4346	0.1450	0.7148	0.4434	0.8322	21.863	5	1.662	2.132	0.0131
EVS-20	0.6297	0.0796	0.9182	0.8294	1.0377	9.125	5	-1.425	2.132	0.0056
EVS-21	0.7357	0.0847	1.0344	0.8878	1.1274	9.111	5	-3.449	2.132	0.0064
*EVS-22	0.3407	0.1467	0.6166	0.4291	0.8349	25.614	5	2.891	2.132	0.0133
EVS-23	0.7445	0.0463	1.0423	0.9828	1.1309	5.238	5	-4.603	2.132	0.0039
*EVS-24	0.4066	0.0715	0.6907	0.6116	0.7909	10.534	5	3.214	2.132	0.0049
EVS-26	0.6011	0.0302	0.8874	0.8543	0.9360	3.491	5	-1.121	2.132	0.0031

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.87846	1.035	-0.4502	1.94772

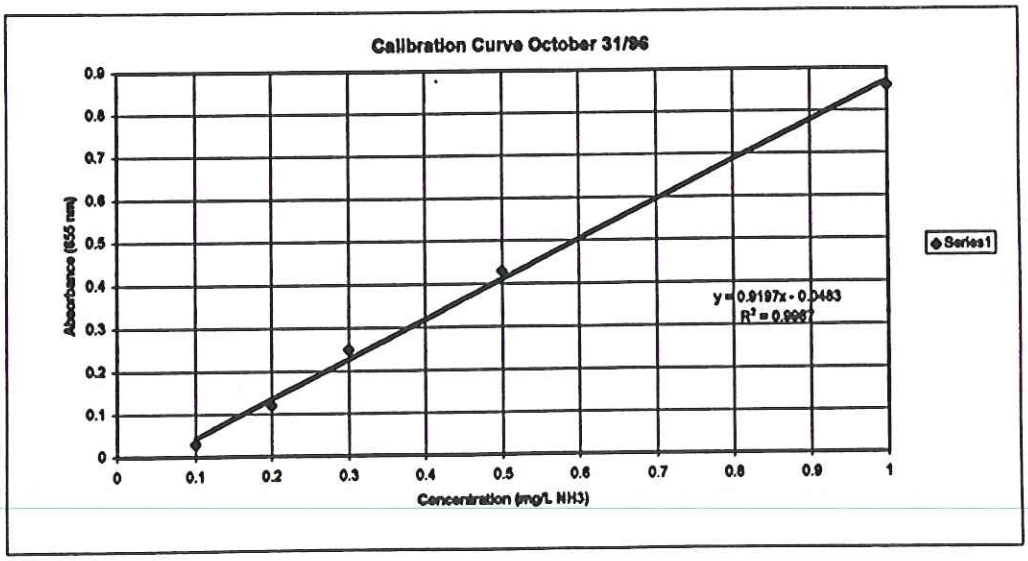
ToxCalc v5.0

Reviewed by: 14JAN97

Ammonia Measurements - October 31, 1996 (~~Day 0~~) 0 hr QS

Client:	Hart Crowser	Test Type:	48-h Bivalve Larvae
Project No.:	9231-06.3	Test Species:	*Mytilus edulis*
Work Order No:	9600633	Date Initiated:	30-Oct-96
		Date Terminated:	1-Nov-96

Standard Concentrations (mg/L NH3)	Absorbance of standards	Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
		Overlying ~~Interstitial~~ water QS.			
0.1	0.03				
0.2	0.12	EVS-1	0.31	1.00	0.4
0.3	0.25	EVS-2	0.43	1.00	0.5
0.5	0.43	EVS-3	0.05	1.00	0.1
1.0	0.86	EVS-4	0.51	1.00	0.6
		EVS-5	0.47	1.00	0.6
		EVS-6	0.31	1.00	0.4
		EVS-7	0.24	1.00	0.3
		EVS-8	0.46	1.00	0.6
		EVS-9	0.30	1.00	0.4
		EVS-10	0.08	1.00	0.1
		EVS-11	0.34	1.00	0.4
		EVS-12	0.46	1.00	0.6
		EVS-13	0.08	1.00	0.1
		EVS-14	0.32	1.00	0.4
		EVS-15	0.39	1.00	0.5
		EVS-16	0.67	1.00	0.8
		EVS-17	0.43	1.00	0.5
		EVS-18	0.28	1.00	0.4
		EVS-19	0.44	1.00	0.5
		EVS-20	0.28	1.00	0.4
		EVS-21	0.27	1.00	0.3
		EVS-22	0.33	1.00	0.4
		EVS-23	0.00	1.00	<0.1
		EVS-24	0.49	1.00	0.6
		EVS-25	0.70	1.00	0.8
		EVS-26	0.18	1.00	0.2



