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REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT,
UNION BAY WASTE COAL PILE
UNION BAY, BC
BC SITE 4291

SEACOR PROJECT NO: 201.01022.01 & 201.01069.01

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SEACOR PROJECT: 201.01022.01 & 201.01069

Submitted by
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For

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TABLE OF CONTENTS

List of Tables (Presented in the Report Text) iii
List of Tables (Presented Following Text) iii
List of Tables (Appendix B) iii
List of Figures iii
List of Photographs iv
List of Appendices iv
1.0 PROBLEM FORMULATION 1
1.1 Site Setting 2
1.2 Contaminants of Potential Concern (COPCs) 3
1.2.1 Substances Exceeding Numerical Guidelines 3
1.2.2 Selection of COPCs 5
1.3 Future Human Receptors and Exposure Pathway Analysis 6
1.4 Ecological Receptors of Concern and Exposure Pathway Analysis 7
1.4.1 Freshwater Aquatic Life 8
1.4.2 Marine Aquatic Life 9
1.4.3 Terrestrial Wildlife and Plants 10
1.4.4 Aquatic Wildlife 11
1.4.5 Exposure Pathway Analysis 11
2.0 HUMAN HEALTH RISK ASSESSMENT – RECREATORS EXPOSURE TO THE WASTE COAL PILE AND INTERTIDAL AREA 12
2.1 Exposure Assessment 14
2.1.1 Exposure Point Concentrations 14
2.1.2 Intake Equations and Receptor Characteristics 14
2.1.3 Inadvertent Ingestion of Sediment/Precipitate (Ferricrete) 15
2.1.4 Ingestion of Shellfish (Clams and Oysters) 16
2.1.5 Inadvertent Ingestion of Intertidal Water (Seep, Tide Pool, and Ocean Water) 17
2.1.6 Dermal Contact with Sediment/Precipitate (Ferricrete) 18
2.1.7 Dermal Contact with Intertidal Water (Seep, Tide Pool, and Ocean Water) ... 19
2.1.8 Inhalation of Waste Coal and Sediment 20
2.2 Toxicity Assessment 20
2.2.1 Non-Carcinogenic Toxicity Reference Values 22
2.2.2 Carcinogenic Toxicity Reference Values 23

2.3 Risk Characterization 23
2.3.1 Risk Estimates - Recreator 24
2.3.1.1 Individual Pathways 24
2.3.1.2 Combined Pathways 25
2.4 Summary of Human Health Risk Calculations 26
2.5 Background Shellfish Metal Levels 27
2.5.1 Cadmium 27
2.5.2 Arsenic 27
3.0 ECOLOGICAL RISK ASSESSMENT – INTERTIDAL TOXICITY TEST RESULTS AND BIOLOGICAL OBSERVATIONS 28
3.1 Groundwater and Seep Water Toxicity Test Results 28
3.1.1 September 17th 2005 Groundwater and Seep Water Samples 29
3.1.2 January 26th and February 10th, 2006 Seep Water Samples 30
3.1.3 Summary of Water Toxicity Test Results 31
3.2 Sediment Toxicity Test Results 31
3.2.1 Amphipod Testing 32
3.2.2 Polychaete Testing 32
3.2.3 Summary of Sediment Toxicity Results 33
3.3 Aquatic Biological Surveys 34
3.3.1 Biological Surveys – Baynes Sound 34
3.3.2 Biological Survey - Hart Creek 37
4.0 CONCLUSIONS 39
5.0 PROFESSIONAL STATEMENT 40
6.0 STATEMENT OF LIMITATIONS 40
7.0 REFERENCES 42

LIST OF TABLES (PRESENTED IN THE REPORT TEXT)

Table 2.1: EPA And Health Canada Carcinogenicity Classification Scheme
Table 2.2: Carcinogenicity Classification For COPCs
Table 2.3: Individual Pathway Risk Estimates Exceeding Risk-Based Standards
Table 2.4: Combined Pathway Risk Estimates Exeeeding Risk-Based Standards

LIST OF TABLES (PRESENTED FOLLOWING TEXT)

Table 1: Groundwater And Seep Water Toxicity Test Results
Table 2: Sediment Toxicity Test Results

LIST OF TABLES (APPENDIX B)

Table B1: Human Exposure Point Concentrations For COPCs In Intertidal Sediment
Table B2: Human Exposure Point Concentrations For COPCs In Intertidal Precipitate (Ferricrete)
Table B3: Human Exposure Point Concentrations For COPCs In Intertidal Water (Seep, Tide Pool, And Ocean Water)
Table B4: Human Exposure Point Concentrations For COPCs In Intertidal Shellfish (Clams)
Table B5: Human Exposure Point Concentrations For COPCs In Intertidal Shellfish (Oysters)
Table B6: Receptor Characteristics – Recreator
Table B7: Chemical Properties
Table B8: Non-Cancer Reference Doses
Table B9: Cancer Slope Factors
Table B10: Recreator Inadvertent Ingestion Of Intertidal Sediment (1 Day/Week)
Table B11: Recreator Inadvertent Ingestion Of Intertidal Precipitate (Ferricrete) (1 Day/Week)
Table B12: Recreator Inadvertent Ingestion Of Intertidal Water (Seep, Tide Pool, And Ocean Water) (1 Day/Week)
Table B13: Recreator Ingestion Of Intertidal Clams (1 Meal/Week)
Table B14: Recreator Ingestion Of Intertidal Oysters (1 Meal/Week)
Table B15: Recreator Dermal Contact With Intertidal Sediment (1 Day/Week)
Table B16: Recreator Dermal Contact With Intertidal Precipitate (Ferricrete) (1 Day/Week)
Table B17: Recreator Dermal Contact With Intertidal Water (Seep, Tide Pool, And Ocean Water) (1 Day/Week)
Table B18: Recreator Inhalation Of Intertidal Sediment Particles (1 Day/Week)
Table B19: Recreator Non-Carcinogenic Hazard Indices (1 Day/Week, 1 Shellfish Meal/Week)
Table B20: Recreator Non-Carcinogenic Hazard Indices (3 Days/Week, 1 Shellfish Meal/Week)
Table B21: Recreator Non-Carcinogenic Hazard Indices (5 Days/Week, 1 Shellfish Meal/Week)
Table B22: Recreator Incremental Lifetime Cancer Risks (1 Day/Week, 1 Shellfish Meal/Week)
Table B23: Recreator Incremental Lifetime Cancer Risks (3 Days/Week, 1 Shellfish Meal/Week)
Table B24: Recreator Incremental Lifetime Cancer Risks (5 Days/Week, 1 Shellfish Meal/Week)

LIST OF FIGURES

Figure 1 – Site Location Map
Figure 2 – Aerial Photo of Waste Coal Pile Intertidal Areas
Figure 3 – Site Plan – Sample Locations
Figure 4 – Soil Chemistry Results – Waste Coal Pile

Figure 5 – Groundwater Chemistry Results
Figure 6 – Marine Sediment Chemistry Results
Figure 7 – Marine Seep Water, Porewater and Ocean Water Chemistry Results
Figure 8 – Waste Cool Pile Human Site Conceptual Model
Figure 9 – Waste Cool Pile Ecological Site Conceptual Model
Figure 10 – Regional versus Site Oyster Cadmium Concentrations

LIST OF PHOTOGRAPHS

Photograph 1: Waste coal in mid intertidal area north of Waste Coal Pile, sediment sampling station S8.
Photograph 2: Sediment in mid intertidal area east of Waste Coal Pile.
Photograph 3: North Face Seep Area (April, 2004), looking east from SW10/SW2.
Photograph 4: Combined North Face seepage (April, 2004), looking west from SW27.
Photograph 5: East Face Seep Area, upper and mid intertidal (April, 2004), looking northeast towards SW1 (at rail car wheels).
Photograph 6: East Face Seep Area, mid and lower intertidal (April, 2004), looking towards PSED4 iron accretion.
Photograph 7: East Face seep water mixing with ocean water (April, 2004).
Photograph 8: Sheen atop East Face seep water.

LIST OF APPENDICES

APPENDIX A – Regional Biological Information
APPENDIX B – Human Health Risk Exposure Scenarios, TRVs, Risk Calculations
APPENDIX C – Laboratory Water And Sediment Toxicity Test Reports
APPENDIX D – Seacology Subtidal Survey Report
APPENDIX E – Updated Protocol 5

1.0 PROBLEM FORMULATION

On behalf of West Fraser Mills Ltd. and Kensington Island Properties Ltd., SEACOR Environmental Inc. (SEACOR) has completed this Revised Problem Formulation and Preliminary Quantitative Risk Assessment for contamination at the Union Bay Waste Coal Pile (BC Site 4291). This report replaces Section 5.0 Problem Formulation of the Stage I Preliminary Site Investigation, Detailed Site Investigation, Problem Formulation and Remediation Plan for the Union Bay Waste Coal Pile and Kensington Property – Areas 1 & 2 (SEACOR, May 31, 2005). The Problem Formulation was revised to incorporate additional Site data collected between August, 2005 and April, 2006, to address BC Ministry of Environment (MOE) comments (Preliminary Comments on Approval in Principle for Union Bay Waste Coal Pile and Kensington Property, MOE Site ID 4291, July 8, 2005), and to incorporate SEACOR's plan to cap the Waste Coal Pile with a low permeability soil cover.

The term Site herein refers to the combination of four areas, namely the Waste Coal Pile, Kensington Property Area 1 (KP-Area 1), Kensington Property Area 2 (KP-Area 2), and the marine area adjacent to these parcels. This report has been prepared as an initial step in assessing risks to human and ecological receptors associated with exposure to the Site as a whole. It presents the Site setting, contaminants of potential concern, receptors of concern, and classification of exposure pathways (complete/incomplete) under the main remedial option proposed for the Waste Coal Pile (capping). Soil contamination in un-capped areas outside of the Waste Coal Pile will be removed and disposed of, or will be the subject of future smaller scale risk assessment/management work. At the request of BC MOE, SEACOR has included in this report the results of preliminary quantitative risk estimates to humans (recreational users) and aquatic life associated with exposure to intertidal media and COPCs. These risks were calculated using baseline (present day) chemistry from the DSI and Supplemental DSI, as future groundwater and seep water chemistry post-capping cannot accurately be predicted at this time. Obtaining a better understanding of baseline intertidal area risks under present conditions is of key interest/priority to SEACOR and BC MOE. With respect to recreators, these preliminary quantitative risk estimates include the calculation of hazard quotients and incremental lifetime cancer risks for recreator exposure to intertidal sediment, water, precipitate, and shellfish. These calculations are presented in Section 2.0. With respect to aquatic life, these preliminary quantitative risk estimates include the results of aquatic toxicity testing of sediments, groundwater and seep water from the Site's intertidal area. These toxicity test results are presented in Section 3.0, along with qualitative biological observations for the intertidal area. Sections 2.0 and 3.0 represent an initial partial assessment of risks to key intertidal area receptors, namely recreators and aquatic life. Further assessment of risks to intertidal area receptors will likely be performed in the future once information on post remediation intertidal chemistry (seep water) is available.

Human health risks associated with potential future exposure to soil in the Waste Coal Pile or other Site areas have not been included in Section 2.0. In order to improve the quality of Waste Coal Pile groundwater and seep water, the Waste Coal Pile will be capped with a low permeability soil cover, as discussed in the Remediation Plan. This should effectively eliminate any direct exposure pathways between soil COPCs and human receptors.

1.1 Site Setting

Specifics regarding historical, present and future Site use; physical setting, surrounding land and water use; location of nearby surface water bodies; climate; topography; geology and hydrogeology were presented in the DSI (SEACOR, May 31, 2005) and Supplemental DSI (SEACOR, August 31, 2006). A summary of this information is presented below:

The location of the Site is shown on Figure 1. The Site was a major shipping port from approximately 1888 to 1960; the docks for the port were located on the peninsula at the south end of KP - Area 1, approximately 600 m to the south of the Waste Coal Pile. Coal was transported by rail (via the Esquimalt and Nanaimo (E&N) Railway) from the coal mines in Cumberland, BC to the port at Union Bay. The coal was unloaded from the railcars at the washer, adjacent to Hart (Washer) Creek, and processed. The waste coal (rock and low grade coal) was then transported as a slurry down a metal lined flume to the end of Union Point to form the existing Waste Coal Pile. During the operation of the port, an industrial area including coal processing facilities, as well as operations related to the construction and maintenance of locomotives, were present on KP-Area 1. An elevated railbed and small roundtable was present on KP-Area 2.

The Waste Coal Pile occupies approximately 13 hectares of provincial Crown (BC) land leased to West Fraser (formerly Weldwood); waste coal is also present on the southern and western adjacent properties (KP-Area 1 and KP-Area-2). The Waste Coal Pile and KP-Area 1 are bounded to the west by Hart Creek, and to the north and east by Baynes Sound, an extension of the Strait of Georgia. A small portion of the Union Bay Waste Coal Pile is present on the west side of Hart Creek (KP-Area 2). Waste coal is not visually present in Hart Creek. The hydraulic placement of waste coal into the marine environment, as well as erosion of the Waste Coal Pile by Hart Creek, have resulted in the presence of waste coal in both the intertidal and subtidal areas of Baynes Sound along the Site's North and East Faces. The lateral extent of waste coal in sediments has not been fully delineated. A conventional beach profile bounds the pile; the re-established beach consists predominantly of waste coal. Investigations conducted in the intertidal zone on the North Face of the Site indicate that the waste coal extends to depths of approximately 3.0 m bgs. The intertidal area that is exposed during low tide and which consists largely of waste coal, is in the order of approximately 3 ha on the East Face and 16 ha on the North Face (Photograph 1). The proportion of coal waste in sediments along the East Face appears to decrease as one moves south of the coal pile's northeast tip. East Face sediments are rockier than North Face sediments (Photograph 2). Coal (higher-grade material with a higher total organic carbon content) has been identified in parts of KP - Area 1, near the briquette plant and coke ovens, in Crown lands south of KP - Area 1 and in a thin layer (20 to 30 cm thick) on top of the former elevated railbed in KP - Area 2. Coal (raw and processed) in these locations is likely present as a result of spillage during

transport across the Site and loading or unloading activities. Coal in these locations is visually distinctive from local soils.

Total annual precipitation for the area is estimated to be 1,442 mm. Nearly 80 % of this precipitation (1152 mm) occurs between the start of October and the end of March. Pools of standing water were observed in low-lying areas of the pile during periods of rain, mainly in winter. Stormwater runoff from the Waste Coal Pile has also been observed entering Hart Creek. Infiltration of groundwater is expected to result in mounding of the water table beneath the centre of the pile. This likely results in a somewhat radial groundwater flow pattern from the centre of the pile towards the ocean (to the north, east and southeast). Groundwater flow rates have been estimated to be approximately 35 m/year within the waste coal material and approximately 5 m/year within the underlying native material. These velocity estimates are expected to vary seasonally.

Two iron stained groundwater seep areas are present in the intertidal areas adjacent to the Waste Coal Pile's East and North Faces (Figure 2). The staining on the North Face of the pile is on the mid to upper intertidal sediments, beneath a narrow stream-like flow of seep water which flows to Baynes Sound (estimated cumulative area of 600 m^2). The staining on the East Face of the pile appears to be banded, with the majority of staining (approximately 10,000 m^2, 1 ha) present beneath channelized and diffuse seeps in the mid intertidal area, with some staining also present in the low intertidal area and possibly shallow subtidal area. The North Face seep area is shown on Photographs 3 and 4 while the East Face seep area is shown on Photographs 5 and 6. During mid to low tide events, the seep water is visible mixing with Baynes Sound ocean water (Photograph 7). Seacology (2005) reported that iron staining extended subtidally to –0.8 m below chart datum. The base of the perimeter of the main pile at Hart Creek is eroded and chemically cemented (i.e. ferricrete). Precipitate (ferricrete) is also present in a few small patches in the iron stained groundwater seep areas on the Site's North and East Faces (visible in Photograph 6). Sheen has been observed atop ponded seep water on both the East and North Faces (Photograph 8). The sheen consists predominantly of iron.

Human use of the Site is presently limited to recreators (walking, picnicing, motorcycle and ATV riding, shellfish harvesting, and possibly wading/swimming). Future use of the Site will include commercial and residential uses on KP-Area 1 and KP-Area 2, and urban park and residential use on the Waste Coal Pile. The Site and adjacent intertidal areas, and Hart Creek are habitat for multiple species, details of which are discussed in a following section.

1.2 Contaminants of Potential Concern (COPCs)

1.2.1 Substances Exceeding Numerical Guidelines

Soil, groundwater, sediment (marine and freshwater), intertidal seep water, ocean water, and stream water samples were collected from on and around the Site (Waste Coal Pile, KP-Area 1, KP-Area 2, and reference areas) during the DSI and Supplemental DSI. Sampling locations are shown on Figures 1 and 3. Samples were submitted for analysis of potential contaminants of concern (PCOCs) including PAHs and metals, LEPH/HEPH, and various geochemical parameters.

The CSR land use standards applicable at the Site were described in detail in Section 2.1 of the Supplemental DSI. The proposed development plans for the Site include residential, urban parkland, commercial, and industrial (roadway) land uses. As the exact locations of future roadways are unknown the CSR RL, PL, and CLstandards have been applied to Site soil. Based on the presence of Hart Creek and Baynes Sound immediately adjacent to the Site, the CSR aquatic life – freshwater (AWF) and aquatic life – estuarine and marine (AWM) standards have both been applied to groundwater at the Site. Similarly, the CSR matrix numerical soil standards for "groundwater flow to surface water used by aquatic life" for both freshwater and marine were applied to soil at the Site, with the exception of the lands along the east and south ends of KP – Area 1, where only the marine standards were applied, as this area is unlikely to contribute groundwater to Hart Creek. Sediment chemistry was compared to the BC $SedQC_{SCS.}$. Surface water chemistry was compared to the BC Approved and Working Water Quality Guidelines for the protection of marine and freshwater aquatic life.

The chemistry of Waste Coal Pile soil, groundwater, sediment, precipitate (ferricrete), and intertidal waters (seep, ocean, porewater) are shown on Figures 4 through 7. These figures were included in the original and/or Supplemental DSI. For detailed chemistry for the Waste Coal Pile and other areas, the reader should consult Supplemental Detailed Site Investigation Union Bay Waste Coal Pile (SEACOR, August 31, 2006) and Stage I Preliminary Site Investigation, Detailed Site Investigation, Problem Formulation and Remediation Plan for the Union Bay Waste Coal Pile and Kensington Property – Areas 1 & 2 (SEACOR, May 31, 2005)".

BC MOE requires contaminants in excess of applicable land/water use standards to be remediated to meet numerical criteria/standards or to be further evaluated through risk assessment, or through the development of site-specific cleanup protocols to meet the applicable numerical or risk based standards. Chemicals measured in soil, groundwater, sediment and surface water in excess of the lowest applicable standards/criteria/guidelines at the Site are listed on the following page.

Substances in Waste Coal Pile soil greater than RL/PL:
PAHs – naphthalene and phenanthrene
Metals – arsenic and copper

Substances in KP-Area 1 soil greater than CL
PAHs – benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, naphthalene and phenanthrene
Metals – antimony, arsenic, barium, cadmium, chromium, copper, lead, molybdenum, nickel, tin, and zinc
HEPHs

Substances in groundwater greater than AWM and/or AWF:
Metals – cadmium, cobalt, copper, nickel and zinc
Sulphate

Although there are currently no AW standards for iron or aluminum in groundwater, these metals have been included as COPCs based on their elevated concentrations in relation to BC Water Quality Guidelines.

Substances in marine sediment greater than BC Marine SedQCscs:
PAHs – acenaphthene, acenaphthylene, anthracene, chrysene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene
Metals – arsenic, copper and mercury

Substances in Hart Creek freshwater sediment greater than BC Freshwater SedQCscs:
PAHs – naphthalene and phenanthrene
Metals – arsenic

Substances in intertidal seep and ocean water greater than Marine BCWQ, or of concern given elevated concentration:
Metals – aluminum, cadmium, copper, iron, manganese, nickel and zinc

Substances in Hart Creek fresh surface water greater than Freshwater BCWQ:
None

1.2.2 Selection of COPCs

COPCs are chemicals of potential concern and are usually those chemicals that exceeded at least one standard, criterion, or guideline (i.e. all site contaminants can be COPCs). For simplicity, all chemicals discussed in Section 1.2.1 above are identified as COPCs for the Site.

Some consideration can often be given for the basis of the standard when determining if a chemical should be a COPC for certain types of receptors. Where warranted, and depending on the basis for the standard, and other toxicological information, chemicals exceeding standards may only be

retained as COPCs for select types of receptors. For example, metal concentrations in soil in excess of CSR matrix numerical soil standards for "toxicity to soil invertebrates and plants" but below CSR matrix numerical soil standards for "human intake of contaminated soil" may only warrant retention as COPCs for soil invertebrates, plants, and wildlife but not for humans.

There are few tissue guidelines/criteria for shellfish. All metals present in Waste Coal Pile seep water and/or sediment at concentrations greater than aquatic life guidelines, or concentrations greater than those observed in reference area seep water and/or sediment samples, were retained as COPCs for shellfish. Shellfish COPCs also included all PAHs detected in shellfish tissue (phenanthrene in clams). Contaminants deemed COPCs in one medium (e.g. shellfish) were also in some cases retained as COPCs in other media (e.g. sediment), regardless of whether or not those chemicals exceeded standards/guidelines in the other media. This conservative approach was applied in evaluating human health risks, given the potential for combined exposure to contaminants via multiple exposure pathways.

With respect to human receptors, the following contaminants have been retained as COPCs for the intertidal area media and human health preliminary quantitative risk assessment:

- Shellfish (Al, As, Cd, Co, Cu, Fe, Pb, Mn, Ni, Zn, phenanthrene)
- Sediment (Al, As, Fe, Mn, naphthalene, phenanthrene*)
- Precipitate (Ferricrete) (Al, As, Fe, Mn, Mo*)
- Water (Seep, Tide Pool, Ocean) (Al*, As, Cd, Fe*, Mn*)

*Exceeds a human health standard or guideline in that medium.

1.3 Future Human Receptors and Exposure Pathway Analysis

Under future post-remedial conditions, human receptors at the Site will include residents, recreators, commercial workers, construction and utility workers.

The most common uses of the Site by recreators will include walking atop the capped urban park areas of the Waste Coal Pile, and picnicking, wading/swimming, and shellfish harvesting on the intertidal portions of the Site.

While on the intertidal area, the recreator has the potential to be exposed to the COPCs identified in sediment and seep area precipitate (ferricrete) via incidental ingestion of and dermal contact with sediment and precipitate (ferricrete), and the inhalation of sediment particulate - precipitate (ferricrete) inhalation is unlikely as seep areas are wet, and this material is a cementatious precipitate. While on the intertidal area, the recreator also has the potential to be exposed to COPCs identified in seep and ocean water via dermal contact with and ingestion of these waters (e.g. during wading or swimming). If the recreator collects shellfish while on the intertidal area, he/she also has the potential to ingest water and sediment associated contaminants that may have accumulated in the collected shellfish. The receptor groups most applicable to intertidal area exposure include toddler (7 months-4 years), child (5-11 years), teen (12-18 years), and adult (19+

years). Infants (0-6 months) could also be exposed to terrestrial portions of the Site, in particular residential areas.

A human conceptual model is shown in Figure 8 and depicts the array of the most probable exposure pathways between Waste Coal Pile media/COPCs and people who may use the Waste Coal Pile and/or intertidal area under future conditions. Additional conceptual models will need to be prepared for other Site areas (KP–Area 1 and KP–Area 2) if risk assessments are performed for contamination remaining in these parcels.

For the Waste Coal Pile site conceptual model (SCM), the various exposure pathways have been categorized in the three manners listed below:

- Pathway is likely complete and quantitative assessment of dose/risk is warranted (shaded black). Exposure pathways recommended for quantitative assessment of dose/risk require a realistic possibility of exposure to contaminated media (soil, water, air, food), and a route of entry into the body at the time of contact (i.e. ingestion, inhalation, dermal contact);
- Pathway with slight potential to be complete but possibility of exposure is highly unlikely, highly infrequent, or dose would be so low it does not warrant quantitative assessment of dose/risk. Qualitatively poses a negligible level of risk based on professional judgement (shaded grey); and
- Pathway is incomplete and no further evaluation is recommended. Qualitatively poses no risk (no shading).

For future use of the Waste Coal Pile by human receptors, the only exposure pathways categorized as being potentially complete and requiring quantitative assessment of dose/risk are those associated with exposure to intertidal area media.

Exposure pathways considered to have a slight potential to be complete but not warranting quantitative assessment, are listed below.

> SCM Note a: The Waste Coal Pile will be capped with clean soil. Direct human exposure with the underlying waste coal will be highly unlikely.
>
> SCM Note b: Waste coal organics exceeding CSR soil standards (e.g. naphthalene) are unlikely to be volatile as they are bound up in coal organic material, nor would they likely diffuse through the cap or building foundations to reach appreciable concentrations in outdoor or indoor air.

1.4 Ecological Receptors of Concern and Exposure Pathway Analysis

Many animals and plants potentially exist on this Site, either as residents or as periodic visitors (as part of their foraging range). Risk assessments must limit their focus to a representative subset of the organisms that might use a site. Risk assessments also often evaluate risks to general types of organisms such as marine birds, benthic invertebrates, and fish, as opposed to species. BC MOE (2000) lists the following selection criteria for receptors of concern:

- potentially sensitive to the stressors from the contaminated site
- threatened or endangered (e.g., Red and Blue listed species)
- ecologically significant (e.g., a migratory species that may be a significant proportion of the population; is concentrated in the vicinity of the site during specific periods; is dominant within the local biological communities, or functions as keystone species within nearby ecosystems)
- recognized as good indicator or surrogate species
- aesthetic value to local residents
- recreational or commercial importance

SEACOR reviewed the following information sources to determine federally endangered or threatened species, and Provincially red- and blue-listed species, which may inhabit or forage on the Site, including Hart Creek and its intertidal area. Supporting maps and lists are included in Appendix A.

- Lists of red-listed (extirpated, endangered, threatened) and blue-listed (of special concern) animal and plant species, and plant communities for the Campbell River Forest District from BC MOE's Conservation Data Centre, BC Species and Ecosystem Explorer website; http://srmapps.gov.bc.ca/apps/eswp/;
- A list of endangered and threatened animal and plant species (searching the geographic area around Union Bay) from the Canadian Wildlife Service's on-line Species at Risk Act (SARA) mapping system; http://www.sis.ec.gc.ca/ec_species/ec_species_e.phtml;
- A map of known locations of terrestrial red-listed and blue-listed animal and plant species for the region specifically around the Site from BC MOE's Conservation Data Centre Terrestrial Information Mapping Service website, including associated Element Occurrence Records; http://www.env.gov.bc.ca/atrisk/ims.htm
- Information on the Community Mapping Network's Sensitive Habitat Inventory and Mapping system.
- Fisheries information for Hart (Washer) Creek from the BC Ministry of Agriculture and Lands Fisheries Information Summary System, i.e. a FISS Report; http://srmapps.gov.bc.ca/apps/fidq/;

1.4.1 Freshwater Aquatic Life

Hart Creek bounds the Site to the west, and is salmonid habitat (chum, coho, cutthroat, steelhead, rainbow). Its potential for use by anadromous species has recently been enhanced via the re-engineering of those reaches of the creek within the Site, below the old Island Highway, although the creek does go dry in the summer for several months. No COPCs have been identified in surface water in the creek. However, two of the four sediment samples collected from the lower reaches of the creek alongside the Waste Coal Pile contained contaminant concentrations in

excess of the BC SedQCscs. During re-engineering of the reaches of the creek upstream of the Waste Coal Pile, some contamination was encountered in creek bed soil. The reaches of the creek that are tidally influenced likely have limited use by freshwater aquatic life; however freshwater aquatic species likely use the portions of Hart Creek alongside KP-Area 1. The re-engineered creek channel bed consists largely of rocks and gravel, with a boulder and pool-riffle habitat. The following freshwater aquatic organisms have been selected as receptors of concern for the freshwater reaches of Hart Creek alongside KP-Area 1: **benthic invertebrates (stonefly, mayfly), periphyton, salmon**.

1.4.2 Marine Aquatic Life

At low tide, an estuarine mixture of groundwater and seawater is visible draining from the Waste Coal Pile's East and North Faces in a stream like fashion, and discharging to and mixing with Baynes Sound ocean water. Both the volume and chemistry of the discharge vary seasonally. Seep and ocean water sampling for metals chemistry and laboratory toxicity testing was the focus of much of the supplemental DSI work performed adjacent to the Waste Coal Pile between August, 2005 and April, 2006.

The hydraulic placement of the Waste Coal Pile, as well as erosion of the pile and eastern shoreline over the last century, has resulted in the widespread deposition of waste coal in the intertidal and subtidal sediments of Baynes Sound. The intertidal area exposed during low tide that consists largely of waste coal is in the order of approximately 3 ha on the East Face and 16 ha on the North Face. Subtidally, the Waste Coal Pile slopes east of the site to a break point with native sediments approximately 300 m from the Site's foreshore, and approximately 150 m from the 0.5 m lowest normal tide (LNT) line shown on Figure 3.

In addition, there are two intertidal areas with extensive sediment iron staining along the Waste Coal Pile's East and North Faces. The iron staining present is likely ferric hydroxide $Fe(OH)_3$, the result of dissolved ferric iron (Fe^{2+}) in Waste Coal Pile groundwater oxidizing and precipitating onto beach gravel upon daylighting into the neutral to slightly alkaline, oxygen rich intertidal environment. This iron is strongly adhered to the beach gravel, driftwood, etc. in the iron-stained areas. Suspended iron floc has also been observed at the ocean edge where seep water and ocean water mix. The iron staining appears to be limited to the intertidal area. At low tides (~0-0.3 m) the intertidal area on the East Face of the Waste Coal Pile extends roughly 100 m from the high tide mark. The iron staining on the East Face appears to partially banded, with more prominent staining occurring in the mid-intertidal and low-intertidal areas. SEACOR staff have waded beyond the 0 m tide line on the East Face. Iron staining was not apparent in these subtidal areas.

SEACOR has observed a variety of marine aquatic life in the Site's intertidal and subtidal areas. These are identified in Section 3.3. Additionally, the anadromous fish species reported to use Hart Creek (chum, coho, cutthroat) likely spend time rearing as smolts in the nearshore ocean habitat off of the Site. The following marine aquatic organisms have been selected as receptors of concern for the Site: **eelgrass, seaweed (sea lettuce), benthic invertebrates (oysters, clams, amphipods, polychaetes, shore crab, sand dollars), salmon, sculpin.**

1.4.3 Terrestrial Wildlife and Plants

The Site is within the Coastal Western Hemlock biogeoclimatic zone, very dry maritime (eastern) subzone (CWHxm1). No vegetation is present on the majority of the Waste Coal Pile, with the exception of an approximate 0.9 ha area on the northeast corner of the pile, where there has been some significant re-vegetation in the form of coniferous and deciduous trees with an understorey of grass. In addition, a small patch of grass has established itself on imported fill (composted material from Comox Strathcona Regional District) atop the pile (a previous re-vegetation test). The Kensington Property - Area 1, including portions of the area where waste coal is present, is covered by vegetation in the form of established trees with a grass and shrub understorey. These vegetated areas potentially offer habitat to terrestrial wildlife. To date, SEACOR has observed the following terrestrial wildlife in these areas: Bald eagle, crows, various unidentified bird species.

There are relatively few red- and blue-listed terrestrial species reported to occur in the surrounding Campbell River Forest District. With respect to terrestrial animals and plants, these include the red-listed Northern goshawk, Vancouver Island marmot, Sand verbena moth, deltoid balsamroot, yellow montaine violet, and the blue-listed Peregrine falcon, Barn owl, Western screech owl, Grizzly bear, red legged frog, Dun skipper butterfly and seaside centipede. Union Bay also recently contained nesting habitat for the blue-listed Great Blue heron. The Great Blue heron is the species with the masked occurrence record overlapping the Site shown on the map in Appendix A.

However, the sand verbena moth, seaside centipede, and deltoid balsamroot are reported as being extirpated from BC. Their presence on the Site is thus highly unlikely. Active colonies of the Vancouver Island marmot are presently only believed to exist in the mountainous interior of Vancouver Island east of Alberni Inlet, and northwest of Comox (VIMRT, 2000). Grizzly bear presence on the Site is also highly unlikely.

The following text from BC MOE *Preliminary Comments on Approval in Principle for Union Bay Waste Coal Pile and Kensington Property, MOE Site ID 4291, July 8, 2005* indicates that snakes and small mammals also may be present in these vegetated areas, or the intertidal area.