RSB 27 NOV 96

RESULTS OF ANALYSIS - Water

File No. G6691

	Sulphide S WS 48 hr
EVS-1 Day 0 1996 Oct 30	<0.04
EVS-2 Day 0 1996 Oct 30	<0.04
EVS-3 Day 0 1996 Oct 30	<0.04
EVS-4 Day 0 1996 Oct 30	<0.02
EVS 5 Day 0 1996 Oct 30	0.01
EVS-6 Day 0 1996 Oct 30	<0.04
EVS 7 Day 0 1996 Oct 30	<0.01
EVS-8 Day 0 1996 Oct 30	0.05
EVS-9 Day 0 1996 Oct 30	<0.02
EVS-10 Day 0 1996 Oct 30	<0.04
EVS-11 Day 0 1996 Oct 30	<0.02
EVS-12 Day 0 1996 Oct 30	<0.02
EVS 13 Day 0 1996 Oct 30	<0.01
EVS-14 Day 0 1996 Oct 30	<0.02
EVS-15 Day 0 1996 Oct 30	<0.04
EVS-16 Day 0 1996 Oct 30	<0.04
EVS-17 Day 0 1996 Oct 30	0.05
EVS-18 Day 0 1996 Oct 30	<0.04
EVS-19 Day 0 1996 Oct 30	0.05
EVS-20 Day 0 1996 Oct 30	<0.04

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G6691

Water	EVS-21 Day 0	EVS-21 Day 0
	96 10 30	QC # 77158
Inorganic Parameters		
Sulphide S	<0.02	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water

File No. G6890

	Sulphide S
EVS-21 48h 1996 Nov 1	<0.02
EVS-22 48h 1996 Nov 1	<0.02
EVS-23 48h 1996 Nov 1	<0.02
EVS-24 48h 1996 Nov 1	<0.02
EVS-25 48h 1996 Nov 1	<0.02
EVS-26 48h 1996 Nov 1	<0.02

Results are expressed as milligrams per litre.
< = Less than the detection limit indicated.

Appendix 2 - METHODOLOGY

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows:

Conventional Parameters in Water

These analyses are carried out in accordance with procedures described in "Methods for Chemical Analysis of Water and Wastes" (USEPA), "Manual for the Chemical Analysis of Water, Wastewaters, Sediments and Biological Tissues" (BCMOE), and/or "Standard Methods for the Examination of Water and Wastewater" (APHA). Further details are available on request.

End of Report

EVS CONSULTANTS
48-h LARVAL DEVELOPMENT TOXICITY TEST - DAILY WATER QUALITY DATA

Client Name: Hart Crowser
EVS Project Number: 9231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99

Test Species: Mytilus edulis
Test Start (Day 0): October 30, 1996
Test End: November 1, 1996

Sample I.D.	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
	0	24	48	0	24	48	0	24	48	0	24	48
SDS 1.0 mg/l	16.5	16.0	16.5	7.6	7.7	7.5	28	28	27	8.2	7.7	7.6
1.8	16.5	16.0	16.5	7.6	7.7	7.5	28	28	28	8.2	7.7	7.6
3.2	16.5	16.0	16.5	7.6	7.7	7.5	28	28	28	8.2	7.8	6.9
5.6	16.5	16.0	16.5	7.6	7.7	7.4	28	28	28	8.2	7.8	5.8
10	16.5	16.0	16.5	7.6	7.7	7.2	28	28	28	8.2	7.8	3.2
Technician Initials — Analyst	BST	M	PH	BST	M	PH	BST	M	PH	BST	M	PH
Technician Initials — Recorder	BST	M	PH	JGH	M	PH	JGH	M	PH	JGH	M	PH

WQ Instruments Used: Temp. Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Comments:

Data Certified by: Jennifer Biberg Date Certified: 27Nov96

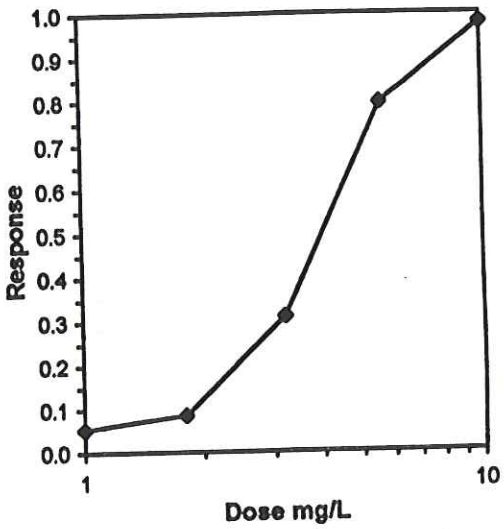
Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	30/10/96 18:00	Test ID:	RTMEUS7	Sample ID:	REF-Ref Toxicant
End Date:	01/11/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SDS-Sodium dodecyl sulfate
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis
Comments:	Hart Crowser, 9/231-06.3, 9600633; Bivalve Larvae				

Conc-mg/L	1	2	3	4	5
D-Control	0.8803	0.8933	0.8660	0.9198	0.8923
1	0.8859	0.7532	0.8836		
1.8	0.8144	0.7765	0.8485		
3.2	0.6195	0.6503	0.5755		
5.6	0.1207	0.2816	0.1899		
10	0.0588	0.0000	0.0000		

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%	3.8826	3.7335	4.0377
20.0%	3.9241	3.7808	4.0729
Auto-5.4%	3.8443	3.6917	4.0033



Reviewed by: 27 NOV 96

EVS CONSULTANTS
48-h LARVAL DEVELOPMENT TOXICITY TEST - DAILY WATER QUALITY DATA

Client Name: Hart Crowser
EVS Project Number: 9(231-06.3
EVS W.O. Number: 9600633
Logbook: 8 Page: 94-99

Test Species: Mytilus edulis
Test Start (Day 0): October 30, 1996
Test End: November 1, 1996

Sample I.D.	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
	0	24	48	0	24	48	0	24	48	0	24	48
NH_3 1.25 mg/l	16.5	16.0	16.5	7.6	7.7	7.6	28	28	28	8.0	7.9	8.0
2.5	16.5	16.0	16.5	7.6	7.7	7.6	28	28	28	8.2	7.9	8.3
5	16.5	16.0	16.5	7.6	7.7	7.6	28	28	28	8.2	8.0	8.4 / 8.0 pH
10	16.5	16.0	16.5	7.6	7.7	7.6	28	28	28	8.2	8.0	8.4
20	16.5	16.0	16.5	7.6	7.6	7.6	28	28	28	8.2	8.0	8.6
40	16.5	16.0	16.5	7.6	7.5	7.6	28	28	28	8.2	8.0	8.3
Technician Initials — Analyst	BWJ		PH	BST		PH	BST		PH	BSJ		PH
Technician Initials — Recorder	BWJ		PH	JGL		PH	JGL		PH	JGL		PH

WQ Instruments Used: Temp. Thermometer pH II-C-36 Salinity II-C-22 DO II-A-19

Comments:

Data Certified by: [signature] Date Certified: 27 NOV 96

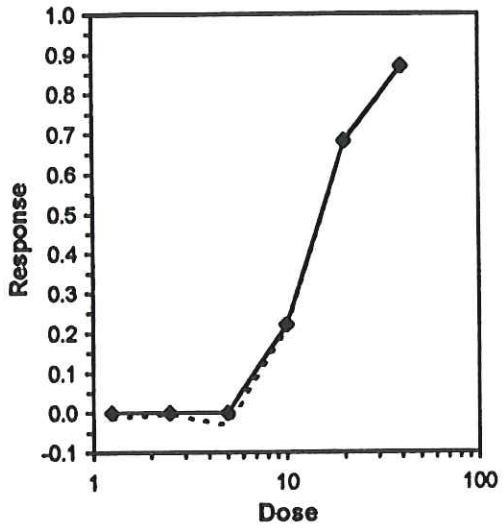
Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	10/30/96 18:00	Test ID:	RTMENH1	Sample ID:	REF-Ref Toxicant
End Date:	11/1/96 20:00	Lab ID:	BCEVS-EVS Environment C	Sample Type:	NH4CL-Ammonium chloride
Sample Date:		Protocol:	PSEP 95	Test Species:	ME-Mytilus edulis
Comments:	Hart Crowser, 9/231-06.3, 9600633; Bivalve Larvae				

Conc-	1	2	3	4	5
D-Control	0.8803	0.8933	0.8660	0.9198	0.8923
1.25	0.8834	0.9143	0.9064		
2.5	0.9025	0.8901	0.8894		
5	0.8974	0.9299	0.9243		
10	0.7584	0.6234	0.7193		
20	0.2826	0.3108	0.2678		
40	0.1587	0.0351	0.1383		