- "1.6.2. Various terrestrial species use the Site, including two species of snakes which were observed in the intertidal coal waste during low tide. Numerous birds use the extensive berry bushes growing on the site and one expects populations of small mammals in the area. The problem formulation for terrestrial risk assessment has excluded assessment of plants, soil invertebrates, and wildlife. From the soil chemistry results it is clear there is current exposure of terrestrial receptors to contamination within 15 centimeters of the surface. It is unknown whether the site contains contaminated food sources. It is unclear how the final remediated site will prevent exposure of all terrestrial receptors to the contaminated fill, as the intertidal area, beach crest and backshore are all composed of fill and terrestrial receptors will be able to access these areas even with a cap and shore armouring. Plants, soil invertebrates and terrestrial wildlife will have to be considered in the risk assessment with a contingency plan to limit exposure if the risk assessment indicates unacceptable impacts."

Based on the above information, and BC MOE comments, the following terrestrial organisms have been selected as receptors of concern for the Site: **plants (including the yellow montaine violet), soil invertebrates, Peregrine falcon, owl (including Barn owl and Western screech owl), Bald eagle, Great blue heron, snakes, mice, and Red-legged frog.**

1.4.4 Aquatic Wildlife

There are relatively few red- and blue-listed aquatic wildlife species reported to occur in the surrounding Campbell River Forest District. With respect to marine aquatic wildlife, these include the red-listed Marbled murrelet, Leatherback, sea otter, Northern sea lion, Killer whale (Populations 1 and 3), and the blue-listed Grey whale and Killer whale (Population 2). However, Leatherback are reported as being extirpated from BC. Leatherback, whale, and sea otter presence in the subtidal area adjacent to the Site is highly unlikely. Sea lions are present on log booms northwest of the Site, however they are believed to be Californian or Stellar sea lions as opposed to Northern sea lions. SEACOR has observed diving ducks (possibly Lesser scaup), and seagulls in the Site's subtidal/intertidal areas.

No red- or blue-listed freshwater aquatic wildlife are reported to occur in the surrounding Campbell River Forest District. SEACOR has observed a mink in Hart Creek just downstream of the old Island Highway bridge.

Based on the above information, and BC MOE comments "3.2. ---Diving duck consumption of shellfish should be considered in the marine ecological assessment", the following aquatic wildlife have been selected as receptors of concern for the Site: **diving ducks, sea gulls, marbled murrelet, and mink**.

1.4.5 Exposure Pathway Analysis

An Ecological Conceptual Model (Figure 9) depicts the array of the most probable exposure pathways between Waste Coal Pile media/COPCs and animals and plant ROCs noted above which may use the Waste Coal Pile or the adjacent intertidal area under baseline conditions. The exposure pathways have been classified in the same manner used for the human conceptual model, described in Section 1.3.

2.0 HUMAN HEALTH RISK ASSESSMENT – RECREATORS EXPOSURE TO THE WASTE COAL PILE AND INTERTIDAL AREA

A human health risk assessment (HHRA) was first conducted by Norecol, Dames and Moore in 1995, to evaluate the potential for elevated arsenic concentrations in the Waste Coal Pile to adversely impact recreational users, under both current Site conditions and proposed future urban parkland Site conditions. That HHRA was presented in the NDM report titled Draft Report, *Human Health Risk Assessment, Waste Coal Pile, Union Bay, British Columbia*, dated October 18, 1995 (NDM, 1995). That report was updated and finalized in 2000 and was presented in the URS/NDM report titled Final Report, *Human Health Risk Assessment, Waste Coal Pile, Union Bay, British Columbia*, dated October 2000 (URS, 2000). Neither of these reports was submitted to BC MOE.

The earlier URS/NDM HHRA evaluated the potential for elevated arsenic concentrations in the Waste Coal Pile to adversely impact human health. Receptors of concern were limited to recreational users of the Waste Coal Pile, including motorbike (or ATV) users, hikers and mountain bikers. The recreational users were assumed to be present at the Waste Coal Pile 25 days a year for a period of 10 years; only adults were evaluated. Complete exposure pathways identified for the recreational user included inhalation of fugitive dust, soil ingestion, dermal absorption of soil and incidental ingestion of surface water runoff. Exposures via these exposure pathways were estimated using the 95 % upper confidence limit of the arithmetic mean arsenic concentrations measured in waste coal and surface water. The URS NDM human health risk estimates for the recreational users were below the BC acceptable risk level of incremental lifetime cancer risk (ILCR) > 1E-05 for carcinogens and harzard quotient and hazard index (HQ/HI) > 1 for non-carcinogens. The maximum ILCR was 5.0E-07 and the maximum HI was 0.04.

SEACOR's subsequent Problem Formulation (SEACOR, May 31, 2005) included similar calculation of risks to recreators using the same exposure frequency listed above (8 hours/day, 25 days/year, 10 years), and maximum COPC concentrations in waste coal. COPCs were expanded to include arsenic, copper, naphthalene, and phenanthrene in waste coal. Risks associated with shellfish (clams) cadmium ingestion were also evaluated. Risks were evaluated for the adult, teen and child receptors. Shellfish ingestion rates were from USEPA (1997). Shellfish consumption frequency was assumed to be 104 meals/year (i.e. 2 meals per week).

BC MOE provided the following in their July 8, 2005 letter Preliminary Comments on Approval in Principle for Union Bay Waste Coal Pile and Kensington Property, MOE Site ID 4291:

- "1.6.1 The HHRA did provide risk quotients and cancer risk estimates for recreational receptor exposure and shellfish consumers, however, some exposures were excluded which should be considered. Specifically, the dermal and incidental ingestion of tidepool water, the toddler exposure to waste coal from beach use, the consumption of oysters, and possibly the exposure of SCUBA divers to coal drainage water. Further comments are provided in the detailed report comment section."
- "1.6.1 Errors were found in the table listing exposure assumptions and this needs clarification as well as whether using the recommended Health Canada receptor characteristics would change the results of the assessment. SEACOR plans to redo the

human health risk assessment once the remediation is complete. The human health risk assessment may be more accurately assessed by probabilistic modeling. Shellfish contamination could be put in the context of consumption guidance values as long as there are sufficient local and regional concentration measurements to determine if contamination is from high background or from Site contamination."

- "2.13.1 The SEACOR report states that under the current land use, the human receptors of concern at the Site are limited to individuals using the Site for recreational purposes. In the Ministry site inspection in May, it was noted people were walking their dogs, and a man and child were having a picnic on the coal waste beach. The dive shop owner said he regularly led dive excursions along the east shore coal slope to view octopus and marine life. The locals were asked if anyone ate clams or oysters from the area, and one said she did not but knew others did, and the second person said the clams and oysters are plentiful and good from the coal beach area. In the proposed development, one can assume children will spend a lot of time in the tide pools and unless mitigation measures are taken, people will consume shellfish from the beach.
- "2.13.1 The SEACOR waste coal recreational receptor risk assessment did not consider infant or children less than three years, "as exposures for these receptors are not expected". A child was seen at a picnic on the coal beach and the exposure of toddlers and infants to eroded coal on the beach will likely increase with the development. The SEACOR report states that dermal exposure to and incidental ingestion of marine water were not considered in the risk assessment as the part of Baynes Sound that lies adjacent to the coal waste pile was not considered to be a recreational swimming area and the amount of time that a recreational swimmer might spend in this area was considered to be negligible. With the large numbers of families living at the Site, one can anticipate children spending time playing in the tide pools. The eastern coal face is a common recreational dive site and dermal and incidental ingestion of seawater at the Site is needed. Item: The human health risk assessment must include child and adult exposure to tide pool water, and toddler exposure to coal waste from beach activity. Consideration should be given to the assessment of SCUBA diver exposure to water influences by coal drainage." **MOE subsequently verbally agreed that assessment of risks to scuba divers was not necessary.**
- "2.13.2 The risk assessment uses the Ministry standards of health quotients below one and lifetime cancer risk of 10^{-5}. The compounds considered in the risk assessment were limited to those most commonly found to exceed the CSR standards: arsenic, copper, phenanthrene and naphthalene. Item: The tide pool exposure will require consideration of additional contaminants to the four selected in the waste coal exposure assessment."
- "2.13.3 Table 5.1 provides the age specific exposure assumptions for the recreational receptor. It contains a number of inconsistencies: The skin surface area of the 6-10 year old child is larger than the listed skin surface of an adult and the adolescent skin surface is the same as an adult. The inhalation rate of the child 3-5 years is greater than the adult inhalation rate. Item: Please provide a corrected table of exposure assumptions and confirm the appropriate characteristics were used in the risk calculations. Is there a reason the Health Canada recommended human receptor characteristics for the Canadian

population was not used? Will use of the Canadian guidance change the results of the risk assessment?"

- "2.13.4 The average concentration of cadmium in BC oysters is approximately 2.3 ppm wet weight and the average for the whole of Baynes Sound is approximately 1.9 ppm wet weight (personal communication Klaus Schallie Canadian Food Inspection Agency). Oysters and scallops accumulate cadmium to a higher degree than clams, and data on concentrations of metals in oysters around and adjacent to the Site is needed. The basis question that needs to be answered is whether the Site contamination is causing increased shellfish contamination above local background concentrations. Item: The risk assessment needs to include oyster consumption, as Union Bay locals currently consume clams and oysters from the Site."

Revisions have now been made to the earlier SEACOR risk estimates to reflect additional intertidal data collected between August, 2005 and April, 2006 and to revise some of the earlier exposure assumptions (to reflect Health Canada guidance and best professional judgement). Recreator receptor exposure to the intertidal area has been retained as a complete exposure pathway/receptor combination. Exposure and risk estimates for a recreational user of the Waste Coal Pile have not been evaluated in the current revised assessment as the remedial strategy includes placement of a cap that will negate direct exposure to the Waste Coal Pile soils, and indirect exposure will likely not occur (e.g. COPCs are low volatility and likely bound to coal organic matter).

2.1 Exposure Assessment

2.1.1 Exposure Point Concentrations

Maximum COPC concentrations measured in intertidal area media (sediment, precipitate (ferricrete), seep water, ocean water, clams, oysters) were initially used as human exposure point concentrations (EPCs) to model risks to recreators. For those media/COPC combinations resulting in HQs or ILCRs in excess of CSR acceptable risk-levels (i.e. shellfish), where a sufficient amount of data was available risks were also modeled using upper 95th percent confidence limit of the mean (95% UCLM) concentrations. These statistical concentrations are more realistic EPCs for mobile receptors and chronic exposures; these EPCs are shown in Tables B1 through B5. Tables B1 and B2 also contain the maximum concentrations of iron and aluminium in sediment and precipitate (ferricrete). These were not reported in the DSI or Supplemental DSI, as they are not regulated compounds. However, these data were obtained from the lab and can be made available upon request.

2.1.2 Intake Equations and Receptor Characteristics

The following section presents the intake equations and recreator exposure characteristics and assumptions used to quantify COPC intakes. The equations used are from Table 5 of Health Canada (2004a) *Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA)*. The receptor characteristics

were a combination of those shown in Table 3 of Health Canada (2004a) and more site-specific values selected by SEACOR using professional judgement.

Risks were modelled for the recreator. Unfortunately Health Canada (2004a) offers no guidance on appropriate frequency of exposure for recreators to a park or beach. USEPA (1997) also does not contain such information. The number of days per week recreators will likely use the intertidal area under post development conditions is unknown. However, use of the intertidal area by recreators could be frequent, especially if housing is constructed in the immediate vicinity. A single value (days/week) cannot be accurately assigned.

Consequently, risks were calculated under three separate exposure scenarios – use of the intertidal area 1 day/week, 3 days/week, and 5 days/week. Recreators were also assumed to use the intertidal area 26 weeks per year (to reflect use mainly between Spring and Fall, as well as during periods of lower tides). Given the existing and planned residences in Union Bay, exposure was assumed to occur for 30 years.

The equations used to determine intake of COPCs via different exposure pathways, as well as the values used in these equations, are presented in the following section.

2.1.3 Inadvertent Ingestion of Sediment/Precipitate (Ferricrete)

COPC intakes via inadvertent ingestion of sediment and precipitate (ferricrete) from the intertidal area were calculated using the following equation from Health Canada (2004a):

$$Intake\ \ (mg\ /\ kg\ /\ day\ ) = \frac{C_S * IR_S * AF_{GIT} * D_1 * D_2 * D_3}{BW\ * LE}$$

Where:

Cs = exposure point concentration (EPC) of COPC in sediment and precipitate (ferricrete) (mg/kg)
IR_s = soil ingestion rate (kg/d)
AF_{GIT} = absorption factor from the gastrointestinal tract (unit less)
D_1 = days per week exposed/7 days
D_2 = weeks per year exposed/52 weeks
D_3 = total years exposed to site (to be employed for assessment of carcinogens only)
BW = body weight (kg)
LE = life expectancy (yrs) (to be employed for assessment of carcinogens only)

The following characteristics were used for the Recreator (adult) intake of arsenic from the intertidal area via the inadvertent ingestion of sediment and precipitate (ferricrete). Receptor characteristics for the other age groups are shown in Table B6.

Cs intertidal sediment – maximum (49.2 mg/kg As)

Cs intertidal precipitate (ferricrete) – maximum (30.4 mg/kg As)
IR_s - 20 mg/d = 0.00002 kg/d (Health Canada, 2004a)
AF_{GIT} - 1 (Health Canada, 2004a)
D_1 - intertidal sediment and precipitate (ferricrete) – 1, 3, and 5 days per week exposed/7 days (Best Professional Judgement)
D_2 - Waste Coal Pile - 52 weeks per year exposed/52 weeks (Best Professional Judgement)
D_2 - intertidal sediment and precipitate (ferricrete) - 26 weeks per year exposed/52 weeks (Best Professional Judgement)
D_3 = 30 yrs (95th percentile time spent at one residence, USEPA 1997)
BW = 70.7 kg (Health Canada, 2004a)
LE = 56 yrs (Health Caanda, 2004a)

2.1.4 Ingestion of Shellfish (Clams and Oysters)

COPC intake via the ingestion of clams and oysters was calculated using the following equation from Health Canada (2004a):

$$Intake\ (mg\ /\ kg\ /\ day) = \frac{C_{Food} * IR_{Food} * AF_{GIT} * D_{Seafood} * D_3}{BW * 365 * LE}$$

Where:

$C_{Seafood}$ = exposure point concentration (EPC) of COPC in seafood (shellfish) (mg/kg wet weight)
$IR_{Seafood}$ = seafood ingestion rate (kg/d wet weight)
AF_{GIT} = absorption factor from the gastrointestinal tract (unitless)
$D_{Seafood}$ = seafood ingestion frequency (days/yr)
D_3 = total years exposed to site (to be employed for assessment of carcinogens only)
BW = body weight (kg)
365 = conversion factor (days/yr)
LE = life expectancy (yrs) (to be employed for assessment of carcinogens only)

The following characteristics were used for the Recreator (adult) intake of arsenic from the ingestion of intertidal clams and oysters. Receptor characteristics for the other age groups are shown in Table B6.

$C_{Seafood}$ clams – maximum (2.86 mg/kg ww As), maximum (0.14 mg/kg ww assumed inorganic As)*
$C_{Seafood}$ oysters – maximum (2.24 mg/kg ww As), 95% UCLM (1.58 mg/kg ww As), maximum (0.112 mg/kg ww assumed inorganic As), 95% UCLM (0.079 mg/kg ww assumed inorganic As)*
$IR_{Seafood}$ = 0.22 kg/d (Health Canada, 2004a)
AF_{GIT} = 1 (Health Canada, 2004a)

$D_{Seafood}$ = 52 days/yr (1 day/week, 52 weeks/year)(Best Professional Judgement and USEPA, 1997)
D_3 = 30 yrs (Best Professional Judgement)
BW = 70.7 kg (Health Canada, 2004a)
365 = days/yr
LE = 56 yrs (Health Canada, 2004a)

*For combined pathway (hazard index) and ILCR risk estimates, used maximum assumed inorganic concentration for clams as sample size was small (n=5), while used 95% UCLM assumed inorganic concentration for oysters as sample size was adequate to apply statistics (n=12).

The majority of arsenic in shellfish is reported to be in the form of organic arsenic, whereas the toxicological reference values available for arsenic are for inorganic arsenic. As speciated arsenic concentrations in seafood have not been determined for the Site, SEACOR estimated seafood ingestion risks for two assumed scenarios:

- Using total arsenic concentrations and assuming that organic and inorganic arsenic are equipotent (i.e. all arsenic measured in seafood tissue is inorganic for purposes of risk estimation)
- Using inorganic arsenic concentrations of 2% of the total arsenic in the Site's clams and oysters and assuming that organic arsenic is non-carcinongenic. .

The 2% value was selected following SEACOR's review of a study published by the Washington State Department of Ecology (Ecology, 2002) and another study published by the United Kingdom Food Standards Agency (FSA, 1995). These studies report the fraction of total arsenic that was found to be present as inorganic arsenic in many fish and shellfish samples.

2.1.5 Inadvertent Ingestion of Intertidal Water (Seep, Tide Pool, and Ocean Water)

COPC intakes via inadvertent ingestion of intertidal water during wading/swimming or shellfish harvesting in the seeps, tide pools, and ocean were calculated using the following equation from Health Canada (2004a):

$$Intake\ (mg\ /\ kg\ /\ day) = \frac{Cw\ *\ IRw\ *\ AF_{GIT}\ *\ D\ *\ D_1\ *\ D_2\ *\ D_3}{BW\ *\ LE}$$

Where:

Cw = concentration of COPC in intertidal water (mg/L)
IRw = surface water ingestion rate (L/d)
AF_{GIT} = absorption factor from the gastrointestinal tract (unitless)
D = daily exposure duration (hours)
D_1 = days per week exposed/7 days
D_2 = weeks per year exposed/52 weeks
D_3 = total years exposed to site (to be employed for assessment of carcinogens only)
BW = body weight (kg)
LE = life expectancy (yrs) (to be employed for assessment of carcinogens only)

The following characteristics were used for the Recreator (adult) intake of arsenic from the intertidal area via the incidental ingestion of seep, tide pool, and ocean water. Receptor characteristics for the other age groups are shown in Table B6.

Cw = intertidal water - maximum (4.78 μg/L = 0.00478 mg/L As) in seep, tide pool, and ocean water
IRw = 0.05 L/hour (USEPA, 1989)
AF_{GIT} = 1 (Health Canada, 2004)
D = 1 hour/day (Best Professional Judgement)
D_1 = 1, 3, and 5 days per week exposed/7 days (Best Professional Judgement)
D_2 = 26 weeks per year exposed/52 weeks (Best Professional Judgement)
D_3 = 30 yrs (95th percentile time spent at one residence, USEPA 1997)
BW = 70.7 kg (Health Canada, 2004a)
LE = 56 yrs (Health Canada, 2004a)

2.1.6 Dermal Contact with Sediment/Precipitate (Ferricrete)

COPC intake via dermal contact with sediment and precipitate (ferricrete) from the intertidal area was calculated using the following equation from Health Canada (2004a):

$$Intake\ (mg\ /\ kg\ /\ day\ ) = \frac{(C_S * SA_H * SL_H + C_S * SA_{A\ \&\ L} * SLo\ ) * AF_{skin} * EF\ * D_1 * D_2 * D_3}{BW\ * LE}$$

Where:

Cs = exposure point concentration (EPC) of COPC in sediment and precipitate (ferricrete) (mg/kg)
SA_H = surface area hands (cm^2)
SL_H = soil loading to hands (kg/cm^2-event)
$SA_{A\&L}$ = surface area arms and legs (cm^2)
SLo = soil loading to other body parts (kg/cm^2-event)
AF_{skin} = Health Canada (2004a) Table 6 values
EF = exposure frequency (events/day)
D_1 = days per week exposed/7 days
D_2 = weeks per year exposed/52 weeks
D_3 = total years exposed to site (to be employed for assessment of carcinogens only)
BW = body weight (kg)
LE = life expectancy (to be employed for assessment of carcinogens only)

The following characteristics were used for the Recreator (adult) intake of arsenic from the intertidal area. Receptor characteristics for the other age groups are shown in Table B6.

Cs intertidal sediment – maximum (49.2 mg/kg As)
Cs intertidal precipitate (ferricrete) – maximum (30.4 mg/kg As)
SA_H = 890 cm^2 (Health Canada, 2004a)
SL_H = 1.00E-07 kg/cm^2-event (Health Canada, 2004a)

$SA_{A\&L}$ = 8220 cm^2 (Health Canada, 2004a)
SLo = 1.00E-08 kg/cm^2-event (Health Canada, 2004a)
AF_{Dermal} = 3.0E-02, Health Canada (2004a) Table 6 value (unitless)
EF = 1 event/day (Best Professional Judgement)

D_1 intertidal sediment and precipitate (ferricrete) – 1, 3 and 5 day per week exposed/7 days (Best Professional Judgement)
D_2 Intertidal sediment and precipitate (ferricrete) - 26 weeks per year exposed/52 weeks (Best Professional Judgement)
D_3 = 30 yrs (95^{th} percentile time spent at one residence, USEPA 1997)
BW = 70.7 kg (Health Canada, 2004a)
LE = 56 yrs (Health Canada, 2004a)

2.1.7 Dermal Contact with Intertidal Water (Seep, Tide Pool, and Ocean Water)

COPC intakes via dermal contact with intertidal water during wading/swimming or shellfish harvesting in the seeps, tide pools, and ocean were calculated using the following equation from Dillon (2005):

$$Intake\ (mg\ /\ kg\ /\ day) = \frac{Cw * PC * SA * CF * D * D_1 * D_2 * D_3}{BW * LE}$$

Where:

Cw = concentration of COPC in intertidal water (mg/L)
PC = permeability coefficient (cm/hour)
SA = surface water hands, arms and legs (cm^2)
CF = conversion factor (0.001)
D = daily exposure duration (hours)
D_1 = days per week exposed/7 days
D_2 = weeks per year exposed/52 weeks
D_3 = total years exposed to site (to be employed for assessment of carcinogens only)
BW = body weight (kg)
LE = life expectancy (yrs) (to be employed for assessment of carcinogens only)

The following characteristics were used for the Recreator (adult) intake of arsenic from the intertidal area via dermal contact with seep, tide pool, and ocean water. Receptor characteristics for the other age groups are shown in Table B6.

Cw = intertidal water - maximum (4.78 μg/L = 0.00478 mg/L As) in seep, tide pool, and ocean water
PC = 1.0E-03 cm/hour, ORNL (2006) value
SA = 9110 cm^2 (Health Canada, 2004a)
AF_{GIT} = 1 (Health Canada, 2004a)
CF = 0.001
D = 1 hour/day (Best Professional Judgement)
D_1 = 1, 3, and 5 days per week exposed/7 days (Best Professional Judgement)
D_2 = 26 weeks per year exposed/52 weeks (Best Professional Judgement)

D_3 = 30 yrs (95th percentile time spent at one residence, USEPA 1997)
BW = 70.7 kg (Health Canada, 2004a)
LE = 56 yrs (Health Canada, 2004a)

2.1.8 Inhalation of Waste Coal and Sediment

COPC intakes via inadvertent ingestion of waste coal from the Waste Coal Pile and sediment from the intertidal area were calculated using the following equation from Health Canada (2004a):

$$Intake\ (mg\ /\ kg\ /\ day\ ) = \frac{C_S * P_{air} * IR_A * AF_{Inh} * D * D_1 * D_2 * D_3}{BW\ * LE}$$

Where:

Cs = exposure point concentration (EPC) of COPC in sediment (mg/kg)
P_{air} = particulate concentration in air (kg/m^3)
IR_A = inhalation Rate (m^3/h)
AF_{Inh} = Inhalation absorption factor (unitless)
D = hours per day exposed (h/d)
D_1 = days per week exposed/7 days
D_2 = weeks per year exposed/52 weeks
D_3 = total years exposed to site (to be employed for assessment of carcinogens only)
BW = body weight (kg)
LE = life expectancy (yrs) (to be employed for assessment of carcinogens only)

The following characteristics were used for the Recreator (adult) intake of arsenic from the Waste Coal Pile and intertidal area via the inhalation of sediment particulate. Receptor characteristics for the other age groups are shown in TableH6.
Cs intertidal sediment – maximum (49.2 mg/kg As)
P_{air} = 7.6E-04 mg/m^3 = 7.6E-10 kg/m^3 (Health Canada, 2004a)
IR_A = 1.6 m^3/h
D_1 Waste Coal Pile – 1, 3 and 5 days per week exposed/7 days (Best Professional Judgement)
D_1 intertidal sediment and precipitate (ferricrete) – 1, 3 and 5 days per week exposed/7 days (Best Professional Judgement)
D_2 intertidal sediment and precipitate (ferricrete) - 26 weeks per year exposed/52 weeks (Best Professional Judgement)
D_3 = 30 yrs (95th percentile time spent at one residence, USEPA 1997)
BW = 70.7 kg (Health Canada, 2004a)
LE = 56 yrs (Health Canada, 2004a)

2.2 Toxicity Assessment

To estimate a level of risk or impact for chemicals at a site, cancer and non-cancer adverse health effects need to be assessed. For evaluation of possible cancer effects, USEPA and Health Canada assign a provisional weight-of-evidence classification to a chemical. This classification is based on

evidence from human and animal studies, which the agencies classify as being sufficient, limited, inadequate, no data, or evidence of non-carcinogenicity. Health Canada classifies chemicals into six groups using criteria modified from those of the International Agency for Research on Cancer (IARC). The USEPA letter classification scheme was first published in their 1986 risk assessment guidelines.

Beginning in 1996 the USEPA began revising its carcinogen risk assessment guidelines to "known/likely," "cannot be determined," and "not likely," with sub-descriptors in each group. However, for many compounds the USEPA Integrated Risk Information System (IRIS) and International Toxicity Estimates for Risk database (ITER, 2006) still report the original letter classification. The EPA (letter classification) and Health Canada (roman numeral classification) schemes are shown below in Table 2.1.

TABLE 2.1: EPA AND HEALTH CANADA CARCINOGENICITY CLASSIFICATION SCHEME

EPA Group	Health Canada Group	Description
A	I	Human carcinogen (USEPA, 1986). Carcinogenic to humans (HC).
B1 or B2	II	Probable human carcinogen (USEPA, 1986). Probably carcinogenic to humans (HC). B1 = limited evidence of carcinogenicity in humans. B2 = sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans.
C	III	Possible human carcinogen (USEPA, 1986). Possibly carcinogenic to humans (HC).
	IV	Unlikely to be carcinogenic to humans (HC).
	V	Probably not carcinogenic to humans (HC).
D	VI	Not classifiable as to human carcinogenicity (USEPA, 1986) (HC). Unclassifiable with respect to carcinogenicity to humans (HC).
E		Evidence of non-carcinogenicity for humans (USEPA, 1986).

The carcinogenicity classification for retained COPCs was determined through a review of the USEPA IRIS and ITER databases. Table 2.2 below shows the letter letter/roman numeral carcinogenicity classification for retained COPCs. No classification information was available for aluminium, cobalt, iron, or molybdenum.

TABLE 2.2: CARCINOGENICITY CLASSIFICATION FOR COPCS

COPC	Classification
Aluminium	NC
Arsenic	A, I
Cadmium	B1, II
Cobalt	NC
Copper	D, NC
Iron	NC
Lead	B2, NC
Manganese	D, NC
Molybdenum	NC
Nickel	A, I (Refinery Dusts)
Zinc	D, NC

Naphthalene	C, NC
Phenanthrene	D, NC

Health Canada (2004a) provides no guidance on which classifications require quantitative assessment of cancer risks. Historically, chemicals classified as A or B1 were required by BC MOE to be assessed as carcinogens. However, more recent work by Health Canada has led to the development of cancer slope factors for some compounds with B2 carcinogenicity classifications. Consequently, SEACOR has assessed cancer risks for A, B1 and B2 chemicals.

When evaluating carcinogen risk, it is assumed that if a chemical is known or suspected to have carcinogenic effects in humans or laboratory animals, that the chemical has potential to cause cancer at any level of exposure. This is referred to as a "non-threshold" effect. In contrast, for chemicals with non-carcinogenic effects, there is a threshold below which there are no adverse impacts.

BC MOE have indicated that they will consider sources of toxicity data in the following order of preference:

1. Health and Welfare Canada;
2. US EPA sources, including Integrated Risk Information System (IRIS);
3. Health Effects Assessment Summary Tables (HEAST);
4. World Health Organization data; and,
5. Literature (e.g. USEPA's National Center For Environmental Assessments - NCEA).

Health Canada (2004a) has indicated it will consider sources of toxicity data in the following order of preference:

1. Health Canada;
2. US EPA Integrated Risk Information System (IRIS);
3. World Health Organization sources;
4. Netherlands National Institute of Public Health and the Environment (RIVM); and
5. Agency for Toxic Substances and Disease Registry (ATSDR).

Both hierarchies are similar. The Health Canada hierarchy was used for this risk assessment, based on it being more recent than the MOE hierarchy, and based on MOE's July 2005 review comments regarding preferred use of the Health Canada (2004a) guidance document for other aspects of this risk assessment (exposure assumptions).

2.2.1 Non-Carcinogenic Toxicity Reference Values

Non-carcinogenic toxicity reference values used included USEPA IRIS oral and inhalation reference doses (RfDo, RfDi) for arsenic (3.0E-04 mg/kg-day oral), manganese (1.4E-01 mg/kg-day oral,

1.4E-05 mg/kg-day inhalation), molybdenum (5.0E-03 mg/kg-day oral), zinc (3.0E-01 oral), and naphthalene (2.0E-02 mg/kg-day oral, 8.6E-04 mg/kg-day inhalation); Health Canada (2004b) oral and inhalation tolerable daily intake (TDI) for cadmium (8.0E-04 mg/kg-day oral), copper (3.0E-02 mg/kg-day oral), lead (3.6E-03 mg/kg-day oral), and nickel (chloride 1.3E-03 mg/kg-day oral, metallic 4.0E-06 mg/kg-day inhalation); WHO oral values for aluminium (1.0E+00 mg/kg-day oral) and iron (8.0E-01 mg/kg-day oral); and RIVM oral values for cobalt (1.4E-03 mg/kg-day oral) and phenanthrene (4.0E-02 mg/kg-day oral). These are shown in Table B8.

For the risks associated with dermal exposures to the COPCs, route-to-route extrapolation was performed. As per USEPA recommended methods (USEPA, 1989), the oral reference doses (i.e. administered doses) for the COPCs were adjusted to absorbed dermal doses by multiplying the oral reference dose by gastrointestinal absorption factors (AF_{GIT}) from ORNL (2006).

2.2.2 Carcinogenic Toxicity Reference Values

Carcinogenic toxicity reference values selected for the COPCs included a Health Canada (2004b) oral slope factor (SFo) for arsenic (2.8E+00 mg/kg-day^{-1}), and Health Canada (2004b) inhalation slope factors for arsenic (2.8E+01 mg/kg-day^{-1}), cadmium (4.29E+01 mg/kg-day^{-1}), and nickel (soluble 3.1E+00 mg/kg-day^{-1}). These are shown in Table H9. However, as cadmium and nickel were not retained as COPCs for sediment, cancer risks associated with inhalation of soil or sediment particulate containing cadmium and nickel were not determined.

2.3 Risk Characterization

In risk characterization, dose estimates are mathematically combined with toxicity values for both carcinogenic and non-carcinogenic chemicals to estimate cancer risks and non-cancer hazards.

Carcinogenic risks were estimated by multiplying the exposure intakes by the slope factors, as shown below:

$$\text{Carcinogenic Risk} = \text{Exposure Intake (mg/kg/day)} \times \text{Slope Factor (mg/kg/day)}^{-1}$$

The slope factor converts the daily intakes averaged over a lifetime of exposure directly to an incremental risk of an individual developing cancer (USEPA, 1989). This Excess Lifetime Cancer Risk, or the probability, above background, of an individual developing cancer due to exposures to arsenic in waste coal was compared to the risk level defined as acceptable by the BC CSR (1 in 100,000 or 1E-05) (BC, 1997).

The potential hazards from chemicals with non-carcinogenic effects were estimated by comparing the level of exposure estimated in the exposure assessment to the acceptable level of exposure provided by the reference dose for each chemical. This hazard is expressed as a ratio or quotient for each chemical, as presented below:

$$\text{Hazard Quotient} = \text{Exposure Intake (mg/kg-day)}/\text{Reference Dose (mg/kg-day)}$$

Hazard quotients for the same chemicals via multiple exposure pathways and media (e.g. ingestion, inhalation, dermal) were summed to give a hazard index. Hazard quotients and indices for different chemicals were not summed, as information was not obtained regarding the similarity of health effects and target organs for the various COPCs.

$$\text{Hazard Index} = \sum \text{Pathway/Media Specific Hazard Quotients}$$

If the individual hazard quotients and hazard index are less than one, the COPCs are not considered to pose a non-cancer hazard to the identified receptors (based on the exposure assumptions). The BC CSR defines an acceptable hazard index as less than or equal to one. Hazards in excess of one are typically re-examined in consideration of the uncertainty and modifying factors used to derive the reference dose(s), as well as the uncertainties and assumptions used to estimate exposure.

2.3.1 Risk Estimates - Recreator

Non-cancer hazard quotients and ILCRs were calculated for the recreator for the following exposure pathways:

- Incidental ingestion of sediment, precipitate (ferricrete), and seep water;
- Ingestion of clams and oysters;
- Dermal contact with sediment, precipitate (ferricrete), and seep water;
- Inhalation of sediment particulate.

The non-carcinogenic hazard quotients under 1, 3, and 5 day/week exposure scenarios are summarized in Tables B19, B20, and B21. The ILCRs under 1, 3, and 5 day/week exposure scenarios are summarized in Tables B22, B23, and B24. Hazard indices were also calculated for each COPC for all combined exposure pathways, and are shown in these tables for intertidal use including shellfish ingestion, and intertidal use excluding shellfish ingestion.

2.3.1.1 Individual Pathways

Individual exposure pathway non-cancer and cancer risk estimates for a recreator receptor which exceeded the CSR risk-based standards of HQ=1 and ILCR = 1E-05 for recreator use of the intertidal area 1, 3, and 5 days/week are summarized below in Table 2.3. Preference was given to the risk calculations shown in Appendix B which used 95% UCLM concentrations for oyster COPCs, and assumed inorganic arsenic shellfish concentrations (2% of total arsenic). Values equal to the CSR risk based standards at two significant figures (e.g. HQ=1.0) have not been highlighted, as they are assumed to meet CSR risk-based standards. Risks via other exposure pathways and for other COPCs not shown in Table 2.3 were below the CSR risk-based standards HQ=1 and ILCR = 1E-05, as shown in Appendix B.

TABLE 2.3: INDIVIDUAL PATHWAY RISK ESTIMATES EXCEEDING RISK BASED STANDARDS

	Sediment Ingestion (3 days/week)	Sediment Ingestion (5 days/week)	Ferricrete Ingestion (5 days/week)	Clam Ingestion (1 meal per week)	Oyster Ingestion (1 meal per week)
ADULT					
Arsenic	--	--	--	ILCR = 3.8E-05	ILCR = 2.1E-05
TEEN (12-19 Yr)					
Cadmium	--	--	--	HQ = 1.1	--
CHILD (5-11 Yr)					
Arsenic	--	--	--	ILCR = 1.2E-05	--
Cadmium	**--**	**--**	**--**	HQ = 1.7	**--**
TODDLER (0.5-4 Yr)					
Arsenic	--	ILCR = 1.4E-05	--	--	--
Cadmium	--	--	--	HQ = 1.9	--
NON-ADULT (0.5 to 19 Yr Combined)					
Arsenic	ILCR = 1.2E-05	ILCR = 1.9E-05	ILCR = 1.2E-05	ILCR = 2.9E-05	ILCR = 1.6E-05

2.3.1.2 Combined Pathways

Non-cancer and cancer hazard indices for combined exposure pathways which exceeded the CSR risk-based standards of HQ=1 and ILCR = 1E-05 for recreator use of the intertidal area 1, 3, and 5 days/week are summarized below in Table 2.4. Preference was given to the risk calculations shown in Appendix B which used 95% UCLM concentrations for oyster COPCs, and assumed inorganic arsenic shellfish concentrations (2% of total arsenic).. In addition, for intertidal hazard indices, SEACOR assumed half of shellfish ingestion was clams while half of shellfish ingestion was oysters, half of incidental ingestion was sediment while half of incidental ingestion was precipitate, and half of dermal absorption was from sediment while half of dermal absorption was from precipitate. Values equal to the CSR risk based standards at two significant figures (e.g. HQ=1.0) have not been highlighted, as they are assumed to meet CSR risk-based standards. Risks via other exposure pathways and for other COPCs not shown in Table 2.4 were below the CSR risk-based standards HQ=1 and ILCR = 1E-05, as shown in Appendix B.

TABLE 2.4: COMBINED PATHWAY RISK ESTIMATES EXCEEDING RISK BASED STANDARDS

	Intertidal Area Use Including Shellfish Ingestion			Intertidal Area Use Excluding Shellfish Ingestion		
	1 day/week	3 days/week	5 days/week	1 day/week	3 days/week	5 days/week
ADULT						

TABLE 2.4: COMBINED PATHWAY RISK ESTIMATES EXCEEDING RISK BASED STANDARDS						
	Intertidal Area Use Including Shellfish Ingestion			Intertidal Area Use Excluding Shellfish Ingestion		
	1 day/week	3 days/week	5 days/week	1 day/week	3 days/week	5 days/week
Arsenic	ILCR = 3.2E-05	ILCR = 3.7E-05	ILCR = 4.2E-05	--	--	1.2E-05
TEEN (12-19 Yr)						
Arsenic	--	--	ILCR = 1.1E-05	--	--	--
Iron	--	--	HQ = 1.1	--	--	--
CHILD (5-11 Yr)						
Arsenic	--	ILCR = 1.2E-05	ILCR = 1.3E-05	--	--	--
Cadmium	HQ = 1.1	HQ = 1.1	HQ = 1.1	--	--	--
Iron	--	--	HQ = 1.5	--	--	HQ = 1.1
TODDLER (0.5 – 4 Yr)						
Arsenic	--	ILCR = 1.4E-05	ILCR = 2.0E-05	--	--	ILCR = 1.3E-05
Cadmium	HQ = 1.2	HQ = 1.2	HQ = 1.2	--	--	--
Iron	--	HQ = 1.5	HQ = 2.2	--	HQ = 1.1	HQ = 1.8
NON-ADULT (0.5 – 19 Yr Combined)						
Arsenic	ILCR = 2.7E-05	ILCR = 3.5E-05	ILCR = 4.4E-05	--	ILCR = 1.3E-05	ILCR = 2.1E-05

2.4 Summary of Human Health Risk Calculations

As shown in Tables 2.3 and 2.4, depending on which exposure frequency is used in the modeling (1, 3, or 5 days/week), risk levels to intertidal recreators have the potential to exceed CSR risk-based standards for arsenic, cadmium, and iron.

For those COPCs with HQ > 1 and ILCR > 1E-05, potential health risks are largely associated with the ingestion of shellfish. Shellfish ingestion risks are independent of intertidal exposure frequency (1, 3, or 5 days/week). The number of meals of shellfish eaten (1 per week, BPJ/USEPA, 1997) was assumed to be the same regardless of the number of days the recreator visited the intertidal area.

Shellfish cadmium ingestion risks, and likely shellfish arsenic ingestion risks, are believed to be similar to background risk levels for Baynes Sound and coastal BC. This is briefly discussed in the following section.

2.5 Background Shellfish Metal Levels

2.5.1 Cadmium

Figure 10 depicts regional versus Site oyster cadmium concentrations. The regional data was from Figure 11 of Kruznski (2000). For the individual oyster samples collected from the Site in August 2005, cadmium concentrations ranged from 0.81 to 2.85 μg/g ww. The Site's 95% UCLM and mean oyster cadmium concentrations were 1.86 μg/g ww and 1.5 μg/g ww, respectively, values which are below the average for BC (2.3 μg/g ww) and the average for Baynes Sound (1.9 μg/g ww) based on data provided by MOE). For Baynes Sound, Figure 10 shows a maximum cadmium concentration of 3.93 μg/g ww in farmed oysters on Denman Island, and cadmium concentrations in farmed oysters near the reference area of 2.07 and 2.205 μg/g ww. Kruzynski (2000) identified multiple possible natural and anthropogenic sources of cadmium in BC oysters. The cadmium concentrations and associated risk levels in Site shellfish appear to be similar to or lower than those for Baynes Sound. SEACOR did not identify any evidence to suggest that the Waste Coal Pile is contributing to elevated cadmium concentrations locally or basin wide in Baynes Sound.

2.5.2 Arsenic

No Province-wide or Baynes Sound shellfish data (oysters and clams) could be obtained for other metals, such as arsenic. However, like cadmium, levels in Site shellfish are thought to be similar to those that would be found elsewhere in Baynes Sound and other areas of BC. The maximum clam and oyster total arsenic concentrations measured at the Site were 2.86 μg/g ww and 2.24 μg/g ww, respectively. Ecology (2002) reported clam total arsenic concentrations of 2.3 μg/g ww and 3.4 μg/g ww, at their Twanoh and Sequim Bay State Park reference areas. These values are comparable to those measured at the Site.

In addition, the maximum concentrations of arsenic detected in Waste Coal Pile groundwater and seep water were 12 μg/L (BH21) and 1.51 μg/L (SW9), respectively. Neither of these concentrations exceeds the CSR standard for drinking water (25 μg/L), nor the BCWQG for the protection of aquatic life (12.5 μg/L). Further, a maximum concentration of 1.4 μg/L arsenic was measured in ocean water from the SW12 reference area several kilometres south of the Site, which is similar to the maximum concentration measured in Waste Coal Pile seep waters. Arsenic is present in waste coal, and Site sediment, which could be ingested by filter feeding invertebrates such as clams and oysters. However, this potential particulate bound arsenic in shellfish stomachs does not appear to be elevating the Site's undepurated whole shellfish soft tissue concentrations, relative to that reported for reference areas by Ecology (2002).

3.0 ECOLOGICAL RISK ASSESSMENT – INTERTIDAL TOXICITY TEST RESULTS AND BIOLOGICAL OBSERVATIONS

SEACOR's Problem Formulation (SEACOR, May 31, 2005) included a section headed Ecological Concerns, which contained some information regarding the potential risks intertidal contamination could pose to aquatic life. BC MOE provided the following comments in the document Preliminary Comments on Approval in Principle for Union Bay Waste Coal Pile and Kensington Property, MOE Site ID 4291, dated July 8, 2005:

- "1.5.1. The exceedances of marine water metals criteria (Cd, Cr, Cu, Fe, Mn, Ni, Zn) in the marine surface water samples, look very similar to the groundwater exceedances in the coal pile groundwater (Cd, Co, Cu, Ni, Zn) which also had extremely high Fe and Mn. The humidity cell tests demonstrate the ability of acidified coal to leach metals (As, Cd, Cu, Fe, Ni, Se, and Zn) and it is apparent that some of these enter the groundwater and are then transported to the marine surface water. Given the very high metal concentrations in the water samples, aquatic toxicity assessment is required. Further surface water analysis is needed to characterize the extent of the contamination and both total and dissolved metals should be sampled."
- "1.5.2. The effect of contamination in the iron stained sediment areas is a primary concern and there is evidence of elevated metals and toxicity in these areas. The level of effort in defining the sediment toxicity is insufficient to provide a basis for risk assessment of the sediment contamination. The iron stained areas extend far into the intertidal and even some subtidal areas. The sediment grain size and epibenthic cover changes as one proceeds towards the lower intertidal and includes eelgrass beds with heavy iron staining. These need to be assessed with multiple samples and multiple species."
- 2.11 Numerous specific comments were provided on the initial two of three rounds of sediment toxicity testing.

Revisions have been made to the earlier text to reflect additional data that was collected between August, 2005 and April, 2006 and to address MOE's comments.

3.1 Groundwater and Seep Water Toxicity Test Results

Laboratory toxicity testing was performed on groundwater and downgradient seep water from both East Face and North Face locations exhibiting the highest levels of metals contamination (specifically, BH20 and SW9 on the East Face, and BH16 and SW11 on the North Face). Tests performed included echinoderm (sand dollar and sea urchin) fertilization inhibition assays per Environment Canada EPS 1/RM/27; 48-h bivalve (mussel) survival and shell development assays per EPA/600/R-95-136 (oyster larvae could not be obtained); and 7-day topsmelt survival and growth assays per EPA/600/R-95/136.

Testing using topsmelt (*Atherinops affinis*) and sand dollar gametes (*Dendraster excentricus*) was conducted on salinity adjusted groundwater (BH20 and BH16), seep water (SW9 and SW11), and reference area seawater (SW12) samples collected concurrently at low tide on September 17, 2005. Follow-up testing using mussel larvae (*Mytilus galloprovincialis*) was conducted on salinity

adjusted seep water (SW9 and SW11), and reference area seawater (SW37) samples collected on January 26, 2006. Follow-up testing was also performed using sea urchin (*Strongylocentrotus purpuratus*) gametes on salinity adjusted seep water (SW9, SW11, SW33, SW38, SW40) and reference area seawater (SW37) samples collected on February 10, 2006. Toxicity testing was conducted by Vizon Scitec of Vancouver, BC; and EVS/Golder of North Vancouver, BC. The lab toxicity reports are included in Appendix C. Detailed results of the water toxicity testing are presented below. Estimated IC20/EC20 and EC50 concentrations from the laboratory reports are summarized in Table 1.

3.1.1 September 17th 2005 Groundwater and Seep Water Samples

All Waste Coal Pile groundwater and seep water solutions were lethally toxic to Topsmelt. Complete Topsmelt mortality occurred in the lowest concentrations of groundwater tested within an hour for BH20 groundwater, and within a day for BH16 groundwater. Topsmelt 1-hour and 24-hour LC100s for BH20 and BH16, respectively, were < 4.5% (v/v) for BH20 and < 5% (v/v) for BH16. The seep waters were less toxic to Topsmelt than the groundwaters. After 24-hour exposure, almost all Topsmelt were still alive in the lowest concentrations of SW11 and SW9 seep water tested, 6% (v/v) and 5.5% (v/v), respectively. Some Topsmelt also survived in the lowest concentrations of SW11 and SW9 seep water to test-end, i.e. 7-days. Estimated Topsmelt 7-day LC50s (i.e. median lethal concentration causing mortality to 50% of test organisms) for seep water from SW11 and SW9 were 7.1% (v/v) and 6.6% (v/v), respectively. 7-day Topsmelt growth was reduced in surviving test organisms in the SW11 and SW9 solutions. In comparison, the full-strength reference area seawater sample had a 7-day LC50 for topsmelt of 100% (v/v), with 80% of test organisms surviving in the highest concentration of sample, 94.0% (v/v). 7-day Topsmelt growth was not reduced in surviving test organisms in the SW12 solutions.

Fertilization success for the sand dollar was completely inhibited for all concentrations of September 17th groundwater and seep water tested. In comparison, the full-strength reference area seawater sample did not inhibit fertilization and produced an estimated EC20 for the sand dollar of > 98.4% (v/v).

Given the toxicity observed at the lowest tested concentrations of groundwater and seep water, further repeat testing of the same samples was performed using higher dilutions. Repeat Topsmelt testing was initiated on September 27, 2005, ten days after sample collection (re-collection was not feasible at that time). Complete Topsmelt mortality again occurred in groundwater samples within 24-hours at a concentration of 5% (v/v) and 4.6% (v/v) groundwater from BH16 and BH20, respectively. Almost complete survival occurred after 7-days exposure in the next lowest concentration 0.1% (v/v) groundwater from BH16 and BH20. Almost complete survival also occurred after 7-days exposure in the highest concentrations of seep water tested: 6.2% (v/v) for SW11 and 5.6% (v/v) for SW9. Slight detoxification of the samples during the additional storage time may have occurred based on comparison of the original and repeat test results. Estimated Topsmelt 7-day LC50s for groundwater from BH16 and BH20 were 0.5% (v/v) and 0.6% (v/v), respectively. However, these estimates may be overly conservative based on the lack of test results for dilutions between 0.1% (v/v) and 5.0% (v/v). The resulting EC values are influenced by

the higher dilutions. 7-day Topsmelt growth was not reduced in surviving test organisms in any of the groundwater or seep water solutions.

Repeat sand dollar testing was initiated on September 29, 2005, twelve days after sample collection. Fertilization success for the sand dollar was reduced by 20% relative to controls (i.e. IC20) at estimated concentrations of 0.1% (v/v) and 0.2% (v/v) groundwater from BH16 and BH20, respectively. Estimated EC20s for the sand dollar were 0.6% (v/v) and 2.6% (v/v) seep water from SW11 and SW9, respectively.

3.1.2 January 26th and February 10th, 2006 Seep Water Samples

Based on test results for the September 17th, 2005 samples, a second round of testing using sand dollars and mussels (*Mytilus galloprovincialis*) was conducted. Both organisms (sand dollar and mussel) were the subject of testing using salinity adjusted seep water (SW11, SW9) and reference area seawater (SW37) for samples collected on January 26, 2006. Groundwater was not re-collected, as earlier testing illustrated that groundwater was highly toxic and further testing focussed on seep water, the media with a greater potential for contact with intertidal organisms.

Unfortunately, a control failure occurred in the sand dollar test, and sand dollar test results were not reported for the January 26th samples. Consequently, additional seep samples were collected on February 10, 2006 for further echinoderm testing. However, sand dollar embryos were not available in February, 2006. Consequently, this follow up testing was conducted using echinoderm sea urchin (*Strongylocentrotus purpuratus*) gametes. Both sand dollar and echinoderm gametes can be used in the Environment Canada EPS 1/RM/27 test method. Additionally, the February 10th sampling was expanded to include seep water from some additional locations. February 10th samples included seep water from stations SW11 and SW33 (North Face), and SW9, SW38B, SW40 (East Face), and from the reference area (SW37).

For the mussel tests on the January 26th samples, 48-h survival was statistically lower than control water in all test concentrations between 78.8% (v/v) and 0.2% (v/v) SW11 seep water, and in all test concentrations between 89.3% (v/v) and 3% (v/v) SW9 seep water. Shell development was abnormal in some of the surviving test organisms. Combined survival and normal shell development was estimated to be 20% lower than controls (i.e. IC20) at concentrations of 0.11% (v/v) SW11 seep water and 1.9% (v/v) SW9 seep water. Combined survival and normal shell development was not reduced in seawater from the reference area (SW37).

For the sea urchin tests on the February 10th samples, fertilization success was statistically lower than control water in all test concentrations down to 0.003% (v/v) SW11 seep water, 0.003% (v/v) SW33 seep water, 3% (v/v) SW9 seep water, 1% (v/v) SW38B seep water, 0.01% (v/v) SW40 seep water, and 1% (v/v) SW37 reference area sea water. The estimated IC20s for fertilization success were 0.004% (v/v) SW11 seep water, 0.001% (v/v) SW33 seep water, 1.26% (v/v) SW9 seep water, 0.29% (v/v) SW38B seep water, and 0.05% (v/v) SW40 seep water. Fertilization success was also reduced in seawater from the reference area (SW37) down to a concentration of 1% (v/v) seawater. The estimated IC20 for fertilization success was 0.72% (v/v) SW37 seawater.

Similar toxicity testing was performed using a laboratory prepared iron chloride solution. Sea urchin fertilization success was reduced by 20% relative to control (i.e. IC20) at a total iron concentration of 420 μg/L. Mussel 48-h survival and normal shell development was reduced by 20 % relative to controls (i.e. IC20) at a total iron concentration of 300 μg/L.

3.1.3 Summary of Water Toxicity Test Results

Waste Coal Pile groundwater was highly toxic to fish and sand dollars, and North Face groundwater appears to have been slightly more toxic than East Face groundwater. Daylighting seep water (a mixture of groundwater and seawater) was also toxic to all aquatic life tested (fish, sand dollars, sea urchins, mussels), though less toxic than groundwater. Consistent with groundwater toxicity, North Face seep water also appears to have been slightly more toxic than East Face seep water. Very broadly speaking, acute lethality to fish and larval mussels occurred in concentrations of less than 10% (v/v) seep water (1% to 10% v/v range). Sublethal effects (fertilization reduction) to echinoderm gametes (sand dollar and sea urchin) also occurred in the 1% to 10% v/v range, as well as at lower concentrations.

Iron is believed to be the primary toxicant in groundwater and seep water for the following reasons:

- Iron is the metal in groundwater and seep water that most significantly exceeds water quality guidelines for the protection of aquatic life (iron would have the highest hazard quotient under hazard quotient modelling).
- Most other metals that exceed water quality guidelines in the full-strength samples, would have been present at concentrations below water quality guidelines in the 1 to 10% v/v range which produced toxic effects. However, iron concentrations in the 1 to 10% v/v range would have been above the BC Working Water Quality Guidelines of 50 μg/L minimal risk level, and 300 μg/L severe effects level.
- Iron chloride reference toxicant results for tests performed alongside Waste Coal Pile samples revealed that total iron concentrations in the 300 to 420 μg/L range appear to be associated with IC20 level effects to the sea urchin (fertilization success) and mussel (survival and growth).

However, it must be noted that other metals in groundwater and seep water which exceeded water quality guidelines by several fold, or exceeded literature toxicity values, (e.g. aluminium, cadmium, manganese, nickel, zinc) may also have contributed to the toxicity observed, especially in the near full-strength test solutions.

3.2 Sediment Toxicity Test Results

Laboratory toxicity testing was performed on surficial sediment (0-15 cm) from both East Face and North Face locations. These sediments included material consisting of predominantly waste coal as well as material from seep areas with heavy iron staining. Tests performed included the 10-day amphipod survival and reburial inhibition assay per Environment Canada (EC) EPS 1/RM/35, and 20-day and 28-day polychaete survival and growth assays per PSEP and ASTM test methods.

Results of the sediment toxicity testing are summarized below. Test endpoints are shown in Table 2.

3.2.1 Amphipod Testing

Amphipod sediment toxicity testing was conducted on four marine sediment samples (S7, S10, S14, S15) collected from the Site in April 2004. Samples S7 and S10 were collected from the North Face, sample S15 was collected from the East Face, and sample S14 was collected from south of the Waste Coal Pile.

Amphipod survival ranged from 91% to 95% in Site samples, versus 98% and 99% in laboratory controls. Amphipod reburial success for surviving test organisms ranged from 99% to 100%. A single sample, S10 had statistically lower survival than the laboratory controls. However, although there was a statistically significant difference in amphipod survival in the S10 sample, it "passed" the toxicity test based on Environment Canada's pass/fail criteria. With respect to the amphipod test, Environment Canada states:

> *"In the absence of an acceptable reference sediment, the test sediment is judged to have failed this sediment toxicity test if the mean 10-day survival rate for the replicate groups of test organisms exposed to this sediment is more than 30% lower than that in the control sediment and is significantly different (page 23 EPS 1/RM/35, EC, 1998)."*

While the S10 sample's mean survival (91%) was significantly ($p < 0.05$) different from the laboratory control, survival was only 7 to 8% lower than the controls. The S10 sample would be deemed to have "passed" the amphipod test based on EC (1998) interpretation guidelines presented above. The results of the testing indicated that none of the four samples were particularly toxic to the amphipod (*E. estuarius*). The level of effect observed in all samples was also less than an EC20 level of effect, BC MOE's recommended benchmark/TRV for aquatic life risks.

3.2.2 Polychaete Testing

Laboratory sediment toxicity testing was also conducted on the four marine sediment samples (S7, S10, S14, S15) collected from the Site in April 2004. Polychaete survival was as follows: S7 (96%), S10 (96%), S14 (84%), and S15 (36%). Survival in the S15 sample was statistically lower than that in the laboratory controls (88% to 100%). Polychaete growth ranged from 0.13 mg/worm/day in the S15 sample to 0.53 mg/worm/day in the S14 sample. Growth in the S15 sample was statistically lower than that in the laboratory controls (0.38 to 0.48 mg/worm/day). The S15 sample was an iron stained sample collected from the East Face seep area.

Based on the observed toxicity in the S15 sample, a second round of toxicity testing was conducted for five additional sediment samples (S17, S18, S23, S24 and S26) collected in February 2005. Samples S17 and S18 were collected from the North Face, from areas where the highest concentrations of PAHs and metals have been measured during previous sampling events; these samples were entirely composed of waste coal. Sample S23 was collected from the iron-stained

area located on the North Face, and sample S24 was collected from the iron-stained area on the East Face. Sample S26 was collected from a reference site located to the south of the Waste Coal Pile (south of the Union Bay boat launch).

The polychaete worm survival and growth test was used for the February 2005 samples as this was the organism for which toxicity was pronounced in the April, 2004 samples. At the recommendation of MOE, the duration of the polychaete test was increased from 20 to 28 days to be more representative of a chronic test condition. The results of the testing indicated that none of the five samples were toxic to the polychaete (*N. arenaceodentata*) relative to the laboratory control samples. Survival in the Site samples ranged from 85% to 96%, versus 90% and 96% in the laboratory controls, and 100% in the S26 near-Site reference area. Growth in the Site samples ranged from 0.65 to 0.68 mg/worm/day in the Site samples, versus 0.66 and 0.68 mg/worm/day in the laboratory control samples, and 0.89 mg/worm/day in the near-Site reference area.

Since the April, 2004 S15 sample was toxic to polychaetes, while none of the February, 2005 iron stained samples were toxic to polychaetes, a third and final round of testing using the polychaete was conducted in September 2005 on six additional samples (S27, S28, S29, S30, S31 and S33). Samples S27, S28 and S29 were collected from the East Face, from the area of the iron-staining. Sample S29 was collected proximate to S15 and from the area of the heaviest iron-staining, at the location of the SW 9 seep. Samples S30 and S31 were collected from the North Face, and sample S33 was collected from a new, more distant reference area. The results of the testing indicated that none of the six samples were toxic to the polychaete (*N. arenaceodentata*) relative to the control samples. Survival in the Site samples ranged from 96% to 100%, versus 100% in the laboratory control, and 100% in the S33 reference area. Growth in the Site samples ranged from 0.52 to 0.77 mg/worm/day in the Site samples, versus 0.68 mg/worm/day in the laboratory control sample, and 0.5 mg/worm/day in the reference area.

3.2.3 Summary of Sediment Toxicity Results

Almost all Site sediments were non-toxic in laboratory toxicity tests using amphipods *E. estuarius* and polychaetes *N. arenaceodentata*. Localized toxicity was observed to the polychaete in a single sediment sample from an iron stained area on the East Face (S15); however, additional samples collected from this and other iron stained areas were non-toxic. Based on the results of sediment toxicity testing, contaminants in the sediments (solid phase) at the Site, including waste coal and iron stained sediments, do not appear to produce toxic effects to the benthic invertebrates tested – which are generally considered to be sensitive species representative of other infaunal invertebrates. Porewater and seep water toxicity in groundwater breakout areas is of much greater concern. Porewater toxicity was not apparent in the sediment toxicity tests for most of the samples from the iron stained areas, although it may have contributed to polychaete toxicity observed in the S15 sample. The original S15 sample was also field homogenized, whereas subsequent samples were laboratory homogenized, which may have also had an effect on the test results.

3.3 Aquatic Biological Surveys

Qualitative biological information on the presence and absence of species in the Site's intertidal areas was compiled during the collection of Site sediment, seep water, ocean water, and shellfish (April 2004 to April 2006) samples. A qualitative biological survey of both the low intertidal and the subtidal zones was conducted by Seacology during the diving program conducted during the period of January 31 to February 3, 2005. A qualitiative biological survey was also performed in Hart Creek in April, 2004.

3.3.1 Biological Surveys – Baynes Sound

The results of the intertidal surveys indicate that that there is a distinct difference in the diversity and abundance of intertidal flora and fauna between the North and East Faces of the Waste Coal Pile. A brief discussion of some of the flora and fauna observed in these areas is provided below.

Flora

- Eelgrass (*Zostera sp.*) and seaweed (predominantly green algae *Ulva. sp.* and *Enteromorpha sp.*, to a lesser extent red algae *Porphyra sp.*, and trace amounts of rockweed *Fucus sp.*) are fairly abundant in the lower intertidal and shallow subtidal area adjacent to the East Face of the Waste Coal Pile. These flora appear to be less abundant in the lower intertidal area to the north of the peninsula, less abundant in the East Face iron stained area, and absent along the North Face of the Waste Coal Pile (See Figure 2).

Fauna

- Invertebrates are present in the mid-intertidal to lower-intertidal areas along both the Waste Coal Pile's East and North Faces. However, fewer, and different, invertebrate species were present along the North Face than the East Face. Additionally, fewer and different invertebrate species appear to be present within the East Face seep area. The invertebrates observed to date along the East and North Faces of the Waste Coal Pile are as follows:

East Face:

- Varnish clams, *Nuttallia obscurata*
- Other clam species, including Littleneck clams, *Protothaca staminea*
- Barnacles, *Balanus sp.?*
- Oysters, *Crassostrea gigas?*
- Whelk
- Moon snails
- Sunstar
- Regular starfish
- Sand dollars, *Dendraster excentricus*
- Shore crabs, *Hemigrapsus oregonensis?*
- Kelp crabs
- Anemone

The density of sand dollars and shore crab, and possibly oysters, appears to be higher on either side of the East Face seep area than within the iron stained segment of the lower intertidal area. However, enumeration of population size and distribution has not been performed. Some of these species (e.g. moon snails, starfish) have not been observed in the East Face seep area.

North Side of the Waste coal pile:

- Varnish clams, *Nuttalia obscurata*
- Blue mud shrimp, *Upogebia pugettensis*
- Amphipods,
- Oysters, *Crassostrea gigas?*
- Shore crabs, *Hemigrapsus oregonensis?*
- Small (2-3 cm) sculpin and shore crab also observed in the mouth of Hart Creek

The observed differences in flora and fauna between locations are potentially attributed to a variety of factors, including:

- *Different intertidal zones*. At low tide the ocean's edge does not follow the perimeter of the Waste Coal Pile (See Figure 2). Much of the area north of the Waste Coal Pile appears to be mid-intertidal to upper-intertidal. There is a steeper gradient along the East Face, and low-intertidal habitat runs parallel to this Face within 125 m of the Waste Coal Pile. Algae and invertebrates are often found in distinct intertidal zones; this concept is known as zonation. The species composition present in a given zone is determined by the ability of each to survive while not submersed in water during various tide stages, as well as competitive forces between species. Most seaweed species prefer the mid and low–intertidal zones rather than the upper–intertidal zone. The general absence of vegetation over much of the intertidal zone north of the Site may be partially attributable to zonation.
- *Different sediment grain sizes and composition.* Sediments along the East Face of the Waste Coal Pile appear to be slightly coarser than those on the North Face. Sediments off of the North Face of the Waste Coal Pile appear to be darker, and contain a higher composition of waste coal than those off the East Face of the Waste Coal Pile.
- *Groundwater Contaminants.* Groundwater discharging from the Waste Coal Pile could be altering the abundance of flora inhabiting portions of the North Face of the Waste Coal Pile as well as the East Face of the Waste Coal Pile. Higher eelgrass and macroalgae densities appear to exist on either side of the iron stained area along the Waste Coal Pile's East Face, as visible in Figure 2 and during wading through the intertidal areas. However, less vegetation is also visible at the south end of the Site, and north of the Site distant from iron staining and seep areas. Whether seep waters are inhibiting or enhancing eelgrass abundance (or both) is not known.
- *Different salinities.* Hart Creek discharges a large volume of fresh water across the North Face of the Waste Coal Pile during non-low flow periods. The lower salinity of this discharge could influence the floral and faunal communities on the North Face.

Floral abundance will also affect invertebrate communities, as algae and eelgrass offer both food and cover for invertebrates. Several of the organisms present along the East Face are algal grazers (e.g. kelp crabs, sand dollars) and the lack of these species on the North Face may be related to the lack of flora in this area. Some of the species observed to be present along the North Face, (e.g. mud shrimp and varnish clams) are less reliant on algae as a food source; mud shrimp are detritivores and varnish clams are capable of pedal feeding (gathering detritus from the sediment using their foot).

During the subtidal survey conducted by Seacology during the period of January 31 to February 3, 2005, five distinct habitats were observed including: the low-intertidal waste coal, an eelgrass bed, the shallow-subtidal waste coal, the waste coal slope and the offshore grey silts. Evidence of at least forty-three taxa were observed during a survey of these areas. One plant taxon (a drifting *Laminariale*, kelp), three invertebrate taxa (all medusae, jelly-fish) and two marine mammals (harbour seal and Stellers sea lion) were observed. A description of the five habitats is provided below (taken from Seacology, 2005); a complete list of the various taxa observed during the survey is provided in Appendix D.