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%	15.578	14.822	16.373
Auto-13.0%	15.870	15.097	16.683



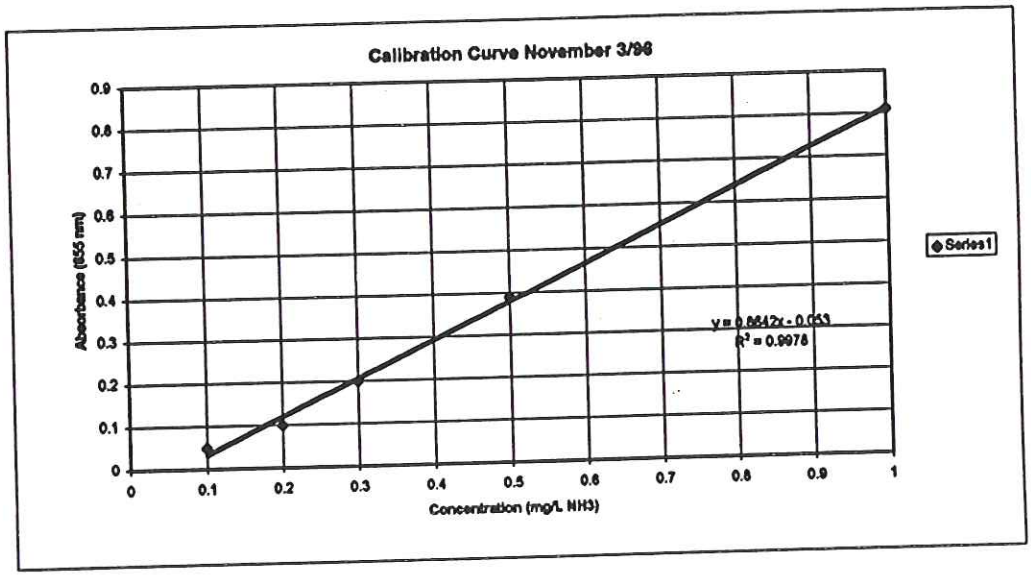
ToxCalc v5.0

Reviewed by: 27NOV96

Ammonia Measurements - November 3, 1996 (48-h)

Client:	Hart Crowser	Test Type:	48-h Bivalve Larvae
Project No.:	9/231-06.3	Test Species:	*Mytilus edulis*
Work Order No:	9600633	Date Initiated:	30-Oct-96
		Date Terminated:	1-Nov-96

Standard Concentrations (mg/L NH3)	Absorbance of standards	Sample ID	Absorbance of samples	Dilution factor	Ammonia concentrations (mg/L NH3)
		Interstitial water			
0.1	0.05	1.25 mg/L	0.58	2.00	1.5
0.2	0.10	2.5 mg/L	0.42	5.00	2.7
0.3	0.20	5 mg/L	0.33	12.50	5.5
0.5	0.39	10 mg/L	0.33	25.00	11.1
1.0	0.81	20 mg/L	0.31	50.00	21.0
		40 mg/L	0.32	100.00	43.2



ATTACHMENT E-3
TOXICITY PROFILE AND ANALYSIS FOR 4-METHYL PHENOL
EVS ENVIRONMENT CONSULTANTS

Whatcom Waterway RIFS

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EVS Project No.

2/231-06.2

DECEMBER 1996

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Table 1. Acute and chronic toxicity of 4-Methylphenol to aquatic organisms

Test Species	Test Type	Test Duration (hours)	EC0 (µg/L)	EC50 (µg/L)	LC50 (µg/L)	Growth (µg/L)	Population (µg/L)	Reproduction (NOEC) (µg/L)	Aquire Accession (number)
Daphnia Magna	Renewal-Lab	24	2,500	na	na	na	na	na	1027110
Daphnia Magna	Renewal-Lab	24	na	4,900	na	na	na	na	1088678
Daphnia Magna	Renewal-Lab	21 days	na	na	na	na	na	1,000	1109421
Daphnia pulicaria	Flow Through-Lab	48	na	na	22,700	na	na	na	1037964
Onchorhynchus mykiss	Flow Through-Lab	96	na	na	7,900	na	na	na	1037962
Onchorhynchus mykiss	Flow Through-Lab	96	na	na	7,500	na	na	na	1076260
Pimphales promelas	Flow Through-Lab	96	na	na	28,600	na	na	na	1037963
Pimphales promelas	Flow Through-Lab	32 days	na	na	na	2,570	na	na	1088871
Invertebrates	Flow Through-Field	96	na	na	na	na	8,000	na	1109049
Stronglyocentrous droebachien	Static-Lab	96	na	5,000	na	na	na	na	1085517