- Low intertidal waste coal debris habitat (north side of Waste Coal Pile) – characterized by sand, gravel and pebble sized waste coal, very few epifauna observed. Horse clam siphons, occasional shore crabs, the hairy hermit crab, a small patch of sand dollars, barnacles, egg laying *Nucella* sp. snails, bivalve shells and red filamentous algae were observed.
- Eelgrass habitat – an extensive eelgrass bed, noted to be in good condition, is present in the low intertidal and shallow subtidal zones. Iron oxide staining of sediments in the area of the bed was noted. The eelgrass was predominantly *Zostera marina*.
- Shallow subtidal and intertidal waste coal habitat – a significant bed of horse clams was observed in the shallow subtidal and intertidal bench. Moon snails are a clam predator and were also observed in abundance in this area. Predator sea stars, including the pink star, the sunflower star and the mottled star were also common.
- Waste coal debris slope habitat – a steep subtidal slope covered in pebble sized waste coal with a small percentage of sand and silt is present. The pebble sized substrate did not appear to favour colonization by epifauna. A large Dungeness crab was observed buried in this substrate and juvenile crabs and red rock crabs were also observed.
- Offshore grey silt habitat – soft grey sediments with evidence of abundant infauna are present; substrates such as large woody debris, pebble to boulder sized rocks, bivalve shells, bivalve siphons and polychaete parchment tubes are encrusted with epifauna including Serpulidae calcareous tube worms, the green false-jingle, barnacles and Plumose anemones. Occasional observations of the sunflower star or the pink star were also made.

3.3.2 Biological Survey - Hart Creek

In April 2004, benthos were collected and roughly identified in the vicinity of Hart Creek sampling stations WC1, WC2, and WC4 (see Figure 3 for station locations). Few biota could be collected at WC1 after 20 minutes of sampling. Those biota present at WC1 included a few small caddisfly larvae, oligochaetes, and a marine polychaete. The general absence of freshwater aquatic invertebrates (or marine invertebrates) at this station likely reflects daily variations in salinity and the intrusion of saline water at mid to high tides, as evidenced by the collection of a marine polychaete, as well as salinity measurements in the area.

A school of small (3-4 cm) fish (appeared to be salmonid) was observed in the creek between stations WC1 and WC2. In addition, a moderate number of mayfly larvae and caddisfly larvae were collected at WC2 after 20 minutes of sampling. Larger caddisfly larvae were observed atop rocks at station WC3. Freshwater aquatic invertebrates were more abundant and more diverse at station WC4, upstream of the Waste Coal Pile and the Highway 19A bridge than at WC2. Specifically, swimming mayfly larvae, caddisfly larvae, cranefly larvae, and two-tailed mayfly larvae were present at WC4, and approximately three times the number of organisms were collected at WC4 than at WC2 in half the sampling time (10 minutes).

In-situ water quality indicators (pH, DO, conductivity) were similar at all four stations. The cause of the differences in biota is unknown; however seawater may also periodically reach the WC2 and WC3 stations at high (+ 4 m) tides or during storm surges. This, along with differences in substrates between the two areas, are likely responsible for the observed differences.

4.0 CONCLUSIONS

Under baseline conditions, the majority of non-cancer and cancer risk estimates for human intertidal recreators are close to, or below, the CSR risk-based standards (HQ = 1 and ILCR = 1.0E-05). Those COPCs with risk estimates in excess of risk-based standards include cadmium, arsenic, and iron (HQs) and arsenic (ILCR). Intertidal risk estimates in excess of CSR risk-based standards are predominantly associated with shellfish ingestion, and are considered to be similar to Baynes Sound and coastal BC risk levels.

Waste Coal Pile groundwater and seep water were toxic (lethally and sublethally) to aquatic life at concentrations ranging from < 1% to 10% v/v. Qualitative biological observations indicate that the Site seep water may be posing some adverse effects to the populations of various aquatic life in and around groundwater breakout areas (e.g. sand dollars, eelgrass).

The information presented within this report indicates that some type or types of remedial option(s) should be explored for the Waste Coal Pile, rather than leaving the area in its present state. SEACOR has proposed capping of the Waste Coal Pile with clean soil, primarily to reduce rainfall infiltration and associated groundwater discharges, thereby reducing intertidal area aquatic life risks. Over time, a reduction in seep water iron concentrations may also reduce the recreator (toddler) hazard index for iron (HQ = 1.5 to 2.2 for 3 and 5 days/week usage) to a value below one, on account of potentially reduced concentrations in shellfish, seep water, and precipitate. Shellfish cadmium and arsenic ingestion risk levels, considered to be similar to Baynes Sound and other coastal BC locations, would likely remain at or near present levels. Other intertidal area risks (e.g. sediment ingestion arsenic ILCR = 1.9E-05 maximum value) would likely remain as is in the absence of intertidal sediment remediation. However, these risk calculations were based on maximum sediment concentrations and repeated chronic exposure to maximum concentrations is unlikely. The maximum sediment arsenic concentration of 49.2 μg/g is also below the CSR Schedule 5 PL matrix standard for human “intake of contaminated soil” (100 μg/g As). Although not calculated, risks using 95% UCLM or mean concentrations would be lower.

5.0 PROFESSIONAL STATEMENT

This Revised Problem Formulation and Preliminary Quantitative Risk Assessment, Union Bay Waste Coal Pile report, dated September 8, 2006 was prepare in accordance with all requirements in the Environmental Management Act and the Contaminated Sites Regulation. The authors of the report, Mr. Michael McLeay and Mr. Sam Reimer have 24 years of combined experience in the assessment and remediation of contaminated sites and are familiar with the works carried out at the Site.

6.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SEACOR for West Fraser and Kensington. It is intended for the sole and exclusive use of West Fraser and Kensington and its authorized agents for the purpose(s) set out in this report. Any use of, reliance on or decision made based on this report by any person other than West Fraser and Kensington for any purpose, or by West Fraser and Kensington for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such other person or West Fraser and Kensington. West Fraser and Kensington and SEACOR make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

The investigation undertaken by SEACOR with respect to this report and any conclusions or recommendations made in this report reflect SEACOR's judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report, on information available at the time of preparation of this report, on the interpretation of data collected from the field investigation, and on the results of laboratory analyses, which were limited to the quantification in select samples of those substances specifically identified in the report. This report has been prepared for specific application to this site and it is based, in part upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. SEACOR expresses no warranty with respect to the accuracy of the laboratory analyses, methodologies used, or presentation of analytical results by the laboratory. Actual concentrations of the substances identified in the samples submitted may vary according to the extraction and testing procedures used.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the site may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Nothing in this report is intended to constitute or provide a legal opinion. Other than as required by provisions of the BC Contaminated Sites Regulation and the BC Environmental Management Act, SEACOR makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

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Regulatory authorities are authorized to rely on the information contained in this report for the purpose of determining whether West Fraser and Kensington is fulfilling or has fulfilled its obligations with respect to the applicable environmental statutory or regulatory requirements. Any use or reliance upon this report by any other third party in not authorized (without West Fraser and Kensington's and SEACOR's consent) and is at the sole risk of such third party.

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TABLE 1. SUMMARY OF SEEP AND GROUNDWATER TOXICITY TESTS, UNION BAY WASTE COAL PILE

	Sand Dollar Gamete Fertilization	Sand Dollar Gamete Fertilization	Sea Urchin Gamete Fertilization	48-h Larval Mussel		7-day Topsmelt			
				Survival	Survival & Normal Dvlp.	Survival	Growth	Survival	Growth
Sampling Date	17-Sep-05	17-Sep-05	10-Feb-06	26-Jan-06	26-Jan-06	17-Sep-05	17-Sep-05	17-Sep-05	17-Sep-05
Test Start Date	20-Sep-05	29-Sep-05	13-Feb-06	01-Feb-06	01-Feb-06	20-Sep-05	20-Sep-05	29-Sep-05	29-Sep-05
	IC20	IC20	IC20	IC20	IC20	EC20	IC20	EC20 or EC50	IC20
	% Sample	% Sample	% Sample	% Sample	% Sample	% Sample	% Sample	% Sample	% Sample
Seep Water									
East Face									
SW9	ND	2.6	1.26	2.2	1.9	EC20 = 4.2	2.4	EC20 > 5.6	> 5.6
SW40			0.05						
SW38			0.29						
North Face									
SW11	ND	0.6	0.004	0.2	0.1	EC50 = 7.1	3	EC50 > 6.2	> 6.2
SW33			0.001						
Groundwater									
East Face									
BH20	ND	0.2 [a]				EC20 < 4.5	0.9	EC50 = 0.6 [a]	0.9 [a]
North Face									
BH16	ND	0.1 [a]				EC20 < 5	1	EC50 = 0.5 [a]	1.1 [a]
Reference Area Seawater									
SW12	> 98.4					EC20 > 100	> 100		
SW37			0.72	> 88.2	> 88.2				
IC20 Using FeCl Solution			430 ug/L Fe	500 ug/L Fe	300 ug/L Fe				

ND = Not determined. Initial testing discarded. Apparent complete mortality. Re-tested using different dilution series (higher dilutions).

[a] SEACOR believes test endpoint to have limited accuracy on account of large spread between two test concentrations which were above and below test endpoint. Actual concentration producing this level of effect may have been a higher concentration.

EC20 = Effective concentration affecting 20% of organisms.

For Topsmelt test, EC20 for survival endpoint is identical to LC20, i.e. concentration killing 20% of test organisms.

For mussel test, IC20 for survival endpoint is identical to LC20, i.e. concentration killing 20% of test organisms.

IC20 = Concentration inhibiting test endpoint by 20%. E.g. Sand dollar IC20 = concentration reducing fertilization success by 20%.

TABLE 2: SUMMARY OF SEDIMENT TOXICITY TEST RESULTS, UNION BAY WASTE COAL PILE

	10-day Amphipod Survival & Reburial		20-day Polychaete Survival & Growth	
Sample ID	Survival	Reburial	Survival	Growth
08-Apr-04	%	%	%	mg/worm/day
S7	93	99	96	0.44
S10	**91***	100	96	0.42
S14	92	100	84	0.53
S15	95	100	**36***	**0.13***
Control-1	99	100	88	0.38
Control-2	98	100	100	0.48

	28-day Polychaete Survival & Growth	
Sample ID	Survival	Growth
03-Feb-05	%	mg/worm/day
S17	85	0.65
S18	94	0.67
S23	98	0.68
S24	96	0.68
S26 (Near Site Reference Area)	100	0.89
Control-1	96	0.68
Control-2	90	0.66

	28-day Polychaete Survival & Growth	
Sample ID	Survival	Growth
16-Sep-05	%	mg/worm/day
S27	100	0.52
S28	96	0.77
S29 (at SW9, close to S15)	100	0.7
S30	100	0.65
S31	96	0.75
S33 (Distant Reference Area)	100	0.5
Control	100	0.68

* Statistically significant difference relative to Control



REFERENCED FROM:
DEP'T OF ENERGY MINES & RESOURCES MAPPING BRANCH
92F/10

KILOMETRES

0 0.5 1 2 3 km

△ TIDE POOL WATER SAMPLE (SEACOR AUG./SEPT. 2005)

□ OCEAN WATER SAMPLE (SEACOR)

● SEDIMENT SAMPLE (SEACOR, SEPT. 2005)

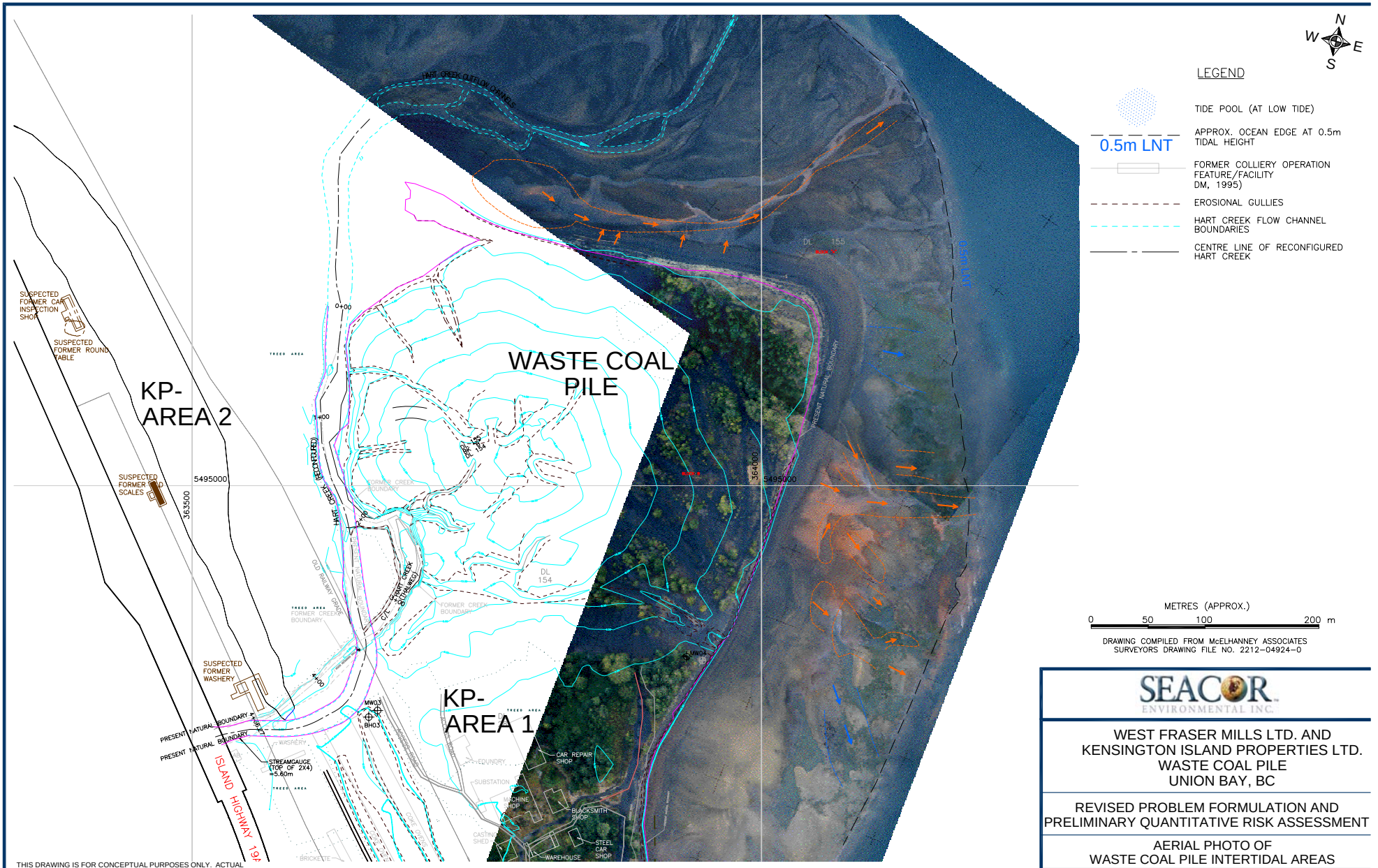
SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

WASTE COAL PILE AND REFERENCE AREA SAMPLE LOCATIONS

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	06/14/06	201-01022-01-C1	201.01022.01	MM	TMS	1



DRAWING COMPILED FROM McELHANNEY ASSOCIATES SURVEYORS DRAWING FILE NO. 2212-04924-0

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

AERIAL PHOTO OF WASTE COAL PILE INTERTIDAL AREAS

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	06/14/06	201-01022-01-C2	201.01022.01	MM	TMS	2

WASTE COAL PILE

KP–AREA 1

HART CREEK OUTFLOW CHANNELS

HART CREEK (RECONFIGURED)

BLOCK A/BLOCK B BOUNDARY

BLOCK B

BLOCK C

DL 155 BLOCK "A"

DL 154

DL 28

0.5m LNT

PRESENT NATURAL BOUNDARY

FORMER CREEK BOUNDARY

TREED AREA

OLD RAILWAY GRADE

HIGHWAY 19A

WASHERY

STREAMGAUGE (TOP OF 2X4) =5.60m

EQUIPMENT SHOP

CAR REPAIR SHOP

SUBSTATION

MACHINE SHOP

BLACKSMITH SHOP

CASTING SHED

STEEL CAR SHOP

WAREHOUSE

BRICKETTE PLANT

COKE OVENS

ACCESS ROAD

ASSESSED AREA

OIL

364000

5495000

0+00

1+00

2+00

3+00

4+00

S1 S2 S3 S4 S5 S10 S11 S12 S13 S15 S16 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31

CL1 CL2 CL3 CL4 CL5

IC1 IC2 IC3 IC4

SW1* SW2 SW3 SW4 SW5 SW6 SW7 SW8 SW9 SW10 SW11 SW13 SW14 SW15 SW16 SW17 SW18 SW19 SW20 SW21 SW22 SW23 SW24 SW25 SW26 SW27 SW28 SW29 SW30 SW31 SW32 SW33 SW34 SW35 SW36 SW38 SW39 SW40 SW41 SW42 SW43 SW44

PSED1 PSED2 PSED3 PSED4 PSED5

SHEEN(N) SHEEN(E)

OYS1 OYS2 OYS3

MDPW3 MDPW4 MDPW5

OW1 OW2 OW3 OW4 OW5 OW6 OW7 OW8

PW1 PW2

MW100 MW102 MW103 MW104 MW105 MW106

BH1 BH2 BH3 BH4 BH5 BH6D BH6S BH7D BH7S BH8D BH8S BH9 BH10 BH11 BH12 BH13 BH14 BH15 BH16 BH17 BH18 BH19 BH20 BH21 BH22

BHK–1 BHK–2 BHK–3 BHK–4 BHK–9 BHK–10 BHK–11 BHK–12 BHK–13 BHK–14 BHK–17 BHK–18 BHK–19 BHK–20 BHK–21 BHK–22

TP01 TP02 TP03 TP04 TP05 TP07 TP08 TP09 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP18 TP19 TP20 TP24 TP104 TP105 TP106 TP107 TP108 TP109 TP110 TP111 TP112

SS001 SS002 SS003 SS004 SS005 SS006 SS009(2) SS011 SS012 SS013 SS014 SS017 SS018 SS019 SS020

WC1 WC2 WC3

C2 C3 C4 C5 C12 C13 C14

KP

LEGEND

- SW4 — SW (SEEP WATER) SAMPLE (SEACOR)
- SW13 — OW (OCEAN WATER) SAMPLE (SEACOR)
- PW1 — PW (PORE WATER) SAMPLE (SEACOR, JAN. 2006)
- MDPW3 — MDPW (MULTI–DEPTH POREWATER) SAMPLE (SEACOR, FEB. 2006)
- Ⓢ — SHELLFISH (oyster) TISSUE SAMPLE (SEACOR, AUG. 2005)
- Ⓢ — SHELLFISH (clam) TISSUE SAMPLE (SEACOR, 2005)
- SHEEN — SHEEN SAMPLE (SEACOR, FEB. 2006)
- ○ — QUANTITATIVE FLOW MEASUREMENT
- X — QUALITATIVE FLOW ESTIMATE
- TIDE POOL (AT LOW TIDE)
- 0.5m LNT — APPROX. OCEAN EDGE AT 0.5m TIDAL HEIGHT
- IRON STAINED SEEP AREAS WITH FLOW DIRECTION
- NON–IRON STAINED DIFFUSE SEEP AREAS WITH FLOW DIRECTION
- © — SUBTIDAL SEDIMENT CORE (SEACOR, 2005)
- KP — KENSINGTON PROPERTY
- * — INDICATES SAMPLE LOCATIONS ARE APPROXIMATE
- (2) — SAMPLES WERE COLLECTED MAY 2005
- FORMER COLLIERY OPERATION FEATURE/FACILITY
- BOREHOLE LOCATION (SEACOR)
- BOREHOLE LOCATION (NDM)
- BOREHOLE LOCATION COMPLETED AS A MONITOR WELL (SEACOR, 2004 & 2005)
- BOREHOLE LOCATION COMPLETED AS A MONITOR WELL (NDM, 1995)
- FORMER MONITORING WELL (DESTROYED)
- TEST PIT LOCATION (SEACOR, 2005)
- TEST PIT LOCATION (NDM, 1995)
- SEDIMENT SAMPLE (SEACOR, 2004 & 2005)
- SURFACE SOIL SAMPLE (SEACOR, 2004 & 2005)
- WC1 — COMBINED SEDIMENT/SURFACE WATER SAMPLING LOCATION (SEACOR, 2004 & 2005)
- INTERTIDAL SEDIMENT CORE (SEACOR, 2005)
- PSED — PRECIPITATE (FERICRETE) SAMPLE (SEACOR FEB. 2006)
- EROSIONAL GULLIES
- HART CREEK FLOW CHANNEL BOUNDARIES
- CENTRE LINE OF RECONFIGURED HART CREEK

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

METRES (APPROX.)
0 25 50 100 150 m

DRAWING COMPILED FROM McELHANNEY ASSOCIATES SURVEYORS DRAWING FILE NO. 2212–04924–0

SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND
KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

SITE PLAN - SAMPLE LOCATIONS

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG.
AS SHOWN	06/14/06	201-01022-01-C3	201.01022.01	EC	TMS	3

WASTE COAL PILE

KP - AREA 1

HART CREEK OUTFLOW CHANNELS

HART CREEK (RECONFIGURED)

FORMER CREEK BOUNDARY

BLOCK A/BLOCK B BOUNDARY

BLOCK "A"

BLOCK B

BLOCK C

DL 155

DL 154

DL 28

PRESENT NATURAL BOUNDARY

0.5m LNT

364000

5495000

OLD RAILWAY GRADE

HIGHWAY 19A

BH ID	Depth (m)	PAH	Metals
BH 6D	0.0-0.9	Naph (11.9) , Phen (6.98)	As (173)
BH 6D	7.3 - 8.4	---	---

BH ID	Depth (m)	PAH	Metals
BH 3	2.4-3.4	Naph (7.27), Phen (7.27)	As (37.5)
BH 3	6.1-6.9	Naph (9.49), Phen (11.1)	As (32.8)
BH 3	7.3-8.2	Naph (13.8), Phen (11.3)	As (30.9)
BH 3	12.2-13.1	Phen (6.12)	---
BH 3	13.1-14.0	n.d.	---
BH 3	16.2-17.4	---	---

BH ID	Depth (m)	PAH	Metals
BH 2	2.1-3.1	Naph (8.1), Phen (8.11)	As (87.4), Cu (190)
BH 2	6.7-7.6	Phen (6.28)	As (34.1)
BH 2	11.6-12.5	Phen (6.51)	---
BH 2	14.3-15.2	---	---
BH 2	15.9-16.8	---	---

BH ID	Depth (m)	PAH	Metals
BH 5	1.2-2.1	Naph (8.19), Phen (8.5)	As (26.1), Cu (106)
BH 5	4.3-5.2	Naph (11.9), Phen (9.14)	As (26.1)
BH 5	7.3-8.2	Naph (5.33), Phen (6.3)	As (23.1)
BH 5	10.4-11.3	---	Cu (119)
BH 5	13.4-14.3	---	---
BH 5	19.5-20.4	---	---
BH 5	22.6-23.5	---	---

BH ID	Depth (m)	PAH	Metals
BH 4	3.7-4.6	---	Cu (274)
BH 4	7.3-8.2	Phen (5.95)	---
BH 4	10.2-11.0	---	---
BH 4	13.4-14.3	---	---

BH ID	Depth (m)	PAH	Metals
BH 8D	0.0-0.9	Naph (7.88)	As (67.5), Cu (142)
BH 8D	4.9-5.8	---	---

BH ID	Depth (m)	PAH	Metals
BH 1	2.1-3.1	Naph (5.61), Phen (5.63)	As (127)
BH 1	6.7-7.6	---	---
BH 1	11.3-12.2	---	---
BH 1	12.2-12.8	---	---

BH ID	Depth (m)	PAH	Metals
BHK-2	1.1-1.4	---	---

BH ID	Depth (m)	PAH	Metals
BHK-3	1.5-2.1	---	---
BHK-3	3.8-4.4	---	As (173)

BH ID	Depth (m)	PAH	Metals
BH 7S	0.0-0.9	Naph (5.65), Phen (8.95)	As (30.3)
BH 7S	3.1-3.7	Phen (8.8)	As (31.3)

BH ID	Depth (m)	PAH	Metals
BHK-12	2.3-2.9	---	---

BH ID	Depth (m)	PAH	Metals
BHK-13	0.8-1.4	Phen (8.81)	---

BH ID	Depth (m)	PAH	Metals
BHK-1	0.8-1.4	---	---

IN CHEMISTRY TABLES:

" --- " INDICATES THAT CONCENTRATIONS WERE BELOW CSR RL

n.d. NO DATA, SAMPLE WAS NOT SUBMITTED FOR ANALYSIS OF PARAMETER

As – Arsenic
Cu – Copper
Naph – Naphthalene
Phen – Phenanthrene
PAH – polycyclic aromatic hydrocarbons

NOTE (1): ALL ANALYTICAL RESULTS REPORTED IN mg/kg

LEGEND

- SW4 — SW (SEEP WATER) SAMPLE (SEACOR)
- SW13 — OW (OCEAN WATER) SAMPLE (SEACOR)
- PW1 — PW (PORE WATER) SAMPLE (SEACOR, JAN. 2006)
- MDPW3 — MDPW (MULTI-DEPTH POREWATER) SAMPLE (SEACOR, FEB. 2006)
- (S) — SHELLFISH (oyster) TISSUE SAMPLE (SEACOR, AUG. 2005)
- (S) — SHELLFISH (clam) TISSUE SAMPLE (SEACOR, 2005)
- SHEEN — SHEEN SAMPLE (SEACOR, FEB. 2006)
- QUANTITATIVE FLOW MEASUREMENT
- X — QUALITATIVE FLOW ESTIMATE
- TIDE POOL (AT LOW TIDE)
- 0.5m LNT — APPROX. OCEAN EDGE AT 0.5m TIDAL HEIGHT
- IRON STAINED SEEP AREAS WITH FLOW DIRECTION
- NON-IRON STAINED DIFFUSE SEEP AREAS WITH FLOW DIRECTION
- © — SUBTIDAL SEDIMENT CORE (SEACOR, 2005)
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- * — INDICATES SAMPLE LOCATIONS ARE APPROXIMATE
- (2) — SAMPLES WERE COLLECTED MAY 2005
- FORMER COLLIERY OPERATION FEATURE/FACILITY
- BOREHOLE LOCATION (SEACOR)
- BOREHOLE LOCATION (NDM)
- BOREHOLE LOCATION COMPLETED AS A MONITOR WELL (SEACOR, 2004 & 2005)
- BOREHOLE LOCATION COMPLETED AS A MONITOR WELL (NDM, 1995)
- FORMER MONITORING WELL (DESTROYED)
- TEST PIT LOCATION (SEACOR, 2005)
- TEST PIT LOCATION (NDM, 1995)
- SEDIMENT SAMPLE (SEACOR, 2004 & 2005)
- SURFACE SOIL SAMPLE (SEACOR, 2004 & 2005)
- WC1 — COMBINED SEDIMENT/SURFACE WATER SAMPLING LOCATION (SEACOR, 2004 & 2005)
- INTERTIDAL SEDIMENT CORE (SEACOR, 2005)
- PSED — PRECIPITATE (FERICRETE) SAMPLE (SEACOR FEB. 2006)
- EROSIONAL GULLIES
- HART CREEK FLOW CHANNEL BOUNDARIES
- CENTRE LINE OF RECONFIGURED HART CREEK
- GREEN INDICATES CONCENTRATIONS ARE BELOW APPLICABLE CSR STANDARDS
- RED INDICATES CONCENTRATIONS IN EXCESS OF APPLICABLE CSR STANDARDS
- NOTE: SAMPLES THAT HAVE NOT BEEN COLOUR CODED HAVE NO AVAILABLE DATA

METRES (APPROX.)
0 25 50 100 150 m

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

DRAWING COMPILED FROM McELHANNEY ASSOCIATES SURVEYORS DRAWING FILE NO. 2212-04924-0

SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND
KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

SOIL CHEMISTRY RESULTS - WASTE COAL PILE

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	06/14/06	201-01022-01-C4	201.01022.01	MM	TMS	4

WASTE COAL PILE

KP AREA 1

BH17	Metals	Sulphate
22-Feb-05	Cd, Cr, Co, Cu, Ni, Zn	X
11-Sep-05	Cd, Cr, Co, Cu, Ni,Zn	X
14-Dec-05	Cr, Co, Cu, Zn	X
4-Apr-06 (L Tide)	Cd, Co, Cu, Ni, Zn	n/a

BH6D	Metals	Sulphate
3-Sep-04	Cd, Co, Cu, Ni, Zn	X
11-Sep-05	Cd, Co, Cu, Ni, Zn	X

BH6S	Metals	Sulphate
3-Sep-04	Cd, Co, Cu, Ni, Zn	X
04-Feb-05	Cd, Co, Cu, Ni, Zn	X
11-Sep-05	Cd, Co, Cu, Ni, Zn	X

BH16	Metals	Sulphate
22-Feb-05	Cd, Co, Ni, Zn	X
11-Sep-05	Cd, Co, Cu, Ni, Zn	X
18-Sep-05	Cd, Co, Cu, Ni, Zn	X
13-Oct-05	Cd, Co, Cu, Ni, Zn	n/a
14-Dec-05 (H Tide)	Cd, Co, Cu, Ni, Zn	X
13-Dec-05 (L Tide)	Cd, Co, Cu, Ni, Zn	X
26-Jan-06	Cd, Co, Cu, Ni, Zn	n/a
4-Apr-06 (L Tide)	Cd, Co, Cu, Ni, Zn	n/a

BH22	Metals	Sulphate
11-Sep-05	Cd, Co, Ni, Zn	X
14-Dec-05	Cd, Co, Cu, Ni, Zn	X

BH15	Metals	Sulphate
22-Feb-05	Co, Ni, Zn	X
11-Sep-05	Co, Ni, Zn	X
14-Dec-05	Co, Ni, Zn	X
04-Apr-06 (L Tide)	Cd, Co, Ni, Zn	n/a

BH21	Metals	Sulphate
11-Sep-05	Co, Ni, Zn	X
14-Dec-05	Co, Cu, Ni, Zn	n/a
4-Apr-06 (L Tide)	Co, Cu, Zn	n/a

BH3	Metals	Sulphate
28-Jan-04	–	X
3-Sep-04	Cd, Co, Ni, Zn	X

BH2	Metals	Sulphate
28-Jan-04	Co, Ni	X
3-Sep-04	Co, Ni, Zn	X

BH5	Metals	Sulphate
28-Jan-04	Co, Ni, Zn	X
3-Sep-04	Co, Ni, Zn	X

BH8S	Metals	Sulphate
04-Apr-06 (L Tide)	Cd, Ni, Zn	–

BH8D	Metals	Sulphate
3-Sep-04	Co, Ni, Zn	X
11-Sep-05	Co	X
14-Dec-05	Co	X
04-Apr-06 (L Tide)	Co, Zn	n/a

BH1	Metals	Sulphate
28-Jan-04	Cd, Co, Cu, Ni, Zn	X
3-Sep-04	Co, Cu, Ni, Zn	X

BH4	Metals	Sulphate
28-Jan-04	Cd, Co, Ni, Zn	X

BH20	Metals	Sulphate
11-Sep-05	Cd, Co, Cu, Ni, Zn	X
18-Sep-05	Cd, Co, Ni, Zn	X
13-Oct-05	Cd, Co, Ni, Zn	n/a
14-Dec- 05 (H Tide)	Cd, Co, Cu, Ni, Zn	--
13-Dec-05 (L Tide)	Cd, Co, Cu, Ni, Zn	X
26-Jan-06	Cd, Co, Cu, Ni, Zn	n/a
4-Apr-06 (L Tide)	Cd, Co, Cu, Ni, Zn	n/a

BH7D	Metals	Sulphate
22-Feb-05	Cu	--

BHK-3	Metals	Sulphate
4-Feb-05	–	--

LEGEND

- FORMER COLLIERY OPERATION FEATURE/FACILITY
- BOREHOLE LOCATION (SEACOR)
- BOREHOLE LOCATION (NDM)
- BOREHOLE LOCATION COMPLETED AS A MONITOR WELL (SEACOR, 2004 & 2005)
- BOREHOLE LOCATION COMPLETED AS A MONITOR WELL (NDM, 1995)
- FORMER MONITORING WELL (DESTROYED)
- -- INDICATES CONCENTRATIONS ARE BELOW THE CSR AWM AND AWF STANDARDS
- CSR AWM — CONTAMINATED SITES REGULATION, MARINE AQUATIC LIFE STANDARDS
- CSR AWF — CONTAMINATED SITES REGULATION, FRESHWATER AQUATIC LIFE STANDARDS
- GREEN INDICATES CONCENTRATIONS ARE BELOW CSR AWM AND CSR AWF STANDARDS
- Cu, Ni — BLUE INDICATES CONCENTRATIONS IN EXCESS OF CSR AWM STANDARDS
- Cu, Ni — RED INDICATES CONCENTRATIONS IN EXCESS OF CSR AWM AND CSR AWF STANDARDS
- Cu, Ni — MAGENTA INDICATES THAT THE DETECTION LIMITS EXCEED THE CSR AWM AND/OR AWF STANDARDS
- n/a — PARAMETER NOT ANALYSED ON DATE INDICATED
- *Cr* — *"italicized"* INDICATES CONCENTRATIONS IN EXCESS OF CSR AWF STANDARDS

NOTE (1): ALL GROUNDWATER SAMPLES SUBMITTED FOR ANALYSIS OF LEPH/HEPH (OR EPH), PAHs AND/OR VOCs WERE BELOW THE BC CSR AWM AND AWF STANDARDS

NOTE (2): ALL METAL ANALYTICAL RESULTS REPORTED IN µg/L

NOTE (3): ALL SULPHATE ANALYTICAL RESULTS REPORTED IN mg/L

IN CHEMISTRY TABLES:

As – Arsenic
Cd – Cadmium
Co – Cobalt
Cr – Chromium
Cu – Copper
Pb – Lead
Ni – Nickel
Se – Selinium
Th – Thallium
Zn – Zinc

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METRES (APPROX.) 0 25 50 100 150 m

DRAWING COMPILED FROM McELHANNEY ASSOCIATES SURVEYORS DRAWING FILE NO. 2212–04924–0

SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

SITE GROUNDWATER CHEMISTRY RESULTS

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG.
AS SHOWN	06/14/06	201-01022-01-C5	201.01022.01	EC	TMS	5

WASTE COAL PILE

KP-AREA 1

ID	Depth (m)	PAH	Metals
S17	0-0.15	Ace (<0.2), Acen (<0.2), Anth <0.2), Flu (<0.2), 2 M/Naph (7.7), Naph (4.01), Phen (4.41), Chry (0.569)	As (40.7), Hg (0.513)

ID	Depth (m)	PAH	Metals
IC1 S4	2.0 - 2.8	Ace (0.334), Acen (0.107), Anth (0.16), Flu (0.618), 2 M/Naph (2.02), Naph (0.997), Phen (3.52)	—
IC1 S6	3.0 - 3.5	—	—

ID	Depth (m)	PAH	Metals
S21	0 - 0.15	Ace (0.216), Acen (0.148), Flu (0.22), 2 M/Naph (6.28), Naph (3.47), Phen (3.89), Chry (<0.58)	As (49.2), Cu (94.3), Hg (0.558)

ID	Depth (m)	PAH	Metals
S7	0 - 0.15	Ace (<0.3), Acen (<0.2), Anth (0.227), Flu (<0.3), Naph (4.43), Phen (6.24), Chry (<0.837)	Hg (0.462)
S7	0.15-0.4	Ace (<0.2), Acen (<0.5), Flu (<0.2), Naph (2.49), Phen (3.82)	—

ID	Depth (m)	PAH	Metals
S18	0-0.15	Ace (<0.3), Acen (<0.2), Flu (<0.3), 2 M/Naph (7.57), Naph (4.54), Phen (6.61), Chry (0.837)	—

ID	Depth (m)	PAH	Metals
IC2 S4	3.0 - 3.8	Ace (0.129), Acen (0.084), Flu (0.141), 2 M/Naph (3.5), Naph (1.83), Phen (2.68)	n.a.
IC2 S5	3.8 - 4.0	—	—

ID	Depth (m)	PAH	Metals
S2	0-0.15	Ace (<0.2), Acen (<0.15), Flu (<0.2), Naph (3.57), Phen (4.9), Chry (0.572)	—

ID	Depth (m)	PAH	Metals
S20	0- 0.15	Ace (0.316), Acen (0.207), Flu (0.265), 2 M/Naph (5.91), Naph (3.27), Phen (6.34), Chry (<0.85)	—

ID	Depth (m)	PAH	Metals
S19	0 - 0.15	Ace (0.158), Acen (0.087), Flu (0.117), 2 M/Naph (3.5), Naph (1.9), Phen (2.83)	—

ID	Depth (m)	PAH	Metals
S1	0-0.15	Naph (0.29), Phen (0.404)	—

ID	Depth (m)	PAH	Metals
S10	0-0.15	Ace (<0.25), Acen (<0.15), Flu (<0.2), Naph (3.63), Phen (4.52), Chry (0.619)	—
S10	0.15-0.4	Ace (<0.15), Flu (<0.15), Naph (1.89), Phen (2.38)	As (30.3)

ID	Depth (m)	PAH	Metals
S23	0 - 0.15	Ace (<0.2), Acen (<0.2), Anth (<0.2), Flu (<0.2), 2 M/Naph (5.23), Naph (2.85), Phen (3.7)	As (35.4)

ID	Depth (m)	PAH	Metals
S3	0 - 0.15	Ace (<0.15), Flu (<0.15), Naph (1.68), Phen (2.48)	—

ID	Depth (m)	PAH	Metals
IC3 S2	1.0 - 2.0	Acen (0.098), Ace (0.14), Flu (0.124), 2 M/Naph (4.24), Naph (2.18), Phen (2.45)	n.a.
IC3 S4	3.0 - 4.0	—	—

ID	Depth (m)	PAH	Metals
S11	0 - 0.15	Ace (<0.2), Acen (<0.2), Flu (<0.2), Naph (2.15), Phen (3.44)	—
S11	0.15-0.4	Ace (<0.2), Flu (<0.2), Naph (1.61), Phen (2.44)	n.a.

ID	Depth (m)	PAH	Metals
S12	0 - 0.15	Ace (<0.23), Acen (<0.11), Flu (<0.35), Anth (0.619), Naph (1.38), Phen (3.51)	n.a.

ID	Depth (m)	PAH	Metals
S4	0 - 0.15	Ace (<0.3), Acen (<0.15), Anth (0.219), Flu (<0.55), Naph (1.32), Phen (3.66)	—

ID	Depth (m)	PAH	Metals
S24	0 - 0.15	Ace (<0.2), Anth (<0.2), Flu (<0.2), 2 M/Naph (1.58), Naph (0.692), Phen (2.43)	—

ID	Depth (m)	PAH	Metals
S13	0 - 0.15	Ace (<0.11), Flu (<0.18), Naph (0.374), Phen (<1.4)	n.a.

ID	Depth (m)	PAH	Metals
S27	0 - 0.15	Ace(<0.20), Flu(0.302), 2 M/Naph(1.34), Naph(0.582), Phen(1.92)	—

ID	Depth (m)	PAH	Metals
S28	0 - 0.15	Ace (<0.15), Flu (<0.15), Naph (0.701), Phen (1.87)	—

ID	Depth (m)	PAH	Metals
S29	0 - 0.15	Ace(<0.10), Flu(0.110), 2 M/Naph(1.31), Naph(0.593), Phen(1.95)	—

ID	Depth (m)	PAH	Metals
S16	0 - 0.15	Ace (<0.06), Phen (0.953), Naph (0.264)	—

ID	Depth (m)	PAH	Metals
S5	0 - 0.15	—	—

ID	Depth (m)	PAH	Metals
S30	0 - 0.15	Ace(<0.30), Acen(<0.20), Chry(0.742), Flu(<0.20), 2 M/Naph(4.79), Naph(2.68), Phen(4.25)	As (27.1)

ID	Depth (m)	PAH	Metals
S31	0 - 0.15	Ace(<0.30), Acen(<0.20), Anth(0.186), Chry(0.930), Flu(0.299), 2 M/Naph(9.53), Naph(4.96), Phen(6.88)	As (34.7)

ID	Date	Depth (m)	PAH	Metals
PSED 1	16-Sep-05	0 - 0.01	n/a	—

ID	Date	Depth (m)	PAH	Metals
PSED 2	16-Sep-05	0 - 0.01	n/a	As (30.4)

ID	Date	Depth (m)	PAH	Metals
PSED 3	16-Sep-05	0 - 0.01	n/a	—

ID	Date	Depth (m)	PAH	Metals
PSED 4	16-Sep-05	0 - 0.01	n/a	—

ID	Date	Depth (m)	PAH	Metals
PSED 5	16-Sep-05	0 - 0.01	n/a	—

ID	Depth (m)	PAH	Metals
C5	0.0-0.1	Flu (0.121), 2 M/Naph (0.755), Naph (0.382), Phen (0.811)	—
C5	0.1-0.3	Flu (0.092), 2 M/Naph (0.464), Phen (0.523)	n.a.
C5	0.3-0.5	—	n.a.

ID	Depth (m)	PAH	Metals
C14	0.0-0.1	Ace (0.345), Acen (0.128), Anth (0.164), Flu (0.546), 2 M/Naph (3.07), Naph (1.62), Phen (3.85)	—
C14	0.1-0.3	Ace (0.583), Acen (0.232), Anth (0.273), Flu (0.972), 2 M/Naph (5.02), Naph (2.43), Phen (5.71)	n.a.

ID	Depth (m)	PAH	Metals
C4	0.0-0.1	Ace (0.234), Acen (<0.15), Anth (0.182), Flu (0.552), 2 M/Naph (3.04), Naph (1.55), Phen (3.12)	Cu (69.7)
C4	0.1-0.3	Ace (0.397), Acen (<0.2), Anth (0.276), Flu (0.995), 2 M/Naph (4.04), Naph (1.94), Phen (5.02), Chry (0.701)	n.a.
C4	0.3-0.36	Ace (0.214), Acen (<0.10), Anth (0.172), Flu (0.581), 2 M/Naph (1.06), Naph (0.532), Phen (2.77)	n.a.

ID	Depth (m)	PAH	Metals
C3	0.0-0.1	Ace (0.489), Acen (<0.25), Anth (0.216), Flu (1.15), 2 M/Naph (5.32), Naph (2.61), Phen (6.45), B(a)A (0.446), Chry (0.812)	—
C3	0.5-0.64	Ace (0.43), Acen (<0.2), Anth (0.273), Flu (1.02), 2 M/Naph (2.58), Naph (1.22), Phen (4.92), Chry (0.632)	n.a.

ID	Depth (m)	PAH	Metals
IC4 S2	0.5 - 1.0	Ace (0.249), Acen (0.125), Flu (0.414), 2 M/Naph (1.71), Naph (0.719), Phen (2.74)	Cu (68.3)
IC4 S4	1.25 - 1.6	Ace (0.188), Acen (0.112), Flu (0.203), 2 M/Naph (1.68), Naph (0.886), Phen (2.55)	—

ID	Depth (m)	PAH	Metals
C13	0.0-0.1	Ace (0.49), Acen (0.133), Anth (0.22), Flu (0.957), 2 M/Naph (2.93), Naph (1.59), Phen (5.08), Chry (<0.56)	—
C13	0.3-0.8	Ace (0.665), Acen (0.145), Anth (0.334), Flu (1.64), 2 M/Naph (2.61), Naph (1.27), Phen (6.98), B(a)A (0.522), Chry (<0.90)	n.a.

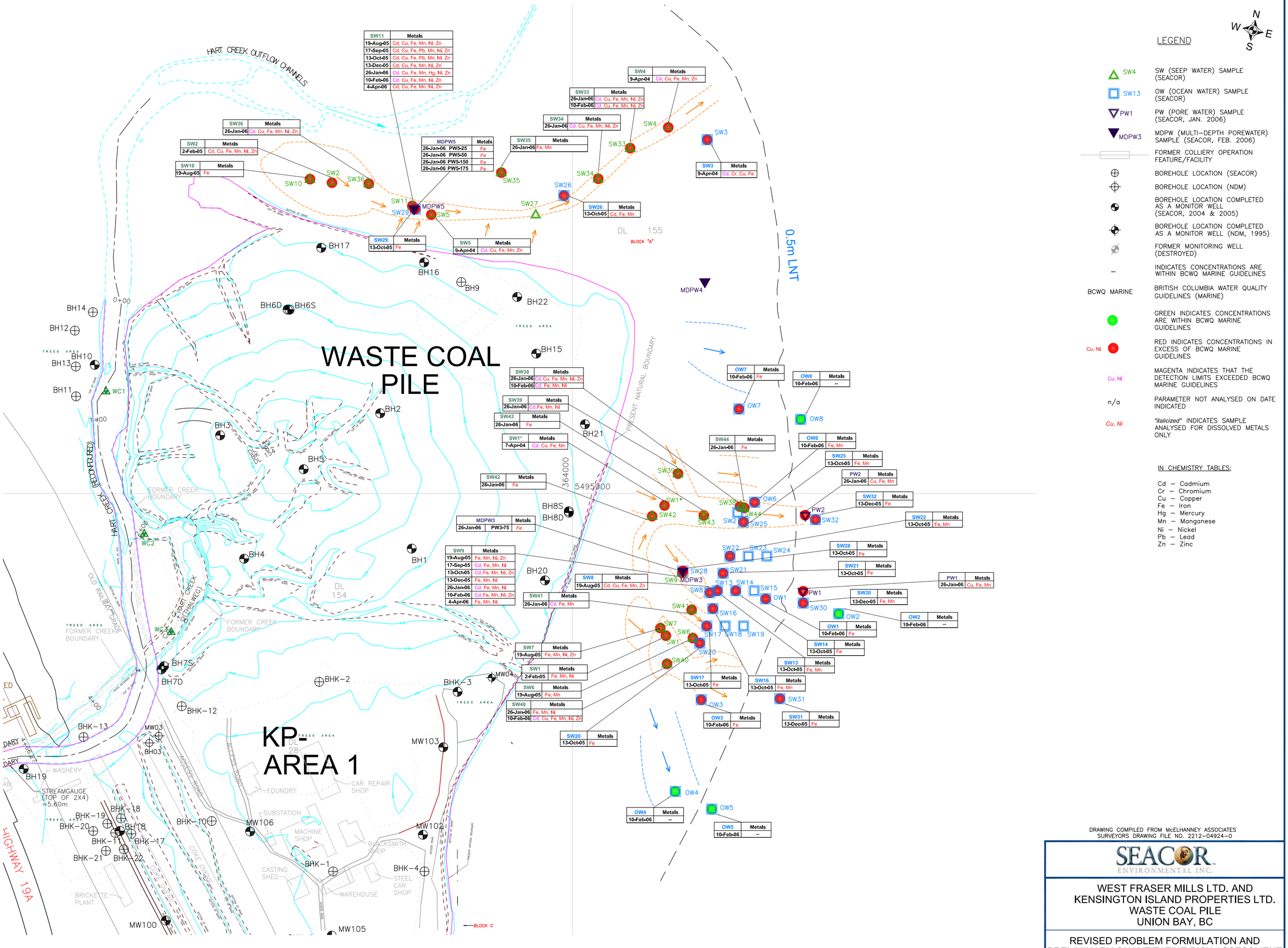
ID	Depth (m)	PAH	Metals
C2	0.0-0.1	Ace (0.082), Flu (0.208), 2 M/Naph (1.03), Naph (0.508), Phen (1.2)	—
C2	0.1-0.3	Flu (0.094), 2 M/Naph (0.33), Phen (0.502)	n.a.
C2	0.3-0.51	—	n.a.

ID	Depth (m)	PAH	Metals
C12	0.0-0.1	Ace (0.293), Acen (0.08), Anth (0.166), Flu (0.607), 2 M/Naph (1.7), Naph (0.807), Phen (3.1)	—
C12	0.1-0.3	Ace (0.412), Acen (0.112), Anth (0.217), Flu (0.868), 2 M/Naph (2.41), Naph (1.15), Phen (4.12)	—
C12	0.84-0.92	2 M/Naph (0.128), Phen (0.345)	n.a.

ID	Date	Depth (m)	PAH	Metals
S26	16-Sep-05	0 - 0.15	Ace(<0.20), Flu(0.284), 2 M/Naph(1.36), Naph(0.534), Phen(2.02)	—

ID	Depth (m)	PAH	Metals
S14	0 - 0.15	Ace (<0.06), Phen (0.953), Naph (0.264)	—

ID	Depth (m)	PAH	Metals
S12	0 - 0.15	Ace (<0.23), Acen (<0.11), Flu (<0.35), Anth (0.619), Naph (1.38), Phen (3.51)



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

DRAWING COMPILED FROM McELHANNEY ASSOCIATES SURVEYORS DRAWING FILE NO. 2212-04924-0

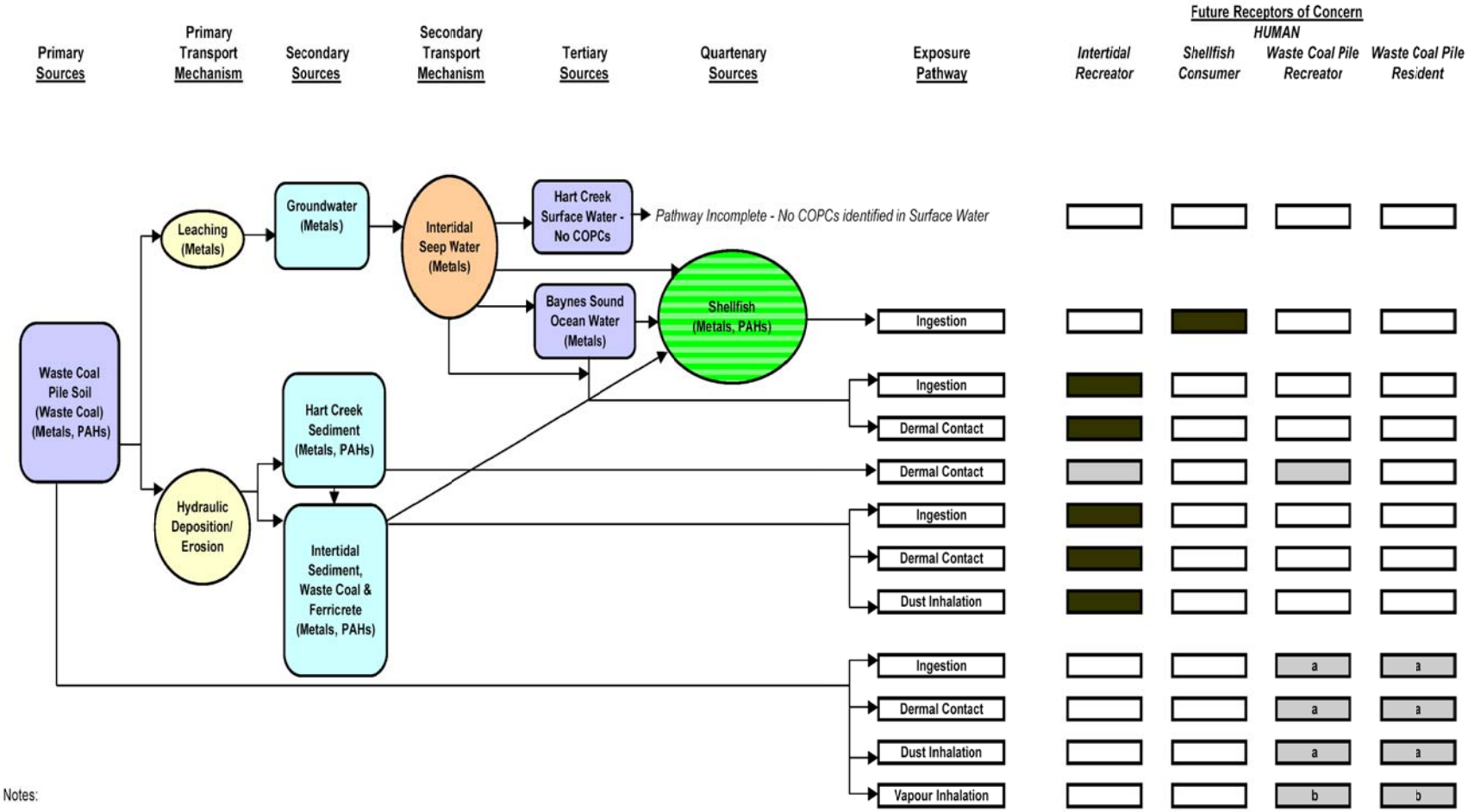
SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

MARINE SURFACE WATER, SEDIMENT POREWATER AND SEEP WATER CHEMISTRY RESULTS

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	06/14/06	201-01022-01-C7	201.01022.01	MM	TMS	7



Notes:

Pathway is likely complete and quantitative assessment of dose/risk is warranted.

Pathway with slight potential to be complete but possibility of exposure is highly unlikely, highly infrequent, or dose would be so low it does not warrant quantitative assessment of dose/risk. Qualitatively poses a negligible level of risk based on professional judgement.

Pathway is incomplete and no further evaluation is recommended. Qualitatively poses no risk.

a The Waste Coal Pile will be capped with clean soil. Direct human exposure with the underlying waste coal will be highly unlikely.

b Waste coal organics exceeding CSR soil standards (e.g. naphthalene) are unlikely to be volatile, nor would they likely diffuse through the cap or building foundations to reach appreciable concentrations in outdoor or indoor air.

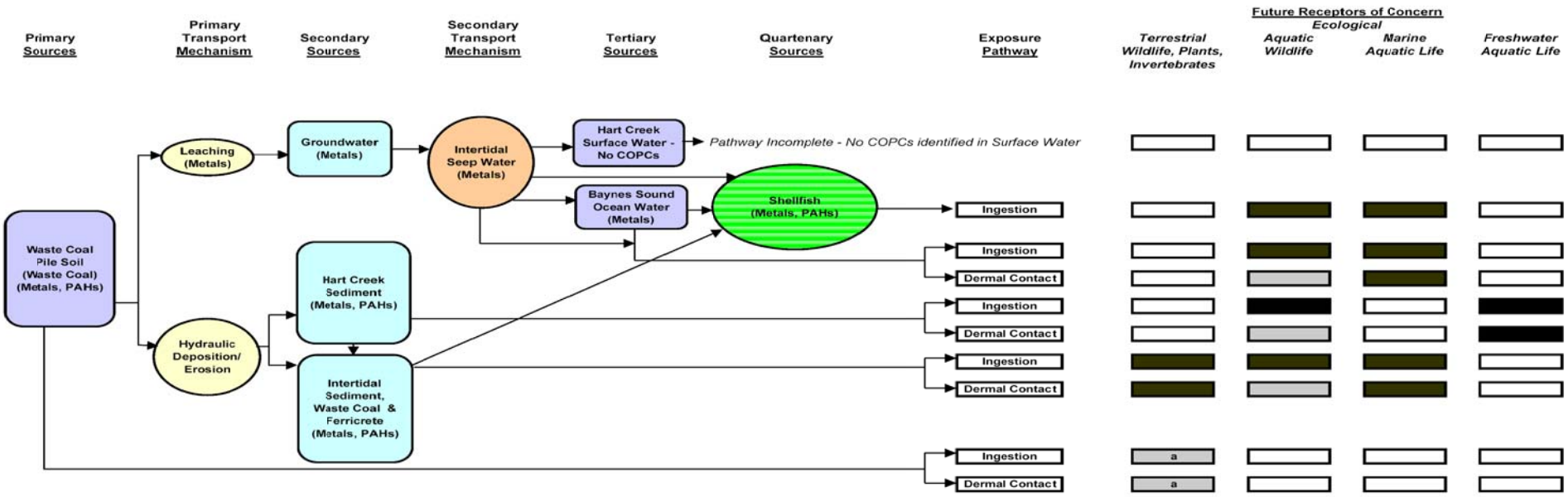
SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND
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WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

WASTE COAL PILE HUMAN SITE CONCEPTUAL MODEL

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	09/07/06	201-01022-01-C8	201.01022.01	MM	TMS	8



Notes:

Pathway is likely complete and quantitative assessment of dose/risk is warranted.

Pathway with slight potential to be complete but possibility of exposure is highly unlikely, highly infrequent, or dose would be so low it does not warrant quantitative assessment of dose/risk. Qualitatively poses a negligible level of risk based on professional judgement.

Pathway is incomplete and no further evaluation is recommended. Qualitatively poses no risk.

a The Waste Coal Pile will be capped with clean soil. Terrestrial wildlife, plants and invertebrates exposure with the underlying waste coal will be highly unlikely.

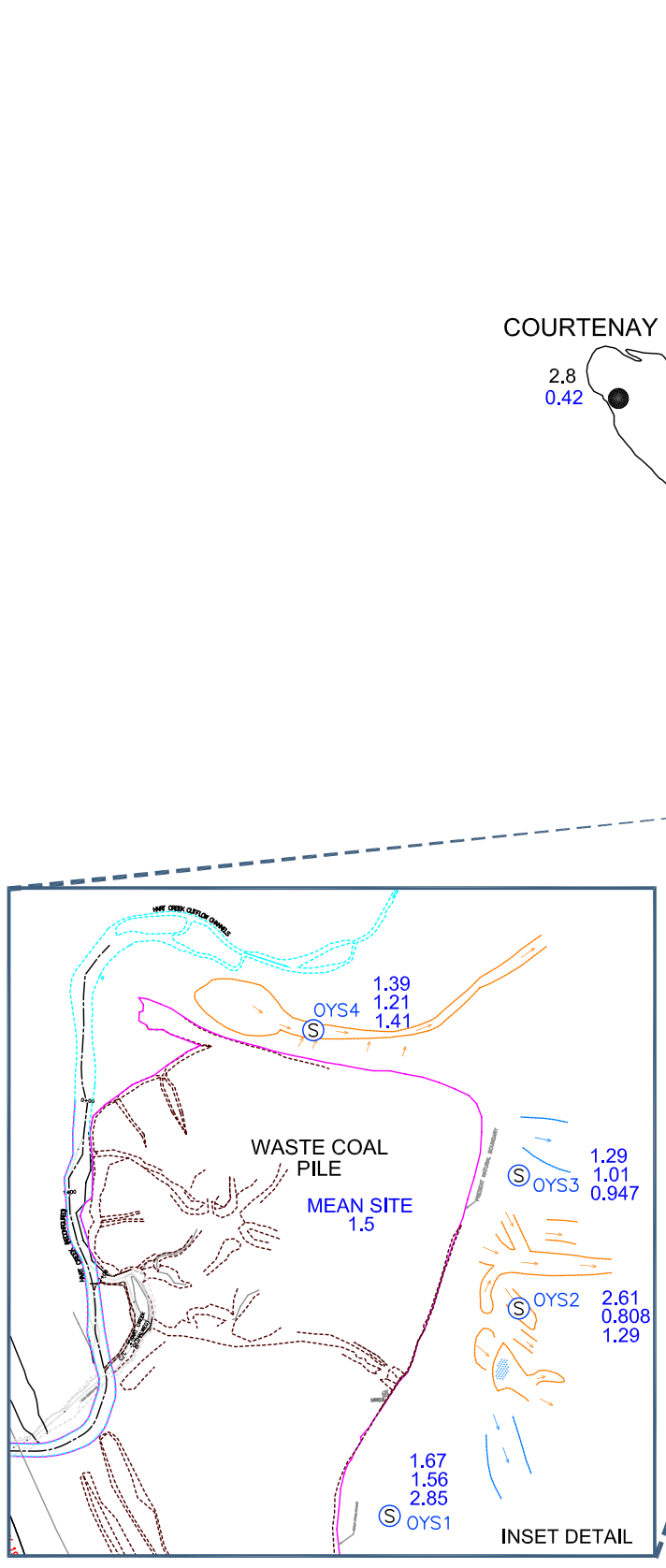
SEACOR ENVIRONMENTAL INC.

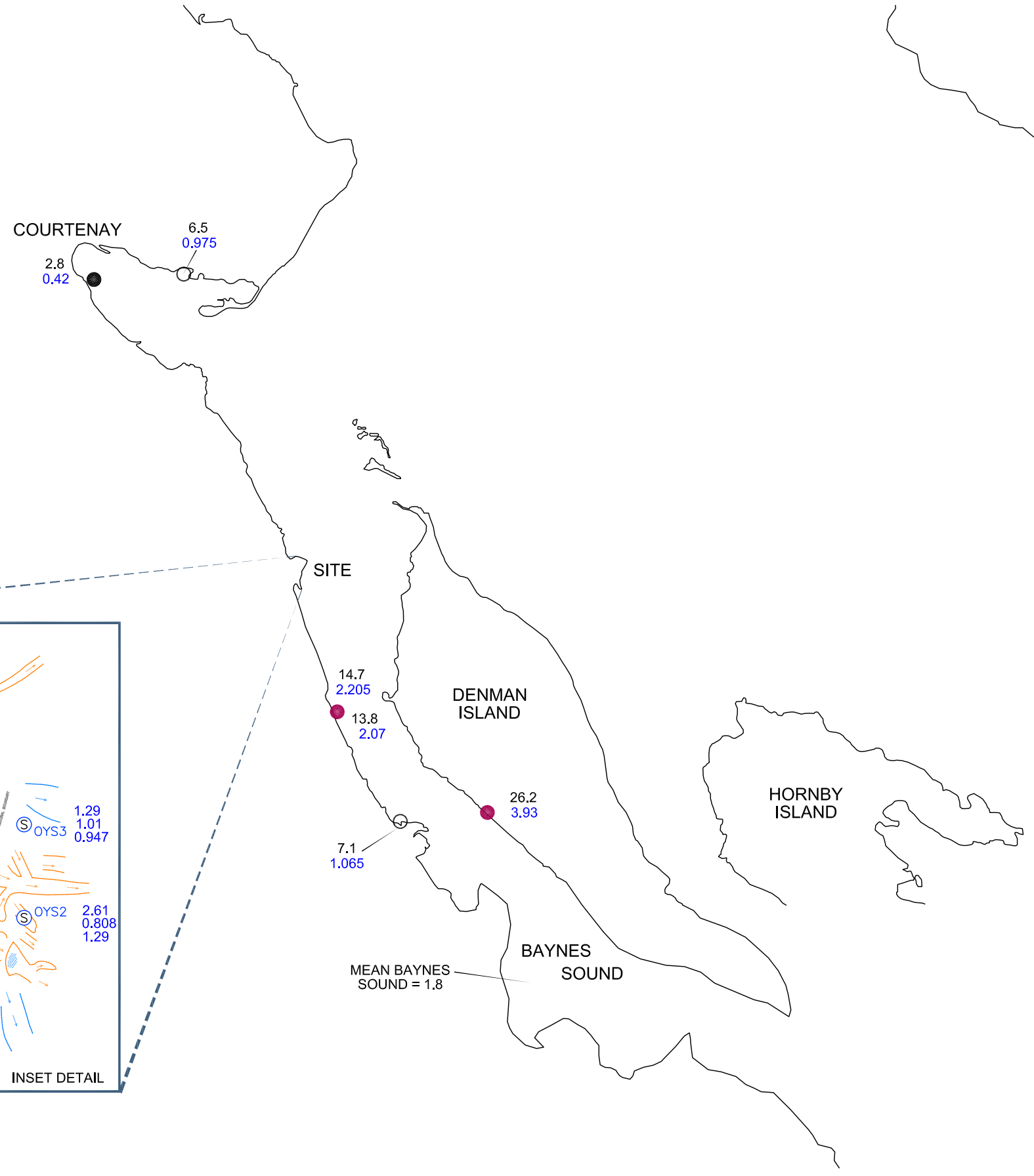
WEST FRASER MILLS LTD. AND
KENSINGTON ISLAND PROPERTIES LTD.
WASTE COAL PILE
UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

WASTE COAL PILE
ECOLOGICAL SITE CONCEPTUAL MODEL

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	06/14/06	201-01022-01-C9	201.01022.01	MM	MT	9





N
W E
S

LEGEND

- (S) SHELLFISH (oyster) TISSUE SAMPLE (SEACOR, AUG. 2005)
- 14.7 CADMIUM RESIDUES (ugCd/g DRY WEIGHT)
- 2.205 CADMIUM RESIDUES (ugCd/g) WET WEIGHT
- CANADIAN FOOD INSPECTION AGENCY, 2000 (FARM)
- ENVIRONMENT CANADA, 1987–1988 (WILD)
- ENVIRONMENT CANADA, 1999 (WILD)
- IRON STAINED SEEP AREAS WITH FLOW DIRECTION
- NON–IRON STAINED DIFFUSE SEEP AREAS WITH FLOW DIRECTION

NOTE: WET/DRY CONVERSION USED FOR ENVIRONMENT CANADA DATA, BASED ON 85% MOISTURE CONTENT (KRUZYNSKI, 2000)

SCALE 1:150 000 (APPROX.)

0 2.5 5 10 km

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

DRAWING BASEPLAN REFERENCED FROM McELHANNEY ASSOCIATES SURVEYORS DRAWING FILE NO. 2212–04924–0
CADMIUM DATA REFERENCED FROM KRUZYNSKI (2000) BC FISHERIES FIG. 1f
CADMIUM RESIDUES (ugCD/G DRY WEIGHT) IN HISTORICAL ENVIRONMENT CANADA (1973–1999) WILD INTERTIDAL OYSTER SAMPLES WITH CFIA 2000 FARMED OYSTER DATA FOR BAYNES SOUND REPORT

SEACOR ENVIRONMENTAL INC.