SOURCE: Aquire Database Version 5.00/3.5 (November 1995)
na - not applicable

Table 2. Whatcom Waterway surface sediment data

SAMPLE ID	TOC (%)	4-METHYLPHENOL (µg/kg)
HC-SC-70	2.2	470
HC-SC-71	2.5	450
HC-SC-72	3.2	310
HC-SC-73	3.6	320
HC-SC-74	8.3	220
HC-SC-75	6.9	420
HC-SC-76	4.6	490
HC-SC-77	3.2	400
HC-SC-78	3.5	440
HC-SC-79	4.2	1600[a]
HC-SC-80	3.5	290
HC-SC-81	4.2	460
HC-SC-82	4.2	340
HC-SC-83	3	110
HC-SC-84	2.7	1200[a]
HC-SC-85	3.1	190
HC-SS-01	2.8	
HC-SS-02	3.4	
HC-SS-03	2.8	1600
HC-SS-04	3.5	
HC-SS-05	2.1	
HC-SS-06	2.9	1900
HC-SS-07	2.8	
HC-SS-08	2.3	870[b]
HC-SS-09	2.4	
HC-SS-10	2.4	
HC-SS-11	2	
HC-SS-12	2.2	
HC-SS-13	2.2	
HC-SS-14	2.6	
HC-SS-15	2.3	
HC-SS-16	2	
HC-SS-17	2.1	
HC-SS-18	2.2	
HC-SS-19	2.6	

Table 2. continued

SAMPLE ID	TOC (%)	4-METHYLPHENOL (µg/kg)
HC-SS-20	3.4	
HC-SS-21	3.7	
HC-SS-22	2.7	
HC-SS-23	3	
HC-SS-24	4	
HC-SS-25	4.1	
HC-SS-26	3.9	
HC-SS-27	2.7	
HC-SS-28	3.8	
HC-SS-29	4.4	410
HC-SS-30	2.4	680[b]
HC-SS-31	2.9	
HC-SS-32	3.9	
HC-SS-33	3.5	200
HC-SS-34	3.8	870[b]
HC-SS-35	3.5	340
HC-SS-36	1.8	320
HC-SS-37	3.5	630
HC-SS-38	3.6	95
HC-SS-39	2.9	55
HC-SS-40	6	
HC-SS-41	1.5	
HC-SS-42	2.4	
HC-SS-43	1.4	
HC-SS-44	2.7	
HC-SS-45	3.4	220
HC-SS-46	2.6	
HC-SS-47	4	210
HC-SS-48	0.82	42

NOTE: Station exceeded the Washington State sediment cleanup criteria

[a] Station not evaluated using sediment toxicity tests.
[b] Station failed *Mytillus edulis* toxicity test.

Table 3. Interstitial water calculation for 4-Methylphenol using a K_{oc} of 300 and 500 (L/kg)

	K_{oc} of 300 (L/kg)	K_{oc} of 500 (L/kg)
SAMPLE ID	IW CONCENTRATION (μg/L)	IW CONCENTRATION (μg/L)
HC-SC-70	71.2	42.7
HC-SC-71	60.0	36.0
HC-SC-72	32.3	19.4
HC-SC-73	29.6	17.8
HC-SC-74	8.8	5.3
HC-SC-75	20.3	12.2
HC-SC-76	35.5	21.3
HC-SC-77	41.7	25.0
HC-SC-78	41.9	25.1
HC-SC-79	127.0	76.2
HC-SC-80	27.6	16.6
HC-SC-81	36.5	21.9
HC-SC-82	27.0	16.2
HC-SC-83	12.2	7.3
HC-SC-84	148.1	88.9
HC-SC-85	20.4	12.3
HC-SS-03	190.5	114.3
HC-SS-06	218.4	131.0
HC-SS-08	126.1	75.7
HC-SS-29	31.1	18.6
HC-SS-30	94.4	56.7
HC-SS-33	19.0	11.4
HC-SS-34	76.3	45.8
HC-SS-35	32.4	19.4
HC-SS-36	59.3	35.6
HC-SS-37	60.0	36.0
HC-SS-38	8.8	5.3
HC-SS-39	6.3	3.8
HC-SS-45	21.6	12.9
HC-SS-47	17.5	10.5
HC-SS-48	17.1	10.2