WEST FRASER MILLS LTD. AND KENSINGTON ISLAND PROPERTIES LTD. WASTE COAL PILE UNION BAY, BC

REVISED PROBLEM FORMULATION AND PRELIMINARY QUANTITATIVE RISK ASSESSMENT

REGIONAL VERSUS SITE OYSTER CADMIUM CONCENTRATIONS

SCALE	DATE	FILE NAME	JOB No.	CHK'D	MADE	FIG
AS SHOWN	06/14/06	201-01022-01-C10	201.01022.01	MM	TMS	10



Photograph 1: Waste coal in mid intertidal area north of Waste Coal Pile, sediment sampling station S8.



Photograph 2: Sediment in mid intertidal area east of Waste Coal Pile.



Photograph 3: North Face Seep Area (April, 2004), looking east from SW10/SW2.



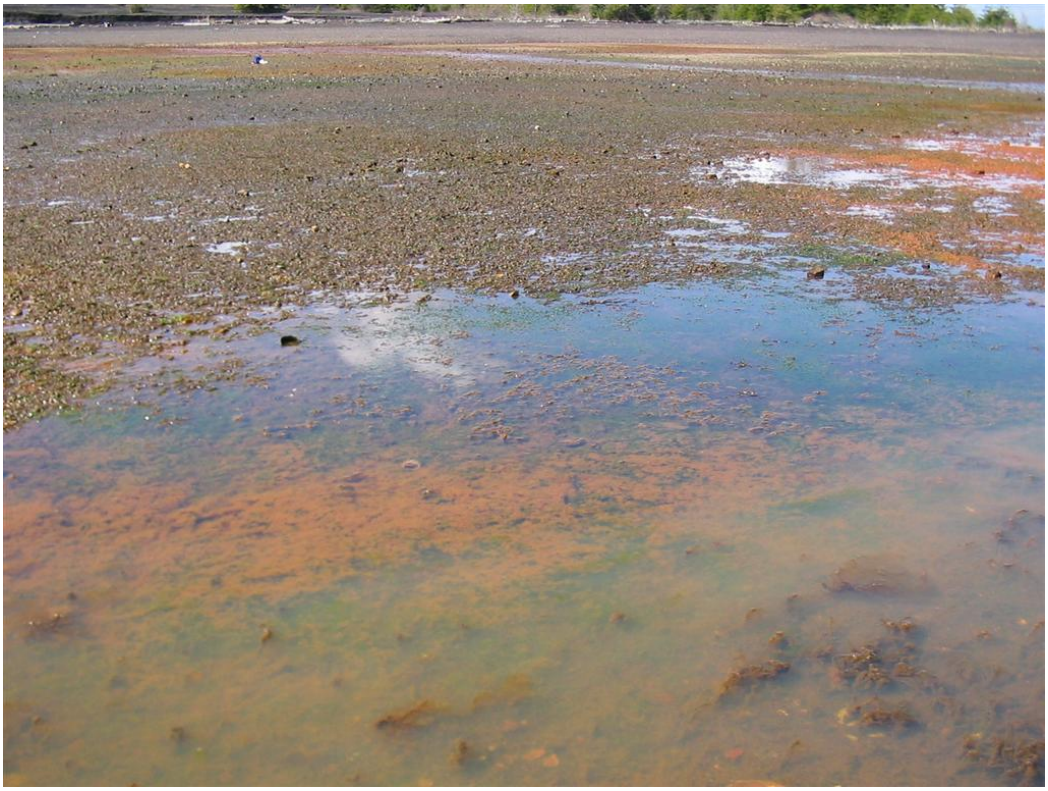
Photograph 4: Combined North Face seepage (April, 2004), looking west from SW27.



Photograph 5: East Face Seep Area, upper and mid intertidal (April, 2004), looking northeast towards SW1 (at rail car wheels).



Photograph 6: East Face Seep Area, mid and lower intertidal (April, 2004), looking towards PSED4 iron accretion.



Photograph 7: East Face seep water mixing with ocean water (April, 2004).



Photograph 8: Sheen atop East Face seep water.

APPENDIX A

Regional Biological Information

Revised Problem Formulation and
Preliminary Quantitative Risk Assessment,
Union Bay Waste Coal Pile, BC Site 4291
Seacor Project: 201.01022.01 & 201.01069.01

Label	Zone Name	Subzone Name	Variant Name	Phase Name
ATunp	Alpine Tundra	Undefined Parkland	-	-
CWHdm	Coastal Western Hemlock	Dry Maritime	-	-
CWHmm1	Coastal Western Hemlock	Moist Maritime	Submontane	-
CWHmm2	Coastal Western Hemlock	Moist Maritime	Montane	-
CWHvh1	Coastal Western Hemlock	Very Wet Hypermaritime	Southern	-
CWHvm1	Coastal Western Hemlock	Very Wet Maritime	Submontane	-
CWHvm2	Coastal Western Hemlock	Very Wet Maritime	Montane	-
CWHxm1	Coastal Western Hemlock	Very Dry Maritime	Eastern	-
CWHxm2	Coastal Western Hemlock	Very Dry Maritime	Western	-
MHmm1	Mountain Hemlock	Moist Maritime	Windward	-

A print file of this map may be obtained from
ftp.for.gov.bc.ca/hre/external/!publish/becmaps/papermaps

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For more information contact the Research Branch
Ministry of Forests
PO Box 9519 Stn Prov Govt
Victoria, BC
V8M 1M2

Data Sources:
Biogeoclimatic subzone variant mapping: ABEC_BC (v.5); Ministry of Forests, Research Branch
Elevation data: Gridded DEM (v1.1)
Base map: Derived from the Digital Baseline Mapping at 1:250,000 (Release 1.2, 1992, Base Mapping and Geomatics Services Branch, Ministry of Sustainable Resource Management).
By providing this base map information, the Ministry of Forests makes no warranty as to its accuracy or utility for any purpose.
Projection: Albers, NAD83

BRITISH COLUMBIA Ministry of Forests Forest Science Program

April, 2003



Biogeoclimatic Ecosystem Classification
Subzone/Variant Map
for the
Campbell River Forest District
Vancouver Forest Region

N

1:300,000

Kilometers
0 2.5 5 10 15 20

- Ferry Route
- Road, gravel, undivided, 1 lane
- Road, gravel, undivided, 3 lanes
- Road, paved, divided
- Road, paved, divided, 2 or more lanes
- Road, loose, undivided, 2 lanes
- Road, paved, undivided, 1 lane
- Road, paved, undivided, 2 lanes
- Road, paved, undivided, 3 lanes
- Road, paved, undivided, 3 or more lanes
- Road, unimproved
- Road, loose, dry weather access
- Road, winter access
- Road, paved, undivided, 2 lanes
- Road, paved, divided, non standard access
- Tunnel
- Bridge
- Rail Line, narrow gauge, single track
- Rail Line, multiple track
- Rail Line, single track
- Rail Line, abandoned track
- Builtup area
- Coastline, definite
- Coastline, indefinite
- Island, definite
- Lake, definite
- Lake, indefinite
- Lake, intermittent
- Lake, marshy, definite
- Reservoir, definite
- River, stream, definite
- Builtup area, town
- Builtup area, village
- Fresh water

BC Species and Ecosystems Explorer Search Results

		Status			
Scientific Name	**English Name**	**Global**	**Provincial**	**COSEWIC**	**BC Status**
Lampetra richardsoni pop. 1	Western Brook Lamprey (Morrison Creek population)	G4G5T1Q	S1	E (May 2000)	Red
Rana aurora	Red-legged Frog	G4	S3S4	SC (Nov 2004)	Blue
Dermochelys coriacea	Leatherback	G2	S1S2N	E (May 2001)	Red
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	G5T2	S2B	T (Nov 2000)	Red
Falco peregrinus pealei	Peregrine Falcon, *pealei* subspecies	G4T3	S3B	SC (Nov 2001)	Blue
Brachyramphus marmoratus	Marbled Murrelet	G3G4	S2B,S4N	T (Nov 2000)	Red
Tyto alba	Barn Owl	G5	S3	SC (Nov 2001)	Blue
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicotii* subspecies	G5T4	S3	SC (May 2002)	Blue
Enhydra lutris	Sea Otter	G4	S2	T (May 2000)	Red
Eumetopias jubatus	Northern Sea Lion	G3	S2B,S3N	SC (Nov 2003)	Red
Ursus arctos	Grizzly Bear	G4	S3	SC (May 2002)	Blue
Eschrichtius robustus	Grey Whale	G4	S2N	SC (May 2004)	Blue
Orcinus orca pop. 1	Killer Whale (Northeast Pacific resident population)	G4G5T3Q	S2	E/T (Nov 2001)	Red
Orcinus orca pop. 2	Killer Whale (Northeast Pacific offshore population)	G4G5TUQ	S3	SC (Nov 2001)	Blue
Orcinus orca pop. 3	Killer Whale (West Coast transient population)	G4G5T3Q	S2	T (Nov 2001)	Red
Marmota vancouverensis	Vancouver Island Marmot	G1	S1	E (May 2000)	Red
Euphyes vestris	Dun Skipper	G5	S3	T (Nov 2000)	Blue
Copablepharon fuscum	Sand-verbena Moth	G1G2	SNR	E (Nov 2003)	Red
Balsamorhiza deltoidea	deltoid balsamroot	G5	S1	E (May 2000)	Red
Viola praemorsa ssp. *praemorsa*	yellow montane violet	G5T3T5	S2	T (May 2000)	Red
Heterodermia sitchensis	Seaside Centipede	G2G3	S2S3	E (Apr 2006)	Blue

Search Summary

Time Performed Tue May 30 09:20:24 PDT 2006

Results 21 records.

Search Criteria Species Group:Plants & Animals
AND BC Conservation Status:Red List (Extirpated, Endangered, or Threatened) OR Blue List (Special Concern)
AND SARA Schedule 1 Status:True
AND Forest District:Campbell River Forest District (DCR) (Restricted to Red, Blue, and Identified Wildlife listed species)
Sort Order:Phylogenetic Ascending

Notes 1. Citation: B.C. Conservation Data Centre. 2006. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, BC. Available: http://srmapps.gov.bc.ca/apps/eswp/ (accessed [enter date accessed]).

2. Forest District tracking lists are restricted to those species that breed in the District; i.e. species will not be placed on Forest District lists for Districts where they occur only as migrants.

Change Criteria | New Search | Results

BC Species and Ecosystems Explorer Search Results

Scientific Name	English Name	Status			BGC
		Global	Provincial	BC Status	
Abies amabilis - Picea sitchensis / Oplopanax horridus	amabilis fir - Sitka spruce / devil's club	GNR	S3	Blue	CWHvm1/08 CWHvm2/08
Abies amabilis - Thuja plicata / Rubus spectabilis Moist Maritime 1	amabilis fir - western redcedar / salmonberry Moist Maritime 1	GNR	S1S2	Red	CWHmm1/07
Abies amabilis - Thuja plicata / Rubus spectabilis Moist Maritime 2	amabilis fir - western redcedar / salmonberry Moist Maritime 2	GNR	S2S3	Blue	CWHmm2/08
Abies amabilis - Thuja plicata / Tiarella trifoliata Moist Maritime 1	amabilis fir - western redcedar / three-leaved foamflower Moist Maritime 1	GNR	S2	Red	CWHmm1/05
Abies grandis / Mahonia nervosa	grand fir / dull Oregon-grape	GNR	S1	Red	CDFmm/04
Abies grandis / Tiarella trifoliata	grand fir / three-leaved foamflower	GNR	S1	Red	CDFmm/06
Alnus rubra / Carex obnupta [*Populus balsamifera* ssp. *trichocarpa*]	red alder / slough sedge [black cottonwood]	GNR	S1	Red	CDFmm/14
Alnus rubra / Lysichiton americanus	red alder / skunk cabbage	GNR	S2S3	Blue	CDFmm/11
Alnus rubra / Maianthemum dilatatum	red alder / false lily-of-the-valley	GNR	S3	Blue	CWHvh1/10 CWHvh2/10
Anaphalis margaritacea - Aster foliaceous	pearly everlasting - leafy aster	GNR	S2	Red	MHmm1/00
Arbutus menziesii / Arctostaphylos columbiana	arbutus / hairy manzanita	GNR	S2	Red	CDFmm/00 CWHxm1/00
Artemisia campestris / Grindelia integrifolia	northern wormwood / Puget Sound gumweed	GNR	S1	Red	CDFmm/00
Calamagrostis purpurascens Herbaceous Vegetation	purple reedgrass Herbaceous Vegetation	GNR	S2	Red	AT MHmmp/00
Carex lasiocarpa - Rhynchospora alba	slender sedge - white beak-rush	GNR	S2	Red	CDFmm/Wf53 CWH/Wf53
Carex lyngbyei Herbaceous Vegetation	Lyngbye's sedge herbaceous vegetation	GNR	S3	Blue	CDFmm/Em05 CWH/Em05
Carex macrocephala Herbaceous Vegetation	large-headed sedge Herbaceous Vegetation	GNR	S1S2	Red	CDFmm/00 CWHvh1/00
Carex sitchensis - Oenanthe sarmentosa	Sitka sedge - Pacific water-parsley	GNR	S3	Blue	CDFmm/Wm50 CWH/Wm50
Carex sitchensis / Sphagnum spp.	Sitka sedge / peat-mosses	GNR	S2	Red	CDFmm/Wf51 CWH/Wf51 ICH/Wf51
Deschampsia cespitosa - Sidalcea hendersonii	tufted hairgrass - Henderson's checker-mallow	GNR	S1S2	Red	CWHxm1/00
Deschampsia cespitosa ssp. beringensis - Aster subspicatus	tufted hairgrass - Douglas' aster	GNR	S3	Blue	CDFmm/Ed02 CWH/Ed02
Deschampsia cespitosa ssp. *beringensis - Hordeum brachyantherum*	tufted hairgrass - meadow barley	GNR	S3	Blue	CDFmm/Ed01 CWH/Ed01
Distichlis spicata var. spicata Herbaceous Vegetation	seashore saltgrass Herbaceous Vegetation	GNR	S1S2	Red	CDFmm/Em03 CWHxm1/Em03
Dulichium arundinaceum Herbaceous Vegetation	three-way sedge	GNR	S2	Red	CDFmm/Wm51 CWH/Wm51 ICH/Wm51

Festuca idahoensis ssp. roemeri - Koeleria macrantha	Roemer's fescue - junegrass	GNR	S1	Red	CDFmm/00 CWHxm1/00
Juncus arcticus - Plantago macrocarpa	arctic rush - Alaska plantain	GNR	S1	Red	CDFmm/Ed03 CWH/Ed03
Ledum groenlandicum / Kalmia microphylla / Sphagnum spp.	Labrador tea / western bog-laurel / peat-mosses	GNR	S3	Blue	CDFmm/Wb50 CWH/Wb50
Myosurus minimus - Montia spp. - *Limnanthes macounii*	tiny mousetail - montias - Macoun's meadow-foam	GNR	S1	Red	CDFmm/00
Myrica gale / Carex sitchensis	sweet gale / Sitka sedge	GNR	S2	Red	CDFmm/Wf52 CWH/Wf52
Phlox diffusa - Selaginella wallacei	spreading phlox - Wallace's selaginella	GNR	S2	Red	MHmm1/00
Picea sitchensis / Calamagrostis nutkaensis	Sitka spruce / Pacific reedgrass	GNR	S3	Blue	CWHvh1/16 CWHvh2/16 CWHwh1/15
Picea sitchensis / Carex obnupta	Sitka spruce / slough sedge	GNR	S3	Blue	CWHvh1/18 CWHvh2/18 CWHwh1/17
Picea sitchensis / Eurhynchium oreganum	Sitka spruce / Oregon beaked-moss	GNR	S3	Blue	CWHvh1/15 CWHvh2/15 CWHwh1/14
Picea sitchensis / Maianthemum dilatatum Very Wet Hypermaritime 1	Sitka spruce / false lily-of-the-valley Very Wet Hypermaritime 1	GNR	S2	Red	CWHvh1/08
Picea sitchensis / Malus fusca	Sitka spruce / Pacific crab apple	GNR	S3	Blue	CWHvh1/19 CWHvh2/19 CWHwh1/18
Picea sitchensis / Polystichum munitum	Sitka spruce / sword fern	GNR	S3	Blue	CWHvh1/17 CWHvh2/17
Picea sitchensis / Rubus spectabilis Dry	Sitka spruce / salmonberry Dry	GNR	S1S2	Red	CWHdm/08 CWHds1/08
Picea sitchensis / Rubus spectabilis Very Dry Maritime	Sitka spruce / salmonberry Very Dry Maritime	GNR	S2	Red	CWHxm1/08 CWHxm2/08
Picea sitchensis / Rubus spectabilis Very Wet Maritime	Sitka spruce / salmonberry Very Wet Maritime	GNR	S2	Red	CWHvm1/09
Picea sitchensis / Trisetum canescens	Sitka spruce / tall trisetum	GNR	S2	Red	CWHvh1/09 CWHvh2/09 CWHwh1/08
Pinus contorta / Sphagnum spp. CDFmm	lodgepole pine / peat-mosses CDFmm	GNR	S1	Red	CDFmm/10
Pinus contorta / Sphagnum spp. *Very Dry Maritime*	lodgepole pine / peat-mosses Very Dry Maritime	GNR	S3	Blue	CWHxm1/11 CWHxm2/11
Pinus contorta var. *contorta / Juniperus communis - Arctostaphylos columbiana*	shore pine / common juniper - hairy manzanita	GNR	S1	Red	CWHxm1/00
Populus balsamifera ssp. *trichocarpa / Cornus stolonifera*	black cottonwood / red-osier dogwood	GNR	S3	Blue	CWHdm/09 CWHds1/09 CWHds2/09 CWHmm1/09 CWHms1/08 CWHms2/08 CWHvm1/10 CWHwm/06 CWHws1/08 CWHws2/08 CWHxm1/09 CWHxm2/09

Populus balsamifera ssp. *trichocarpa / Salix sitchensis*	black cottonwood / Sitka willow	GNR	S2S3	Blue	CWHdm/10 CWHxm1/10 CWHxm2/10
Populus tremuloides / Malus fusca / Carex obnupta	trembling aspen / Pacific crab apple / slough sedge	GNR	S1S2	Red	CDFmm/00
Pseudotsuga menziesii - Arbutus menziesii	Douglas-fir - arbutus	GNR	S2	Red	CDFmm/02
Pseudotsuga menziesii / Mahonia nervosa	Douglas-fir / dull Oregon-grape	GNR	S2	Red	CDFmm/01
Pseudotsuga menziesii / Melica subulata	Douglas-fir / Alaska oniongrass	GNR	S1	Red	CDFmm/03
Pseudotsuga menziesii - Pinus contorta / Cladina spp.	Douglas-fir - lodgepole pine / reindeer lichens	GNR	S2	Red	CWHxm2/02
Pseudotsuga menziesii - Pinus contorta / Holodiscus discolor / Cladina spp.	Douglas-fir - lodgepole pine / oceanspray / reindeer lichens	GNR	S2	Red	CWHdm/02
Pseudotsuga menziesii - Pinus contorta / Racomitrium canescens	Douglas-fir - lodgepole pine / grey rock-moss	GNR	S2	Red	CWHxm1/02
Pseudotsuga menziesii / Polystichum munitum	Douglas-fir / sword fern	GNR	S2	Red	CWHdm/04 CWHxm1/04 CWHxm2/04
Pseudotsuga menziesii - Tsuga heterophylla / Gaultheria shallon Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	GNR	S2S3	Blue	CWHdm/03 CWHxm1/03 CWHxm2/03
Pseudotsuga menziesii - Tsuga heterophylla / Gaultheria shallon Moist Maritime	Douglas-fir - western hemlock / salal Moist Maritime	GNR	S3	Blue	CWHmm1/02 CWHmm2/02
Quercus garryana - Arbutus menziesii	Garry oak - arbutus	GNR	S1	Red	CDFmm/00
Quercus garryana / Bromus carinatus	Garry oak / California brome	GNR	S1	Red	CDFmm/00
Quercus garryana / Holodiscus discolor	Garry oak / oceanspray	GNR	S1	Red	CDFmm/00
Ruppia maritima Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	GNR	S2	Red	CDFmm/Em01 CWH/Em01
Salicornia virginiana - Glaux maritima	American glasswort - sea-milkwort	GNR	S2	Red	CDFmm/Em02 CWH/Em02
Salix sitchensis - Salix lucida ssp. lasiandra / Lysichiton americanus	Sitka willow - Pacific willow / skunk cabbage	GNR	S2	Red	CDFmm/Ws51 CWH/Ws51 ICH/Ws51
Sidalcea hendersonii Tidal Marsh	Henderson's checker-mallow Tidal Marsh	GNR	S1	Red	CWHxm1/00
Thuja plicata / Achlys triphylla	western redcedar / vanilla leaf	GNR	S1	Red	CDFmm/12
Thuja plicata / Carex obnupta	western redcedar / slough sedge	GNR	S2S3	Blue	CWHdm/15 CWHxm1/15 CWHxm2/15
Thuja plicata - Chamaecyparis nootkatensis / Coptis aspleniifolia Moist Maritime 2	western redcedar - yellow-cedar / spleenwort-leaved goldthread Moist Maritime 2	GNR	S2S3	Blue	CWHmm2/07
Thuja plicata / Lonicera involucrata	western redcedar / black twinberry	GNR	S2	Red	CWHdm/14 CWHxm1/14 CWHxm2/14
Thuja plicata / Oemleria cerasiformis	western redcedar / Indian-plum	GNR	S1	Red	CDFmm/13
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	GNR	S3	Blue	CWHdm/12 CWHds1/12 CWHds2/12

					CWHmm1/12 CWHms1/11 CWHms2/11 CWHvh1/13 CWHvh2/13 CWHvm1/14 CWHwh1/12 CWHwh2/06 CWHws1/11 CWHxm1/12 CWHxm2/12
Thuja plicata - Picea sitchensis / Polystichum munitum	western redcedar - Sitka spruce / sword fern	GNR	S2S3	Blue	CWHvh1/05 CWHvh2/05 CWHwh1/03
Thuja plicata / Polystichum munitum Dry Maritime	western redcedar / sword fern Dry Maritime	GNR	S2S3	Blue	CWHdm/05
Thuja plicata / Polystichum munitum Very Dry Maritime	western redcedar / sword fern Very Dry Maritime	GNR	S2S3	Blue	CWHxm1/05 CWHxm2/05
Thuja plicata - Pseudotsuga menziesii / Eurhynchium oreganum	western redcedar - Douglas-fir / Oregon beaked-moss	GNR	S1	Red	CDFmm/05
Thuja plicata / Rubus spectabilis	western redcedar / salmonberry	GNR	S1S2	Red	CWHdm/13 CWHxm1/13 CWHxm2/13
Thuja plicata / Symphoricarpos albus	western redcedar / common snowberry	GNR	S1	Red	CDFmm/07
Thuja plicata / Tiarella trifoliata Dry Maritime	western redcedar / three-leaved foamflower Dry Maritime	GNR	S2S3	Blue	CWHdm/07
Thuja plicata / Tiarella trifoliata Very Dry Maritime	western redcedar / three-leaved foamflower Very Dry Maritime	GNR	S2	Red	CWHxm1/07 CWHxm2/07
Thuja plicata - Tsuga heterophylla / Polystichum munitum	western redcedar - western hemlock / sword fern	GNR	S3?	Blue	CWHmm1/04 CWHmm2/04 CWHvm1/04 CWHvm2/04
Tsuga heterophylla - Abies amabilis / Blechnum spicant Moist Maritime	western hemlock - amabilis fir / deer fern Moist Maritime	GNR	S2	Red	CWHmm1/06 CWHmm2/06
Tsuga heterophylla - Abies amabilis / Rhytidiopsis robusta	western hemlock - amabilis fir / pipecleaner moss	GNR	S3	Blue	CWHmm1/01 CWHmm2/01
Tsuga heterophylla - Picea sitchensis / Rhytidiadelphus loreus	western hemlock - Sitka spruce / lanky moss	GNR	S3	Blue	CWHvh1/04 CWHvh2/04 CWHwh1/01 CWHwh2/01
Tsuga heterophylla / Plagiothecium undulatum	western hemlock / flat-moss	GNR	S2S3	Blue	CWHdm/01
Tsuga heterophylla - Pseudotsuga menziesii / Eurhynchium oreganum	western hemlock - Douglas-fir / Oregon beaked-moss	GNR	S2	Red	CWHxm1/01 CWHxm2/01
Tsuga heterophylla - Thuja plicata / Blechnum spicant	western hemlock - western redcedar / deer fern	GNR	S2	Red	CWHdm/06 CWHxm1/06 CWHxm2/06
Tsuga heterophylla - Thuja plicata / Gaultheria shallon Moist Maritime 1	western hemlock - western redcedar / salal Moist Maritime 1	GNR	S2	Red	CWHmm1/03
Tsuga heterophylla - Thuja plicata / Gaultheria shallon Moist Maritime 2	western hemlock - western redcedar / salal Moist Maritime 2	GNR	S3	Blue	CWHmm2/03
Typha latifolia Marsh	common cattail Marsh	GNR	S3	Blue	BG/Wm05 BWBS/Wm05 CDFmm/Wm05 CWH/Wm05

ICH/Wm05
IDF/Wm05
MS/Wm05
PP/Wm05
SBPS/Wm05
SBS/Wm05
SWB/Wm05

Search Summary

Time Performed Tue May 30 09:23:13 PDT 2006

Results 85 records.

Search Criteria Ecological Communities
AND BC Conservation Status:Red List (Extirpated, Endangered, or Threatened) OR Blue List (Special Concern)
AND Forest District:Campbell River Forest District (DCR)
Sort Order:Scientific Name Ascending

Notes 1. Citation: B.C. Conservation Data Centre. 2006. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, BC. Available: http://srmapps.gov.bc.ca/apps/eswp/ (accessed [enter date accessed]).

2. Results reflect a 2004 review of ecological community Conservation Status Ranks. Additions to the Red- and Blue- Lists include ecological communities previously considered secure and ecological communities recently described from new inventory data.

Biogeoclimatic Site Unit(s): This column indicates the BGC unit(s) on which each ecological community is known to occur (future inventories may indicate range extensions). The two digit number following the slash (01 and up) indicates that the ecological community occurs on a site series that is part of the B.C. Ministry of Forests (MOF) site series classification (see MOF Regional Field Guides to Site Identification and Interpretation for more information). A two digit number of '00' indicates that the ecological community occurs on a site unit that is not part of the MOF site series classification but is recognized from other vegetation and site classifications, and ecosystem mapping projects.

Change Criteria | New Search | Results

NOTE: Before beginning a search and using the results of your search, you must read and understand the Data Description and Limitations and Disclaimer. This web mapping application is limited to species belonging to SARA Schedule 1 (date: December 2005); maps for ten special concern species are missing and will be available soon.

All Endangered, Threatened, and Special Concern Species with a Map

[see the species list below]

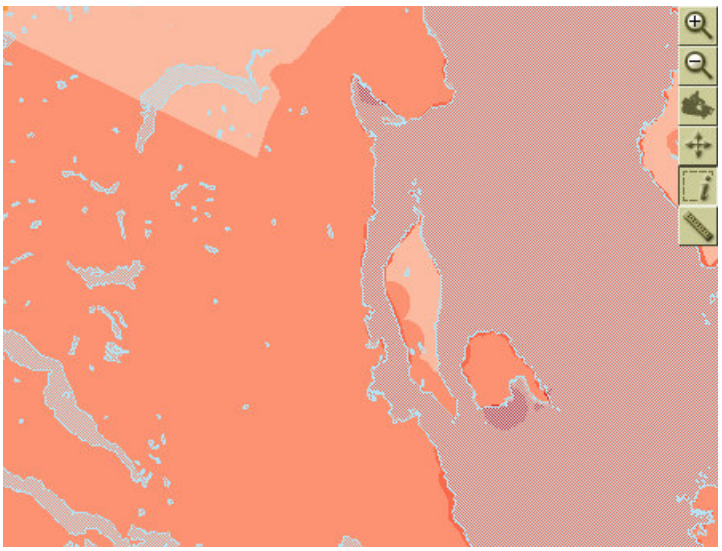


Number of Species

- 1
- 2 - 3
- 4 - 6
- 7 - 10
- 11 - 15
- > 15

Map Layers

- Cities & Towns
- Roads
- Railways
- Water
- Forest
- Urban Areas



Redraw Map

Notes:

- Click a taxonomic group to view the list of species at risk for that group.
- Click a numeric value to display only the distribution maps for the species that belong to the selected taxonomic group and risk category.
- Click for more information about a species.
- Click to view the species distribution map.

Pale highlighting
Species that belong to the selected taxonomic group and risk category (by default, all taxonomic groups and risk categories have been selected).

Bright highlighting
Species that were found in the query area.

Mammals Birds Reptiles... Fishes Lepidopterans Molluscs Plants... All

All Taxa

All 324 Endangered 152 Threatened 98 Special Concern 74

Mammals

All 36 Endangered 13 Threatened 12 Special Concern 11

- American Badger jacksoni subspecies
- American Badger jeffersonii subspecies
- Beluga Whale (St. Lawrence Estuary population)
- Black-tailed Prairie Dog
- Blue Whale (Pacific population)
- Blue Whale (Atlantic population)
- Eastern Mole
- Eastern Wolf
- Ermine haidarum subspecies
- Grey Fox
- **Grey Whale (Eastern North Pacific population)**
- **Harbour Porpoise (Pacific Ocean population)**
- **Humpback Whale (North Pacific population)**
- Killer Whale (Northeast Pacific offshore population)
- **Killer Whale (Northeast Pacific transient population)**
- Killer Whale (Northeast Pacific northern resident population)
- **Killer Whale (Northeast Pacific southern resident population)**
- Mountain Beaver
- Newfoundland Marten
- North Atlantic Right Whale
- Pacific Water Shrew
- Pallid Bat
- Sea Otter

- Sei Whale (Pacific population)
- Spotted Bat
- **Steller Sea Lion**
- Swift Fox
- Townsend's Mole
- Vancouver Island Marmot
- Wolverine (Eastern population)
- Wood Bison
- Woodland caribou (Atlantic-Gaspésie population)
- Woodland caribou (Southern Mountain population)
- Woodland Caribou (Northern Mountain population)
- Woodland caribou (Boreal population)
- Woodland Vole

Birds

All 46 Endangered 23 Threatened 10 Special Concern 13

- Acadian Flycatcher
- Barn Owl (Eastern population)
- **Barn Owl (Western population)**
- Barrow's Goldeneye (Eastern population)
- Burrowing Owl
- Cerulean Warbler
- Eskimo Curlew
- Flammulated Owl
- Greater Sage-Grouse urophasianus subspecies
- Harlequin Duck (Eastern population)
- Henslow's Sparrow
- Hooded Warbler
- Horned Lark strigata subspecies
- Ivory Gull
- King Rail
- Kirtland's Warbler
- Least Bittern
- Lewis's Woodpecker
- Loggerhead Shrike excubitorides subspecies
- Loggerhead Shrike migrans subspecies
- Long-billed Curlew
- **Marbled Murrelet**
- Mountain Plover
- Northern Bobwhite
- **Northern Goshawk laingi subspecies**
- Peregrine Falcon anatum subspecies
- Peregrine Falcon pealei subspecies
- Pink-footed Shearwater
- Piping Plover circumcinctus subspecies
- Piping Plover melodus subspecies
- Prothonotary Warbler
- Red Crossbill percna subspecies
- Roseate Tern
- Ross's Gull
- Sage Thrasher
- Savannah Sparrow princeps subspecies
- **Short-tailed Albatross**
- Spotted Owl caurina subspecies
- Sprague's Pipit
- **Western Screech-Owl kennicottii subspecies**
- Western Screech-Owl macfarlanei subspecies
- White-headed Woodpecker
- Whooping Crane
- Yellow Rail
- Yellow-breasted Chat auricollis subspecies (British Columbia population)
- Yellow-breasted Chat virens subspecies

Fishes

All 34 Endangered 14 Threatened 11 Special Concern 9

- Atlantic Salmon (Inner Bay of Fundy populations)
- Atlantic Whitefish
- Atlantic Wolffish
- Aurora Trout
- Banded Killifish (Newfoundland population)
- Benthic Enos Lake Stickleback
- Benthic Paxton Lake Stickleback
- Benthic Vananda Creek Stickleback
- Blackstripe Topminnow
- Bridle Shiner
- Carmine Shiner
- Columbia Mottled Sculpin
- Cultus Pygmy Sculpin
- Eastern Sand Darter
- Lake Chubsucker
- Lake Utopia Dwarf Smelt
- Limnetic Enos Lake Stickleback
- Limnetic Paxton Lake Stickleback
- Limnetic Vananda Creek Stickleback
- Morrison Creek Lamprey
- Nooksack Dace
- Northern Madtom
- Northern Wolffish
- Pugnose Minnow
- Pugnose Shiner
- Salish Sucker
- Shorthead Sculpin
- Silver Chub
- Spotted Gar
- Spotted Sucker
- Spotted Wolffish
- Vancouver Lamprey
- Warmouth
- Western Silvery Minnow

Reptiles and Amphibians

All 40 Endangered 12 Threatened 16 Special Concern 12

- Allegheny Mountain Dusky Salamander
- Blue Racer
- Butler's Gartersnake
- Coast Tailed Frog
- Coastal Giant Salamander
- Coeur d'Alene Salamander
- Eastern Foxsnake
- Eastern Hog-nosed Snake
- Eastern Ratsnake
- Eastern Ribbonsnake (Great Lakes population)
- Eastern Ribbonsnake (Atlantic population)
- Fowler's Toad
- Great Basin Gophersnake
- Great Basin Spadefoot
- Great Plains Toad
- Jefferson Salamander
- Leatherback Seaturtle
- Massasauga
- Milksnake
- Nightsnake
- Northern Cricket Frog
- Northern Leopard Frog (Southern Mountain population)
- Northern Leopard Frog (Western Boreal/Prairie populations)
- Northern Map Turtle
- Oregon Spotted Frog

- Prairie Skink
- Queen Snake
- Red-legged Frog
- Rocky Mountain Tailed Frog
- Rubber Boa
- Sharp-tailed Snake
- Small-mouthed Salamander
- Spiny Softshell
- Spotted Turtle
- Spring Salamander
- Stinkpot
- Tiger Salamander (Southern Mountain population)
- Western Rattlesnake
- Western Skink
- Western Toad

Molluscs

All 17 Endangered 11 Threatened 2 Special Concern 4

- Banff Springs Snail
- Dromedary Jumping-slug
- Hotwater Physa
- Kidneyshell
- Mudpuppy Mussel
- **Northern Abalone**
- Northern Riffleshell
- **Olympia Oyster**
- Oregon Forestsnail
- Rayed Bean
- Rocky Mountain Ridged Mussel
- Round Hickorynut
- Round Pigtoe
- Snuffbox
- Warty Jumping-slug
- Wavy-rayed Lampmussel
- Yellow Lampmussel

Lepidopterans

All 13 Endangered 6 Threatened 5 Special Concern 2

- Behr's (Columbia) Hairstreak
- Dakota Skipper
- Dun Skipper (Western population)
- Island Blue
- Maritime Ringlet
- **Monarch**
- Mormon Metalmark (Prairie population)
- Mormon Metalmark (Southern Mountain population)
- Poweshiek Skipperling
- Sand-verbena Moth
- Taylor's Checkerspot
- Weidemeyer's Admiral
- Yucca Moth

Plants, Lichens, and Mosses

All 138 Endangered 73 Threatened 42 Special Concern 23

- American Ginseng
- American Hart's-tongue Fern
- American Water-willow
- Anticosti Aster
- Athabasca Thrift
- Barrens Willow
- Bashful Bulrush
- Bearded Owl-clover
- Bear's-foot Sanicle

- Bird's-foot Violet
- Blue Ash
- Bluehearts
- Blunt-lobed Woodsia
- Bog Bird's-foot Trefoil
- Boreal Felt Lichen (Boreal population)
- Boreal Felt Lichen (Atlantic population)
- Branched Bartonia
- Buffalograss
- Butternut
- Climbing Prairie Rose
- Coastal Scouler's Catchfly
- Coastal Wood Fern
- Colicroot
- Columbian Carpet Moss
- Common Hoptree
- Crooked-stem Aster
- Cucumber Tree
- Deerberry
- Deltoid Balsamroot
- Dense Blazing Star
- Drooping Trillium
- Dwarf Hackberry
- Dwarf Sandwort
- Eastern Lilaeopsis
- Eastern Mountain Avens
- Eastern Prairie Fringed-orchid
- Eastern Prickly Pear Cactus
- Engelmann's Quillwort
- False Hop Sedge
- Felt-leaf Willow
- Fernald's Braya
- Fernald's Milk-vetch
- Floccose Tansy
- Flooded Jellyskin
- Forked Three-awned Grass
- Furbish's Lousewort
- Gattinger's Agalinis
- Golden Crest
- Golden Paintbrush
- Goldenseal
- Gulf of St. Lawrence Aster
- Hairy Prairie-clover
- Haller's Apple Moss
- Heart-leaved Plantain
- Hoary Mountain-mint
- Horsetail Spike-rush
- Howell's Triteleia
- Juniper Sedge
- Kellogg's Rush
- Kentucky Coffee-tree
- Lakeside Daisy
- Large Whorled Pogonia
- Large-headed Woolly Yarrow
- Lemmon's Holly Fern
- Long's Braya
- Lyall's Mariposa Lily
- Mackenzie Hairgrass
- Margined Streamside Moss
- Mexican Mosquito-fern
- New Jersey Rush
- Nodding Pogonia
- Phantom Orchid
- Pink Coreopsis
- Pink Milkwort
- Pink Sand-verbena
- Pitcher's Thistle
- Plymouth Gentian

- Poor Pocket Moss
- Prairie Lupine
- Purple Sanicle
- Purple Twayblade
- Red Mulberry
- Redroot
- Riddell's Goldenrod
- Rigid Apple Moss
- Rosy Owl-clover
- Round-leaved Greenbrier (Great Lakes Plains population)
- Sand-dune Short-capsuled Willow
- Scarlet Ammannia
- Scouler's Corydalis
- Seaside Birds-foot Lotus
- Seaside Centipede
- Showy Goldenrod
- Silver Hair Moss
- Skinner's Agalinis
- Slender Bush-clover
- Slender Collomia
- Slender Mouse-ear-cress
- Small White Lady's-slipper
- Small Whorled Pogonia
- Small-flowered Lipocarpha
- Small-flowered Sand-verbena
- Small-flowered Tonella
- Soapweed
- Southern Maidenhair Fern
- Spoon-leaved Moss
- Spotted Wintergreen
- Stoloniferous Pussytoes
- Streambank Lupine
- Sweet Pepperbush
- Tall Bugbane
- Tall Woolly-heads (Pacific population)
- Tall Woolly-heads (Prairie population)
- Thread-leaved Sundew
- Tiny Cryptanthe
- Toothcup
- Tubercled Spike-rush
- Tuberous Indian-plantain
- Turnor's Willow
- Twisted Oak Moss
- Van Brunt's Jacob's-ladder
- Vancouver Island Beggarticks
- Victorin's Gentian
- Victorin's Water-hemlock
- Virginia Goat's-rue
- Water-pennywort
- Water-plantain Buttercup
- Western Blue-flag
- Western Prairie Fringed-orchid
- Western Silvery Aster
- Western Spiderwort
- White Prairie Gentian
- White Wood Aster
- White-top Aster
- Wild Hyacinth
- Willowleaf Aster
- Wood-poppy
- Yellow Montane Violet

Top of Page

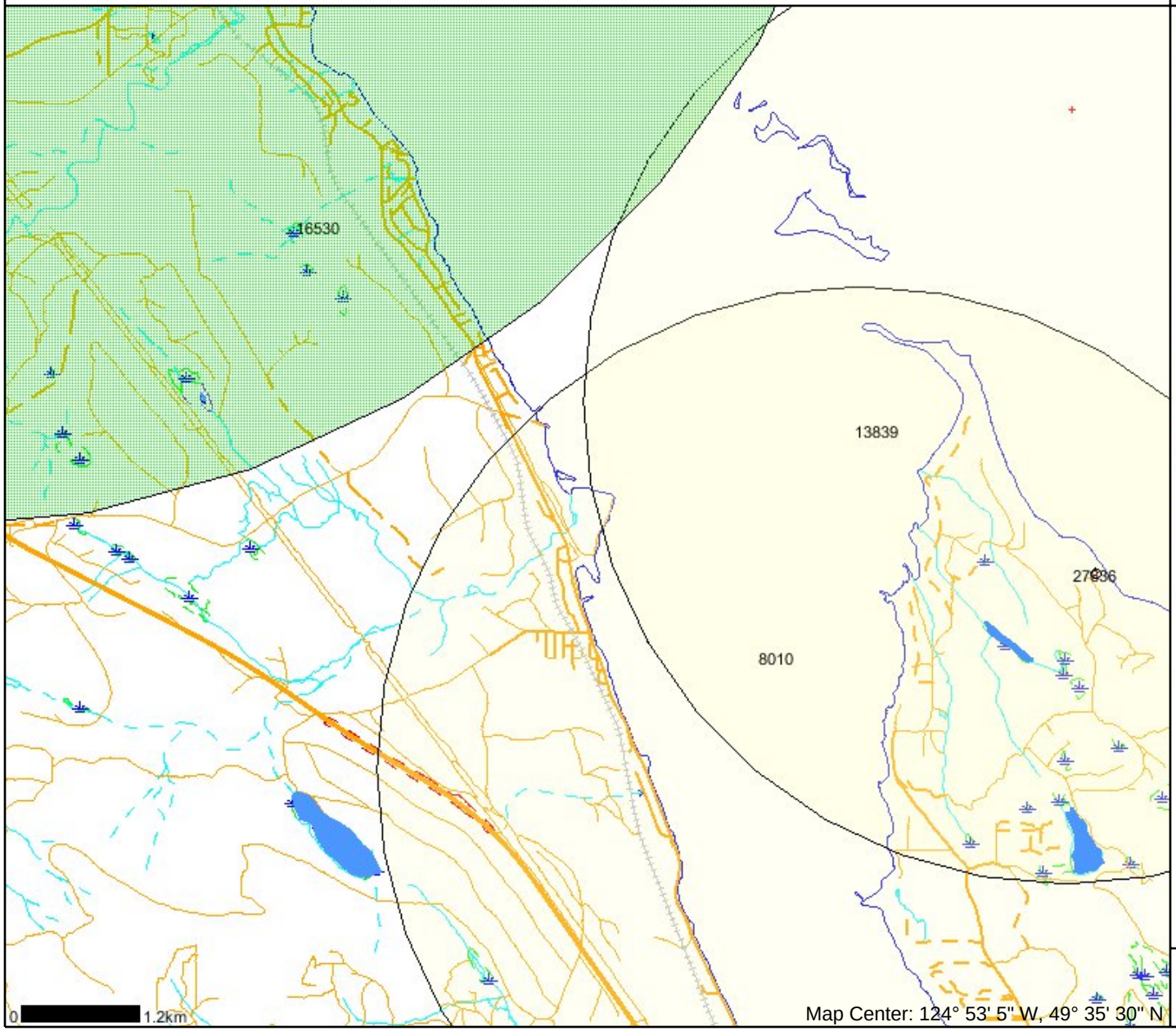


Important Notices

Last update: 2005-12-01

URL of this page: http://www.sis.ec.gc.ca/ec_species/ec_species_e.phtml

Known Occurences of Terrestrial Red and Blue Listed Species



Legend

- WDIC - Waterbody Poly
- Element Occurrence Areas - CDC
  - Animal - Vertebrate
  - Animal - Invertebrate
  - Plant - Vascular
  - Plant - Non Vascular
  - Plant Association
  - Record Tree
  - Other
- Masked Sensitive Areas - CDC
- Transportation - Points (TRIM)
  - Helipad
- Transportation - Lines (TRIM)
  - Airfield
  - Airport
  - Airstrip
  - Airport.Abandoned
  - Ferry Route
  - Road (Gravel Undivided) - 1 Lane
  - Road (Gravel Undivided) - 2 Lanes
  - Road (Gravel Undivided) - U/C - 1 Lane
  - Road (Gravel Undivided) - U/C - 2 Lanes
  - Road (Paved Divided) - Not Elevated - 1 Lane Each Way
  - Road (Paved Divided) - Not Elevated - 2 Lanes Each Way
  - Road (Paved Divided) - U/C - Not Elevated - 2 Lanes Each Way
  - Road (Paved Undivided) - Not Elevated - 1 Lane
  - Road (Paved Undivided) - Not Elevated - 2 Lanes
  - Road (Paved Undivided) - Not Elevated - 4 Lanes
  - Road (Paved Undivided) - U/C - Not Elevated - 4 Lanes
  - Road (Unimproved)
  - Cut (Roadway)
  - Embankment/Fill (Roadway)
  - Trail
  - Bridge - Foot
  - Bridge - Trestle
  - Tunnel
  - Bridge
  - Rail Line (Double Track)
  - Rail Line (Multiple Track)
  - Rail Line (Single Track)
  - Rail Line - Abandoned Track
  - Spur
- Water - Points (TRIM)
  - Rapids
  - Dam
  - Flooded Land - Inundated
  - Marsh
  - Swamp
  - Sand/Gravel Bar
  - Flow Arrow
  - Arrowhead
  - Island - Definite

Scale: 1:64,051

DO NOT USE FOR NAVIGATION

British Columbia
Conservation Data Centre

Element Occurrence Record (16530)

May 30, 2006

Piperia elegans
(Elegant Rein Orchid)

Please see http://srmwww.gov.bc.ca/cdc/gis/eo_data_fields.htm for definitions.
This is a summary report. For a complete record contact the CDC (cdcdata@victoria1.gov.bc.ca).

Element Type:
Vascular Plant

Taxonomic Class:
Monocots

Status:
Global: G4
Provincial: S3
COSEWIC:
List: Blue

Representational Accuracy:

Location / Directions:
COURTENAY

Element Occurrence Data: (Last Observation: 1957)
None.

General Description:

EO Type:

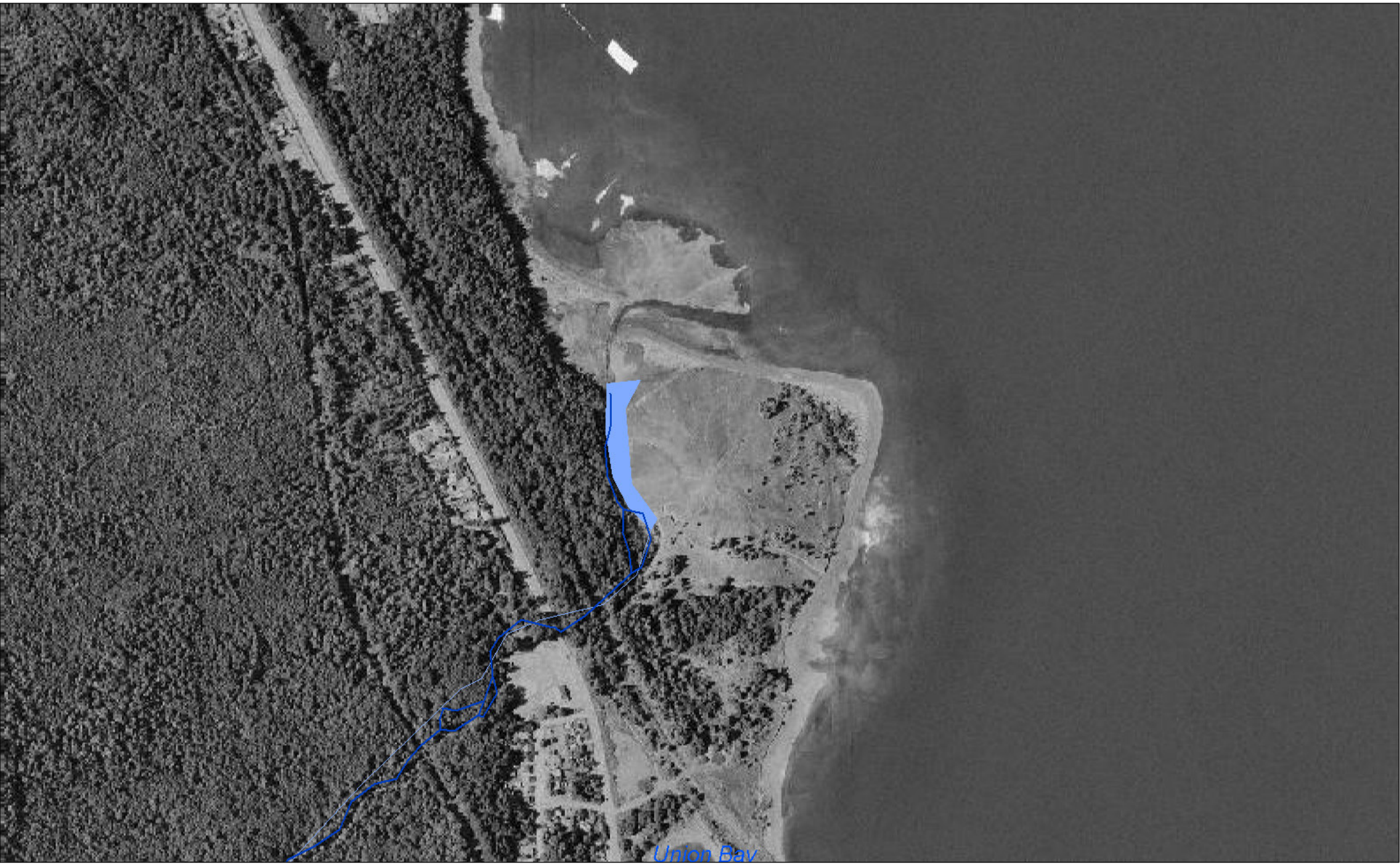
Habitat Keyword:
TERRESTRIAL

EO Rank: **Comments:**

Vegetation Zone:
Lowland

Element Occurrence References:
(O92PMV01BCCA) Royal British Columbia Museum. Minist. Tourism, and the Minist. Responsible for Cult., 675 Belleville St., Victoria, BC, V8V 1X4.

Sensitive Habitat Inventory and Mapping - Waste Coal Hill



SCALE 1 : 8,471

500 0 500 1,000 1,500

FEET

N

Back Main Queries Page

FISS Report

Gazetted Name : HART CREEK
Watershed Code : 920-538600
Waterbody Identifier : 00000COMX
Region : 1
Alias : WASHER CREEK
Type : **S**
Report created on : Tue May 30 11:08:28 PDT 2006

Water Quality Stations

No records found

Water Survey Stations

No records found

Management Objectives

Habitat Type	Objective 1	Objective 2
Anadromous River		

Enhancement

Activity	Start Year	Finish Year	Species Name	Comments	Reference Number	Geo Ref 1	Geo Ref 2
110 Water Quality and Quantity	1998	2000		WATER QUALITY/QUANTITY MONITORING STATION (MAINTAINED BY HART (WASHER) WATERSHED COMMITTEE) (REF #HQ2029)	HQ2029	P 092F10 8012	
215 Biophysical Inventory/Assessment					HQ2029	U 092F10 40	
151 Stocking/Colonization	1947	1960	Rainbow Trout		REL-SUM	W 307606	
210 Biophysical Surveys (unspecified)	2001	2002		Mapping and inventory of wetlands and upper reaches of creek.	DFO131	W 307606	

Harvests and Uses

Species Name	Stock	Start / End Year	Mean / High Catch	Mean / High Effort	Mean / High CPUE	Comments	Season	Reference Number	Geo Ref 1	Geo Ref 2
Steelhead		1972 / 1974	7 / 10	29 / 42	/	For this record, Effort Mean and High units are in days per year, not hours per day. Mean and High Catch for Kept and Released are combined. Catch and effort calculations are generated from the Steelhead Harvest Analysis Database only and do not		STLHD-SUM	W 307606	

include SLAM information.

Resource Use

Sector	Catch (High / Low)	Catch (mean)	Effort (high / low)	Effort (mean)	Season Comments	Start / End Year	Reference Number	Geo Ref 1	Geo Ref 2
Recreational	0 / 0	0	0 / 0	0		9999 / 9999	14-9	W 307606	

Resource Values

No records found

Resource Sensitivities

Description	Comments	Reference Number	Geo Ref 1	Geo Ref 2
Sensitive habitat	(BEST REARING HABITAT LOCATED IN REACH 6 AND IN TRIBUTARY 92-2950-400 REACH 2. HEADWATER OF THIS TRIBUTARY IS HIGH VALUE WET LANDS REF# = 14-10)	14-10	W 307606	

Land Use

Description	Comments	Reference Number	Geo Ref 1	Geo Ref 2
Linear development	(PROPOSED ISLAND HIGHWAY CULVERT CROSSING; 45M STREAM ENCROACHMENT. CV DESING- BOTTOMLESS ARCH REF# = 14-17)	14-17	P 092F10 41	
Mining	(COAL MINING IN THE PAST HAS ADVERESLY AFFECTED THIS SYSTEM REF# = 14-2)	14-2	W 307606	

Fisheries Potentials and Constraints

Activity	Impact	Degree of Impact	Comments	Species Name	Reference Number	Geo Ref 1	Geo Ref 2
HIGH DIVERSITY	Describing potential for increasing fisheries production	high	COMPLEX HABITAT IN LEFT AND RIGHT BANK SIDE CHANNELS. COHO REARING OBSERVED IN LEFT BANK CHANNEL (REF# HQ2029)		HQ2029	P 092F10 38	
580 Disturbance	Not identified as either potential or constraint	Low	INSTREAM TRUCK CROSSING. RARELY USED, LITTLE STREAM DAMAGE (REF# HQ2029)		HQ2029	P 092F10 39	
700 Habitat	Not identified as either potential or constraint	Not Specified	(BEDROCK CHANNEL REF# = 14-17)	Cutthroat Trout	14-17	P 092F10 41	
560 Pollutants	Not identified as either potential or constraint	Not Specified	BODIES OF 4 CARS AND COAL SLAG HEAP WITH UNKNOWN CONTAMINANTS IN IT ON RIGHT BANK (REF#HQ2029)		HQ2029	P 092F10 48	
580 Disturbance	Not identified as either potential or constraint	Low	INSTREAM CROSSING FOR HIKERS/MOTORBIKES. NOT A SERIOUS SOURCE OF SEDIMENTATION (REF #HQ2029)		HQ2029	P 092F10 48	
HIGH QUANTITY OR AMOUNT OF SPAWNING HABITAT	Describing potential for increasing fisheries production	Not Specified	SIDE CHANNEL (REF #HQ2029)		HQ2029	P 092F10 48	
	Describing						

MEDIUM GRAVEL QUALITY	potential for increasing fisheries production	Not Specified	MODERATELY EMBEDDED WITH FINES (REF# HQ2029)	Chum Salmon Pink Salmon	HQ2029	P 092F10 8009	
720 Rearing habitat	Describing potential for increasing fisheries production	Not Specified	230M SIDE CHANNEL, GOOD FOR WINTER REARING. DEBRIS AT BOTH ENDS GUARDS AGAINST FLOODING (REF# HQ2029)		HQ2029	P 092F10 8010	
LOW DIVERSITY	Describing constraint for increasing fisheries production	Not Specified	400M SECTION (REF# HQ2029)		HQ2029	P 092F10 8010	
560 Pollutants	Not identified as either potential or constraint	Not Specified	DRAIN FROM COMMUNITY FIELD MAY BE SOURCE OF FERTILIZER POLLUTION (REF #HQ2029)		HQ2029	P 092F10 8011	
HIGH QUANTITY REARING HABITAT	Describing potential for increasing fisheries production	high	SIDE CHANNEL - LOWER END GROUNDWATER-FED WITH REARING POOLS, UPPER END DRY, LOG JAM AT UPPER END (REF # HQ2029)		HQ2029	P 092F10 8012	
REARING HABITAT	Describing potential for increasing fisheries production	Medium	(REACH 1; FSL, MEAN GRADIENT 2% REF# = 14-10)	Coho Salmon	14-10	U 092F10 38	D 092F10 48
REARING HABITAT	Describing potential for increasing fisheries production	Low	(REACH 2; 80% BEDROCK, LIMITED IS COVER, 20% POOL, MEAN GRADIENT OF 2% REF# = 14-10)	Coho Salmon	14-10	U 092F10 39	D 092F10 38
REARING HABITAT	Describing potential for increasing fisheries production	Medium	(REACH 3; MEAN GRADIENT 2 %, POOLS 20%, REARING POTENTIAL UNDERUTILIZED REF# = 14-10)	Coho Salmon	14-10	U 092F10 40	D 092F10 39
REARING HABITAT	Describing potential for increasing fisheries production	Low	(REACH 4; 70% BEDROCK, FLOOD SIGN 2 M REF# = 14-10)	Coho Salmon	14-10	U 092F10 41	D 092F10 40
630 Flow fluctuations	Describing constraint for increasing fisheries production	Medium	(SUBJECT TO EXTREME SEASONAL FLUCTUATIONS IN WATER LEVELS. THIS STREAM WAS DECIMATED BY PAST COAL MINING ACTIVITY AND WATER DIVERSIONS. REHABILITATION IS RECOMMENDED, AS THERE IS VALUABLE UNDERUTILIZED HABITAT. SUBJECT TO EROSION AND SILTING. REF# = 14-2)		14-2	U 092F10 42	D 092F10 38
REARING HABITAT	Describing potential for increasing fisheries production	high	(REACH 6; < 1% MEAN GRADIENT; 40% POOL, EXCELLENT REARING HABITAT REF# = 14-10)	Coho Salmon	14-10	U 092F10 43	D 092F10 42
REARING HABITAT	Describing potential for increasing fisheries production	Medium	(REACH 5; MEAN GRADIENT 1-2 %, 30% POOL, SEVERE FLOOD DAMAGE REF# = 14-10)	Coho Salmon	14-10	U 092F10 48	D 092F10 41

Obstructions

Description	Height	Length	Comments	Species Name	Reference Number	Geo Ref 1	Geo Ref 2
Falls	0	0	(1KM FROM MOUTH REF# = 14-2)	Chum Salmon	14-2	P 092F10 38	
Falls	4	0		All Fish	13-3 HQ2029	P 092F10 40	
Falls	6	999	BEDROCK FALLS, NO PLUNGE POOL. BARRIER TO ANADROMOUS SPECIES (REF# HQ2029)	Salmon (General)	HQ2029	P 092F10 45	

Log jam	999	999	POTENTIALLY A BARRIER, PASSABLE AT HIGH FLOWS (REF# HQ2029)	HQ2029	P 092F10 8014		
Cascade	0	0	EXTENDS TO INLAND HIGHWAY RIGHT OF WAY (REF# HQ2029)	13-3 HQ2029	U 092F10 40	D 092F10 45	

Escapements

Species Name	Stock	Ten Year Start / End	Ten Year Mean / Max	Max Esc Year	Max. Escapements	Target esc.	Reference Number	Geo Ref 1	Geo Ref 2
Chum Salmon		1980 / 1999	126 / 400	400	400		NUSEDS-SUM	W 307606	
Chum Salmon		1990 / 1999	154 / 400	400	400		DFO_ESC	W 307606	
Coho Salmon		1981 / 1998	40 / 100	300	300		NUSEDS-SUM	W 307606	
Coho Salmon		1990 / 1999	40 / 75	300	300		DFO_ESC	W 307606	

Fish Distributions

Species Name	Stock / Stock Type	Stock Char	Management Class	Activity	Comments	Refs And Dates	Geo Ref 1	Geo Ref 2
Chum Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone	(FEW IN NUMBERS. TO FALLS AT 1 KM. REF#=14-2,14-9)	(14-2, 01-JAN-1985) (14-9, 01-JAN-1993) 	U 092F10 38	
Chum Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone		(14-9, 01-JAN-1993) 	W 307606	
Coho Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone	(OBSERVED AT 2.9 KM AND IN TRIBUTARY. REF#=13-3,14-9)	(13-3, 01-JAN-1990) (14-9, 01-JAN-1993) 	P 092F10 45	
Coho Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone	(OBSERVED FROM MOUTH TO 4 M FALLS BARRIER. REF#=14-17,14-9)	(14-17, 01-JAN-1993) (14-9, 01-JAN-1993) 	U 092F10 40	
Coho Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone	OBSERVED IN SIDE CHANNEL (REF# HQ2029)	(HQ2029, 01-FEB-1999) 	P 092F10 38	
Coho Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone	OBSERVED IN SIDE CHANNEL (REF# HQ2029)	(HQ2029, 01-FEB-1999) 	P 092F10 8012	
Coho Salmon	/ NOT SPECIF	Anadromous	Not Specified	OBL Fish observed at this point or zone		(14-9, 01-JAN-1993) 	W 307606	
Cutthroat Trout	/ NOT SPECIF	Anadromous	Wild indigenous	OBL Fish observed at this point or zone	(OBSERVED FROM CREEK MOUTH TO 4 M FALLS BARRIER AT 3.25 KM. REF#=14-17,14-9)	(14-17, 01-JAN-1993) (14-9, 01-JAN-1993) 	U 092F10 40	
Cutthroat Trout	/ NOT SPECIF	Anadromous	Wild indigenous	OBL Fish observed at this point or zone		(14-9, 01-JAN-1993) 	W 307606	
Cutthroat Trout	/ NOT SPECIF	Fluvial	Wild indigenous	OBL Fish observed at this point or zone	(OBSERVED AT PROPOSED CULVERT CROSSING ABOVE 4 M FALLS BARRIER. REF#=14-17,14-9)	(14-17, 01-JAN-1993) (14-9, 01-JAN-1993) 	P 092F10 41	
Cutthroat Trout	/ NOT SPECIF	Fluvial	Wild indigenous	OBL Fish observed at this point or zone	(THROUGHOUT. OBSERVED ABOVE AND BELOW 4 M FALLS. REF#=13-3,14-9)	(13-3, 01-JAN-1990) (14-9, 01-JAN-1993) 	U 092F10 43	
				OBL Fish				

Cutthroat Trout	/ NOT SPECIF	Fluvial	Wild indigenous	observed at this point or zone	(14-9, 01-JAN-1993) 	W 307606
Rainbow Trout	DREW-WASH. / NOT SPECIF	Not Specif	Hatchery production	OBL Fish observed at this point or zone	(REL-SUM, no date) 	W 307606
Rainbow Trout	KNOUFF / NOT SPECIF	Not Specif	Hatchery production	OBL Fish observed at this point or zone	(REL-SUM, no date) 	W 307606
Steelhead	/ NOT SPECIF	Not Specif	Not Specified	OBL Fish observed at this point or zone	(STLHD-SUM, no date) 	W 307606
Steelhead	WINTER / NOT SPECIF	Anadromous	Wild indigenous	OBL Fish observed at this point or zone	(14-9, 01-JAN-1993) 	U 092F10 40
Steelhead	WINTER / NOT SPECIF	Anadromous	Wild indigenous	OBL Fish observed at this point or zone	(14-9, 01-JAN-1993) 	W 307606

Species and Life Phase History

No records found

Fiss References

Search AquaCat for keywords: HART CREEK

Reference Number :	HQ2029
Title :	**1998-2000 HART CREEK WATERSHED MAPPING AND INVENTORY PROJECT - SENSITIVE HABITAT INVENTORY AND MAPPING (SHIM) SURVEYS FOR: HART CREEK, "STRAY CREEK" (HART TP 132), "TROUT TRIBUTARY" (HART TP 193), AND "VAN WEST TRIBUTARY' (HART TP 132_TP 188)**
Description :	APPENDICES 1 THROUGH 4 ONLY
Location :	FISHERIES AND OCEANS CANADA, VANCOUVER BC
Reference code :	Community Group Report
Year :	1999
Author :	COMOX VALLEY PROJECT WATERSHED SOCIETY

Reference Number :	DFP001
Title :	**Addition of zones & points re: FISS maps for fish distribution for G.I.S. display purposes**
Description :	Addition of zones & points re: FISS maps for fish distribution for G.I.S. display purposes
Location :	MELP, Fisheries Branch, Victoria
Reference code :	Unpublished Government Report
Year :	1995
Author :	PHILIP, D.F.

Reference Number :	DFO131
Title :	**BAYNES SOUND SENSITIVE HABITAT STEWARDSHIP**
Description :	HRSEP 2001/02 Final Project Report; 13 pp.
Location :	DFO, Vancouver
Reference code :	Community Group Report
Year :	2002
Author :	COMOX VALLEY PROJECT WATERSHED SOCIETY

Reference Number :	14-2
Title :	**CATALOGUE OF SALMON STREAMS ANS SPAWNING ESCAPEMENTS OF STATISTICAL AREA 14 COMOX - PARKSVILLE. MARCH, 1985. DFO CANADIAN DATA REPORT OF FISHERIES & AQUATIC SCIENCES NO. 504. 134 PP.**

Description : AO; enhancement; land use; migration; spawning; ST
Location : DFO - SUBDISTRICT 14: Qualicum Beach & Comox
Reference code : Government Report
Year : 1985
Author : HANCOCK, M.J.

Reference Number : 14-2
Title : **CATALOGUE OF SALMON STREAMS ANS SPAWNING ESCAPEMENTS OF STATISTICAL AREA 14 COMOX - PARKSVILLE. MARCH, 1985. DFO CANADIAN DATA REPORT OF FISHERIES & AQUATIC SCIENCES NO. 504. 134 PP.**
Description : AO; enhancement; land use; migration; spawning; ST
Location : DFO - SUBDISTRICT 14: Qualicum Beach & Comox
Reference code : Government Report
Year : 1985
Author : MARSHALL, D.E.

Reference Number : 13-3
Title : **INLAND ISLAND HIGHWAY STUDY, FISHERIES ASSESSMENT. JANUARY 1990. S.H.I.P. ENVIRONMENTAL CONSULTANTS LTD. FISHERIES HABITAT IMPACTS ASSESSMENT MAPS.**
Description : AF; enhancement; linear developement; land use; obstructions; physical habitat
Location : NOT APPLICABLE
Reference code : Government Report
Year : 1990
Author : ANONYMOUS

Reference Number : 14-9
Title : **MOELP Stream classification overview.**
Description :
Location : MOELP; Region 1; Nanaimo
Reference code : Government Report
Year : 1993
Author : SCOLTEN, A.

Reference Number : NUSEDS-SUM
Title : **NUSEDS Database**
Description :
Location : Ministry of Sustainable Resource Management, Victoria, BC
Reference code : Government Database
Year : 2000
Author : FISHERIES AND OCEANS CANADA

Reference Number : REL-SUM
Title : **RELEASE Database**
Description :
Location : Ministry of Sustainable Resource Management, Victoria, BC
Reference code : Government Database
Year :
Author : MINISTRY OF SUSTAINABLE RESOURCE MANAGEMENT

Reference Number : STLHD-SUM
Title : **STEELHEAD Database**
Description :
Location : Ministry of Sustainable Resource Management, Victoria, BC
Reference code : Government Database
Year :
Author : MINISTRY OF SUSTAINABLE RESOURCE MANAGEMENT

Reference Number : 14-10
Title : **Unpublished status report.**
Description : Habitat sampling; fish sampling
Location : DFO; South Coast Division; Nanaimo
Reference code : Government Report

Year :	1986
Author :	BLACKMAN, B.G.

Reference Number :	14-17
Title :	**Vancouver Island inland highway study, fisheries impact assessment. Volume III Section 441.**
Description :	Prepared by SHIP Environmental Consultants Ltd. for B.C. Ministry of Transportation and Highways. March, 1993. iii + 40pp + appendices I to III.
Location :	Ministry of Transportation & Highways. Library. 3rd flr; 200-546 Yates St.; Victoria; V8W 1K8
Reference code :	Government Report
Year :	1993
Author :	HARDING, T.

12 references were found.

Top of Page

APPENDIX B

Human Health Risk Exposure Scenarios, TRVs, Risk Calculations

Revised Problem Formulation and
Preliminary Quantitative Risk Assessment,
Union Bay Waste Coal Pile, BC Site 4291
Seacor Project: 201.01022.01 & 201.01069.01

TABLE B1: HUMAN EXPOSURE POINT CONCENTRATIONS FOR COPCs IN INTERTIDAL SEDIMENT	
Chemical of Potential Concern[a]	**Cs[b] (mg/kg)[c]**
Metals	
Aluminium (Maximum)	20600
Arsenic (Maximum)	49.2
Iron (Maximum)	93500
Manganese (Maximum)	482
PAHs	
Naphthalene (Maximum)	4.54
Phenanthrene (Maximum)	6.61

Notes:

[a] COPCs include all compounds exceeding CSR soil standard (RL/PL), Human "intake of contaminated soil matrix standards, and generic standards where no intake of contaminated soil matrix standard **OR** the compound is a COPC in another Site media and was retained in sediment to address exposure via multiple pathways.

[b] Represents the maximum in intertidal surface sediment samples collected from the perimeter of the Waste Coal Pile and Union Bay during investigative works.

[c] mg/kg = milligrams per kilogram dry weight.

TABLE B2: HUMAN EXPOSURE POINT CONCENTRATIONS FOR COPCs IN INTERTIDAL PRECIPITATE (FERRICRETE)	
Chemical of Potential Concern[a]	**Cs[b] (mg/kg)[b]**
Aluminium (Maximum)	15400
Arsenic (Maximum)	30.4
Iron (Maximum)	307000
Manganese (Maximum)	269
Molybdenum (Maximum)	37.8

Notes:

[a] COPCs include all compounds exceeding CSR soil standard (RL/PL), Human

[b] Represents the maximum in ferricrete and precipitate (~0-1 cm) from the east face

[c] mg/kg = milligrams per kilogram dry weight.

TABLE B3: HUMAN EXPOSURE POINT CONCENTRATIONS FOR COPCs IN INTERTIDAL WATER (SEEP, TIDE POOL, AND OCEAN WATER)	
Chemical of Potential Concern	**Cw[a] (mg/L)[b]**
Metals	
Aluminium (Maximum)	18.2
Arsenic (Maximum)	0.00478
Cadmium (Maximum)	0.00236
Iron (Maximum)	292
Manganese (Maximum)	3.52
PAHs	
None - < 0.00005 mg/L	

Notes:

[a] COPCs include all compounds exceeding CSR DW standard **OR** the compound is a COPC in another Site media (soil, sediment, or shellfish).

[b] Represents the maximum in foreshore water samples (seep, tide pool, ocean water) collected from the perimeter of the Waste Coal Pile during investigative works.

[c] mg/L = milligrams per litre (total, or dissolved when dissolved > total).

TABLE B4: HUMAN EXPOSURE POINT CONCENTRATIONS FOR COPCs IN INTERTIDAL SHELLFISH (CLAMS)	
Chemical of Potential Concern[a]	**Clams ($C_{Shellfish}$)[b] (mg/kg ww)[c]**
Metals	
Aluminium (Maximum)	171
Arsenic (Maximum - Total)	2.86
Arsenic (Maximum - Inorganic)	0.06
Cadmium (Maximum)	0.523
Cobalt (Maximum)	0.198
Copper (Maximum)	4.67
Iron (Maximum)	208
Lead (Maximum)	0.083
Manganese (Maximum)	3.8
Nickel (Maximum)	0.41
Zinc (Maximum)	26.1
PAHs	
Phenanthrene (Maximum)	0.025

Notes:

[a] COPCs include all metals present in Site seep water and/or sediment at concentrations greater than aquatic life guidelines, **OR** the compound's concentrations in Site seep water and/or sediment were greater than those observed in reference area seep water and/or sediment. COPCs include all PAHs detected in clam tissue.

[b] Maximum concentrations shown. Insufficient sample size to calculate 95% UCLM (n=5). Samples analyzed were composite samples of multiple clams, approx. 10 clams per station. Non-depurated clams (Varnish clams, Littleneck).

[c] mg/kg = milligrams per kilogram wet weight.

Arsenic (Inorganic) assumed value of 2% of arsenic (maximum), based on FSA (2005).

TABLE B5: HUMAN EXPOSURE POINT CONCENTRATIONS FOR COPCs IN INTERTIDAL SHELLFISH (OYSTERS)	
Chemical of Potential Concern[a]	**Oysters ($C_{Shellfish}$)[b] (mg/kg ww)[c]**
Metals	
Aluminium (Maximum)	36.9
Arsenic (Maximum)	2.24
Arsenic (95% UCLM)	1.58
Arsenic (Maximum - Inorganic)	0.045
Arsenic (95% UCLM - Inorganic)	0.032
Cadmium (Maximum)	2.85
Cadmium (95% UCLM)	1.86
Cobalt (Maximum)	0.058
Copper (Maximum)	43.1
Copper (95% UCLM)	29.8
Iron (Maximum)	645
Lead (Maximum)	0.038
Manganese (Maximum)	13.7
Nickel (Maximum)	*0.05*
Zinc (Maximum)	387
Zinc (95% UCLM)	275
PAHs	
Not Suspected	< 0.00005 mg/L in Seep Water

Notes:

[a] COPCs include all metals present in Site seep water and/or sediment at concentrations greater than aquatic life guidelines, **OR** the compound's concentrations in Site seep water and/or sediment were greater than those observed in reference area seep water and/or sediment. COPCs include all PAHs detected in clam tissue.

[b] Maximum and 95% UCLM concentrations shown. Samples analyzed were of individual oysters, 3 oysters per station, 4 stations (n=12).

[c] mg/kg = milligrams per kilogram wet weight.

Italic - Not detected. One half detection limit concentration shown.

Arsenic (Inorganic) assumed value of 2% of arsenic (maximum), based on FSA (2005).

TABLE B6: RECEPTOR CHARACTERISTICS - RECREATOR				
Parameter	**Acronym**	**Value**	**Unit**	**Source**
ADULT				
Life Expectancy	LE	56	years	HC, 2004a
Daily Exposure Frequency	EF	1	events/day	BPJ
Daily Exposure Duration	D	1	hours/day	BPJ
Weekly Exposure Frequency (Intertidal)	D1	1	days per week exposed/7 days	BPJ
Annual Exposure Frequency (Intertidal)	D2	26	weeks per year exposed/52 weeks	BPJ
Lifetime Exposure Duration	D3	30	total years exposed to Site	USEPA, 1997
Seafood Ingestion Frequency	$D_{Seafood}$	52	days/year	BPJ/USEPA, 1997
Body Weight	BW	70.7	kg	HC, 2004a
Inhalation Rate	IR_A	1.6	m^3/hour	USEPA, 1997
Soil Ingestion Rate	IR_S	0.00002	kg/day	HC, 2004a
Seafood Ingestion Rate	$IR_{Seafood}$	0.22	kg/day	HC, 2004a
Surface Water Ingestion Rate	IR_W	0.05	L/hour	USEPA, 1989
Particulate Concentration in Air	P_{Air}	7.60E-10	kg/m^3	HC, 2004a
Skin Surface Area - Hands	SA_H	890	cm^2	HC, 2004a
Skin Surface Area - Arms	SA_A	2500	cm^2	HC, 2004a
Skin Surface Area - Legs	SA_L	5720	cm^2	HC, 2004a
Soil Loading to Exposed Skin - Hands	SL_H	1.00E-07	kg/cm^2-event	HC, 2004a
Soil Loading to Exposed Skin - Other Body Parts	SL_O	1.00E-08	kg/cm^2-event	HC, 2004a
Absorption Factor from Gastrointestinal Tract	AF_{GIT}	See Table B7	unitless	
Permeability Constant	PC	See Table B7	cm/hour	
Dermal Absorption Factor	AF_{Dermal}	See Table B7	unitless	
TEEN (12-19 YR)				
Life Expectancy	LE	63	years	HC, 2004a
Daily Exposure Frequency	EF	1	events/day	BPJ
Daily Exposure Duration	D	1	hours/event	BPJ
Weekly Exposure Frequency (Intertidal)	D1	1	days per week exposed/7 days	BPJ
Annual Exposure Frequency (Intertidal)	D2	26	weeks per year exposed/52 weeks	BPJ
Lifetime Exposure Duration	D3	8	total years exposed to Site	BPJ
Seafood Ingestion Frequency	$D_{Seafood}$	52	days/year	BPJ/USEPA, 1997
Body Weight	BW	59.7	kg	HC, 2004a
Inhalation Rate	IR_A	1.2	m^3/hour	USEPA, 1997
Soil Ingestion Rate	IR_S	0.00002	kg/day	HC, 2004a
Seafood Ingestion Rate	$IR_{Seafood}$	0.2	kg/day	HC, 2004a
Surface Water Ingestion Rate	IR_W	0.05	L/hour	USEPA, 1989
Particulate Concentration in Air	P_{Air}	7.60E-10	kg/m^3	Dillon, 2005
Skin Surface Area - Hands	SA_H	800	cm^2	HC, 2004a
Skin Surface Area - Arms	SA_A	2230	cm^2	HC, 2004a
Skin Surface Area - Legs	SA_L	4970	cm^2	HC, 2004a
Soil Loading to Exposed Skin - Hands	SL_H	1.00E-07	kg/cm^2-event	HC, 2004a
Soil Loading to Exposed Skin - Other Body Parts	SL_O	1.00E-08	kg/cm^2-event	HC, 2004a
Absorption Factor from Gastrointestinal Tract	AF_{GIT}	See Table B7	unitless	
Permeability Constant	PC	See Table B7	cm/hour	
Dermal Absorption Factor	AF_{Dermal}	See Table B7	unitless	HC, 2004a

CHILD (5-11 YR)				
Life Expectancy	LE	70	years	HC, 2004a
Daily Exposure Frequency	EF	1	events/day	BPJ
Daily Exposure Duration	D	1	hours/event	BPJ
Weekly Exposure Frequency (Intertidal)	D1	1	days per week exposed/7 days	BPJ
Annual Exposure Frequency (Intertidal)	D2	26	weeks per year exposed/52 weeks	BPJ
Lifetime Exposure Duration	D3	7	total years exposed to Site	BPJ
Seafood Ingestion Frequency	$D_{Seafood}$	52	days/year	BPJ/USEPA, 1997
Body Weight	BW	32.9	kg	HC, 2004a
Inhalation Rate	IR_A	1.2	m^3/hour	USEPA, 1997
Soil Ingestion Rate	IR_S	0.00002	kg/day	HC, 2004a
Seafood Ingestion Rate	$IR_{Seafood}$	0.17	kg/day	HC, 2004a
Surface Water Ingestion Rate	IR_W	0.05	L/hour	USEPA, 1989
Particulate Concentration in Air	P_{Air}	7.60E-10	kg/m^3	HC, 2004a
Skin Surface Area - Hands	SA_H	590	cm^2	HC, 2004a
Skin Surface Area - Arms	SA_A	1480	cm^2	HC, 2004a
Skin Surface Area - Legs	SA_L	3070	cm^2	HC, 2004a
Soil Loading to Exposed Skin - Hands	SL_H	1.00E-07	kg/cm^2-event	HC, 2004a
Soil Loading to Exposed Skin - Other Body Parts	SL_O	1.00E-08	kg/cm^2-event	HC, 2004a
Absorption Factor from Gastrointestinal Tract	AF_{GIT}	See Table B7	unitless	
Permeability Constant	PC	See Table B7	cm/hour	
Dermal Absorption Factor	AF_{Dermal}	See Table B7	unitless	HC, 2004a
TODDLER (7 MOS-4 YR)				
Life Expectancy	LE	74.5	years	HC, 2004a
Daily Exposure Frequency	EF	1	events/day	BPJ
Daily Exposure Duration	D	1	hours/event	BPJ
Weekly Exposure Frequency (Intertidal)	D1	1	days per week exposed/7 days	BPJ
Annual Exposure Frequency (Intertidal)	D2	26	weeks per year exposed/52 weeks	BPJ
Lifetime Exposure Duration	D3	4.5	total years exposed to Site	BPJ
Seafood Ingestion Frequency	$D_{Seafood}$	52	days/year	BPJ/USEPA, 1997
Body Weight	BW	16.5	kg	HC, 2004a
Inhalation Rate	IR_A	1.2	m^3/hour	USEPA, 1997
Soil Ingestion Rate	IR_S	0.00008	kg/day	HC, 2004a
Seafood Ingestion Rate	$IR_{Seafood}$	0.095	kg/day	HC, 2004a
Surface Water Ingestion Rate	IR_W	0.05	L/hour	USEPA, 1989
Particulate Concentration in Air	P_{Air}	7.60E-10	kg/m^3	HC, 2004a
Skin Surface Area - Hands	SA_H	430	cm^2	HC, 2004a
Skin Surface Area - Arms	SA_A	890	cm^2	HC, 2004a
Skin Surface Area - Legs	SA_L	1690	cm^2	HC, 2004a
Soil Loading to Exposed Skin - Hands	SL_H	1.00E-07	kg/cm^2-event	HC, 2004a
Soil Loading to Exposed Skin - Other Body Parts	SL_O	1.00E-08	kg/cm^2-event	HC, 2004a
Absorption Factor from Gastrointestinal Tract	AF_{GIT}	See Table B7	unitless	
Permeability Constant	PC	See Table B7	cm/hour	
Dermal Absorption Factor	AF_{Dermal}	See Table B7	unitless	

Notes:

Health Canada (HC). 2004a. Federal Contaminated Site Risk Assessment in Canada. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA).

BPJ = Best Professional Judgement

USEPA, 1997. Exposure Factors Handbook. Recommended short term moderate activity inhalation rate for adults and children.

ORNL. 2006. Risk Assessment Information System. Chemical Specific Factors. Current as of February, 2006. http://risk.lsd.ornl.gov/

meals/week.

$IR_{Seafood}$ = Health Canada (2004a) Canadian General Population Fish Consumption Rate.

Note - 0.22 kg/day is the equivalent of less than 10 varnish clams (DFO reports full grown varnish mass incl. shell is 0.061 kg).

USEPA. 1989. Risk Assessment Guidance for Superfund. Volume I Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. December, 1989. http://risk.lsd.ornl.gov/homepage/HHEMA.pdf IR_W shown on page 6-36.

TABLE B7: CHEMICAL PROPERTIES							
Chemical of Potential Concern	**AF_{Dermal}**	**Reference**	**AF_{GIT}** (For Oral Dose Calcs [a])	**AF_{GIT}** (For RfD_o to RfD_d Conversion)	**Reference**	**PC**	**Reference**
	(mg/cm^2)					**(cm/hour)**	
Metals							
Aluminium	1.0E-03	ORNL, 2006	1.0	1.0E-01	ORNL, 2006	1.0E-03	ORNL, 2006
Arsenic	3.0E-02	HC, 2004a	1.0	4.1E-01	ORNL, 2006	1.0E-03	ORNL, 2006
Cadmium	1.4E-01	HC, 2004a	1.0	1.0E-02	ORNL, 2006	1.0E-03	ORNL, 2006
Cobalt	1.0E-03	ORNL, 2006	1.0	8.0E-01	ORNL, 2006	4.0E-03	ORNL, 2006
Copper	1.0E-01	HC, 2004a	1.0	3.0E-01	ORNL, 2006	1.0E-03	ORNL, 2006
Iron	1.0E-03	ORNL, 2006	1.0	1.5E-01	ORNL, 2006	1.0E-03	ORNL, 2006
Lead	6.0E-03	HC, 2004a	1.0	1.5E-01	ORNL, 2006	1.0E-04	ORNL, 2006
Manganese	1.0E-03	ORNL, 2006	1.0	4.0E-02	ORNL, 2006	1.0E-03	ORNL, 2006
Molybdenum	1.0E-01	HC, 2004a	1.0	3.8E-01	ORNL, 2006	1.0E-03	ORNL, 2006
Nickel	1.0E-03	ORNL, 2006	1.0	2.0E-01	ORNL, 2006	2.0E-04	ORNL, 2006
Zinc	2.0E-02	HC, 2004a	1.0	2.0E-01	ORNL, 2006	6.0E-04	ORNL, 2006
PAHs							
Naphthalene	1.0E-01	HC, 2004a	1.0	0.8	ORNL, 2006	0.0694	ORNL, 2006
Phenanthrene	1.8E-01	HC, 2004a	1.0	0.73	ORNL, 2006	0.229	ORNL, 2006

Notes:

[a] Default value of "1" when TRV is based on administered dose, or basis of TRV unknown (i.e. administered versus absorbed).

DAF = Dermal Absorption Factor (from soil)

PC = Permeability Constant

Health Canada (HC). 2004a. Federal Contaminated Site Risk Assessment in Canada. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA).

ORNL. 2006. Risk Assessment Information System. Chemical Specific Factors. Current as of February, 2006. http://risk.lsd.ornl.gov/

TABLE B8: NON-CANCER REFERENCE DOSES (RfDs)[a]					
Chemical of Potential Concern	TDI or RfDo (mg/kg-day) Value	RfDd (mg/kg-day) Value	Source	RfDi (mg/kg-day) Value	Source
Metals					
Aluminium	1.0E+00	1.0E-01	WHO(JEFCA), 1988	--	
Arsenic	3.0E-04	1.2E-04	USEPA IRIS, 1993	--	
Cadmium	8.0E-04	8.0E-06	HC, 2004b	--	
Cobalt	1.4E-03	1.1E-03	RIVM, 2000	--	
Copper	3.0E-02	9.0E-03	HC, 2004b	--	
Iron	8.0E-01	1.2E-01	WHO(JEFCA), 1983	--	
Lead	3.6E-03	5.4E-04	HC, 2004b	--	
Manganese (shellfish)	1.4E-01	--	USEPA IRIS, 1996	--	
Manganese (non food items)	2.4E-02	5.6E-03	USEPA IRIS, 1996	1.4E-05	USEPA IRIS, 1993
Molybdenum	5.0E-03	1.9E-03	USEPA IRIS, 1993	--	
Nickel	1.3E-03	2.6E-04	HC, 2004b	4.0E-06	HC, 2004b
Zinc	3.0E-01	6.0E-02	USEPA IRIS, 2006	--	
PAHs					
Naphthalene	2.0E-02	1.6E-02	USEPA IRIS, 1998	8.6E-04	USEPA IRIS, 1998
Phenanthrene	4.0E-02	2.9E-02	RIVM, 2000	--	

Notes:

TDI = Tolerable Daily Intake

RfDo = Reference Dose (oral), RfDd = Reference Dose (dermal), RfDi = Reference Dose (inhalation)

RfDd = (RfDo or TDI) * AF_{GIT}, to adjust oral dose from administered to uptake.

RfDi = Health Canada Tolerable Concentration (mg/m^3) * 15.8 m^3/day / 70.7 kg BW

RfDi = USEPA Reference Concentration (mg/m^3) * 20 m^3/day / 70 kg BW

mg/kg-day = milligrams per kilogram body weight per day.

[a] Per Health Canada (2004a), toxicity values were obtained from the following sources in order of priority: Health Canada, USEPA IRIS, WHO(JEFCA), RIVM, ATSDR, ORNL.

Health Canada (HC), 2004b. Federal Contaminated Site Risk Assessment in Canada. Part II: Health Canada Toxicological Reference Values

USEPA IRIS. Integrated Risk Information System (IRIS). http://www.epa.gov/iris/subst/index.html

WHO. World Health Organization. Joint FAO/WHO Expert Committee on Food Additives. http://jecfa.ilsi.org/search.cfm

RIVM. Netherlands National Institute of Public Health and the Environment. Toxicity values reported on ITER Database, http://www.tera.org/iter/

ATSDR, 2005. Agency for Toxic Substances and Disease Registry, Minimal Risk Levels. http://www.atsdr.cdc.gov/mrls.html

ORNL. 2006. Risk Assessment Information System. Chemical Specific Factors. Current as of February, 2006. http://risk.lsd.ornl.gov/

TABLE B9: CANCER SLOPE FACTORS (SF)[a]					
Chemical of Potential Concern	SFo (mg/kg-day)$^{-1}$ Value	SFd (mg/kg-day)$^{-1}$ Value	Source	Sfi (mg/kg-day)$^{-1}$ Value	Source
Metals					
Aluminium	--	--		--	
Arsenic	2.8E+00	6.8E+00	HC, 2004b	2.8E+01	HC, 2004b
Cadmium	--	--		4.29E+01	HC, 2004b
Cobalt	--	--		--	
Copper	--	--		--	
Iron	--	--		--	
Lead	--	--		--	
Manganese	--	--		--	
Molybdenum	--	--		--	
Nickel	--	--		3.1E+00	HC, 2004b
Zinc	--	--		--	
PAHs					
Naphthalene	--	--		--	
Phenanthrene	--	--		--	

Notes:

TDI = Tolerable Daily Intake

SFo = Slope Factor (oral), SFd = Slope Factor (dermal), Sfi = Slope Factor (inhalation)

SFd = (SFo) * AF_{GIT}, to adjust oral dose from administered to uptake.

mg/kg-day = milligrams per kilogram body weight per day.

[a] Per Health Canada (2004a), toxicity values were obtained from the following sources in order of priority: Health Canada, USEPA IRIS, WHO(JEFCA), RIVM, ATSDR, ORNL.

Health Canada (HC), 2004b. Federal Contaminated Site Risk Assessment in Canada. Part II: Health Canada Toxicological Reference Values

USEPA, 2006. Integrated Risk Information System (IRIS). On-line computer database.

WHO. World Health Organization.

RIVM. Netherlands National Institute of Public Health and the Environment. Toxicity values reported on ITER Database, http://www.tera.org/iter/

ATSDR, 2005. Agency for Toxic Substances and Disease Registry, Minimal Risk Levels.

ORNL. 2006. Risk Assessment Information System. Chemical Specific Factors. Current as of February, 2006. http://risk.lsd.ornl.gov/

TABLE B10: RECREATOR INADVERTENT INGESTION OF INTERTIDAL SEDIMENT (1 day/week)						
Pathway: Inadvertent Ingestion of Intertidal Sediment						
Dose = $(C_S \times IR_S \times AF_{GIT} \times D_1 \times D_2 \times D_3) / (BW \times LE)$[ab]						
Chemical	Noncarcinogenic Effects			Carcinogenic Effects		
	Dose	Oral Reference Dose (RfDo)	Hazard Quotient (HQ)	Dose	Oral Slope Factor (SFo)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	4.16E-04	1.0E+00	4.2E-04			
Arsenic (Maximum)	9.94E-07	3.0E-04	3.3E-03	5.33E-07	2.8E+00	1.5E-06
Iron (Maximum)	1.89E-03	8.0E-01	2.4E-03			
Manganese (Maximum)	9.74E-06	2.4E-02	4.1E-04			
PAHs						
Naphthalene (Maximum)	9.17E-08	2.0E-02	4.6E-06			
Phenanthrene (Maximum)	1.34E-07	4.0E-02	3.3E-06			
Risk Based Standards			**1.0E+00**			**1.0E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	4.93E-04	1.0E+00	4.9E-04			
Arsenic (Maximum)	1.18E-06	3.0E-04	3.9E-03	1.50E-07	2.8E+00	4.2E-07
Iron (Maximum)	2.24E-03	8.0E-01	2.8E-03			
Manganese (Maximum)	1.15E-05	2.4E-02	4.8E-04			
PAHs						
Naphthalene (Maximum)	1.09E-07	2.0E-02	5.4E-06			
Phenanthrene (Maximum)	1.58E-07	4.0E-02	4.0E-06			
Risk Based Standards			**1.0E+00**			**1.0E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	8.94E-04	1.0E+00	8.9E-04			
Arsenic (Maximum)	2.14E-06	3.0E-04	7.1E-03	2.14E-07	2.8E+00	6.0E-07
Iron (Maximum)	4.06E-03	8.0E-01	5.1E-03			
Manganese (Maximum)	2.09E-05	2.4E-02	8.7E-04			
PAHs						
Naphthalene (Maximum)	1.97E-07	2.0E-02	9.9E-06			
Phenanthrene (Maximum)	2.87E-07	4.0E-02	7.2E-06			
Risk Based Standards			**1.0E+00**			**1.0E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	7.13E-03	1.0E+00	7.1E-03			
Arsenic (Maximum)	1.70E-05	3.0E-04	5.7E-02	1.03E-06	2.8E+00	2.9E-06
Iron (Maximum)	3.24E-02	8.0E-01	4.0E-02			
Manganese (Maximum)	1.67E-04	2.4E-02	7.0E-03			
PAHs						
Naphthalene (Maximum)	1.57E-06	2.0E-02	7.9E-05			
Phenanthrene (Maximum)	2.29E-06	4.0E-02	5.7E-05			
Risk Based Standards			**1.0E+00**			**1.0E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				1.39E-06	2.8E+00	**3.9E-06**
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

TABLE B11: RECREATOR INADVERTENT INGESTION OF INTERTIDAL PRECIPITATE (FERRICRETE) (1 day/week)						
Pathway: Inadvertent Ingestion of Intertidal Seep Ferricrete						
Dose = $(C_S \times IR_S \times AF_{GIT} \times D_1 \times D_2 \times D_3) / (BW \times LE)$[ab]						
Chemical	Noncarcinogenic Effects			Carcinogenic Effects		
	Dose	Oral Reference Dose (RfDo)	Hazard Quotient (HQ)	Dose	Oral Slope Factor (SFo)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	3.11E-04	1.0E+00	3.1E-04			
Arsenic (Maximum)	6.14E-07	3.0E-04	2.0E-03	3.29E-07	2.8E+00	9.2E-07
Iron (Maximum)	6.20E-03	8.0E-01	7.8E-03			
Manganese (Maximum)	5.44E-06	2.4E-02	2.3E-04			
Molybdenum (Maximum)	7.64E-07	5.0E-03	1.5E-04			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	3.69E-04	1.0E+00	3.7E-04			
Arsenic (Maximum)	7.27E-07	3.0E-04	2.4E-03	9.24E-08	2.8E+00	2.6E-07
Iron (Maximum)	7.35E-03	8.0E-01	9.2E-03			
Manganese (Maximum)	6.44E-06	2.4E-02	2.7E-04			
Molybdenum (Maximum)	9.05E-07	5.0E-03	1.8E-04			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	6.69E-04	1.0E+00	6.7E-04			
Arsenic (Maximum)	1.32E-06	3.0E-04	4.4E-03	1.32E-07	2.8E+00	3.7E-07
Iron (Maximum)	1.33E-02	8.0E-01	1.7E-02			
Manganese (Maximum)	1.17E-05	2.4E-02	4.9E-04			
Molybdenum (Maximum)	1.64E-06	5.0E-03	3.3E-04			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	5.33E-03	1.0E+00	5.3E-03			
Arsenic (Maximum)	1.05E-05	3.0E-04	3.5E-02	6.36E-07	2.8E+00	1.8E-06
Iron (Maximum)	1.06E-01	8.0E-01	1.3E-01			
Manganese (Maximum)	9.32E-05	2.4E-02	3.9E-03			
Molybdenum (Maximum)	1.31E-05	5.0E-03	2.6E-03			
Risk Based Standards			**1.0E+00**			
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				8.60E-07	2.8E+00	2.4E-06
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table 7 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

TABLE B12: RECREATOR INADVERTENT INGENSTION OF INTERTIDAL WATER (SEEP, TIDE POOL, AND OCEAN WATER)(1 day/week)						
Pathway: Inadvertent Ingestion of Intertidal Water						
Dose = $(C_W \times IR_W \times AF_{GIT} \times D_1 \times D_2 \times D_3) / (BW \times LE)$[ab]						
	Noncarcinogenic Effects			Carcinogenic Effects		
Chemical	Dose	Oral Reference Dose (RfDo)	Hazard Quotient (HQ)	Dose	Oral Slope Factor (SFo)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	9.19E-04	1.00E+00	9.2E-04			
Arsenic (Maximum)	2.41E-07	3.00E-04	8.0E-04	1.29E-07	2.80E+00	3.6E-07
Cadmium (Maximum)	1.19E-07	8.00E-04	1.5E-04			
Iron (Maximum)	1.48E-02	8.00E-01	1.8E-02			
Manganese (Maximum)	1.78E-04	2.4E-02	7.4E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	1.09E-03	1.00E+00	1.1E-03			
Arsenic (Maximum)	2.86E-07	3.00E-04	9.5E-04	3.63E-08	2.8E+00	1.0E-07
Cadmium (Maximum)	1.41E-07	8.00E-04	1.8E-04			
Iron (Maximum)	1.75E-02	8.00E-01	2.2E-02			
Manganese (Maximum)	2.11E-04	2.4E-02	8.8E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	1.98E-03	1.00E+00	2.0E-03			
Arsenic (Maximum)	5.19E-07	3.00E-04	1.7E-03	5.19E-08	2.8E+00	1.5E-07
Cadmium (Maximum)	2.56E-07	8.00E-04	3.2E-04			
Iron (Maximum)	3.17E-02	8.00E-01	4.0E-02			
Manganese (Maximum)	3.82E-04	2.4E-02	1.6E-02			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	3.94E-03	1.00E+00	3.9E-03			
Arsenic (Maximum)	1.03E-06	3.00E-04	3.4E-03	6.25E-08	2.8E+00	1.7E-07
Cadmium (Maximum)	5.11E-07	8.00E-04	6.4E-04			
Iron (Maximum)	6.32E-02	8.00E-01	7.9E-02			
Manganese (Maximum)	7.62E-04	2.40E-02	3.2E-02			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				1.51E-07	2.8E+00	4.2E-07
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table 7 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

TABLE B13: RECREATOR INGESTION OF INTERTIDAL CLAMS (1 meal/week)						
Pathway: Ingestion of Clams						
Dose = $[\Sigma [C_{Seafood} \times IR_{Seafood} \times AF_{GIT} \times D_{Seafood} \times D_3]] / (BW \times 365 \times LE)^{ab}$						
	Noncarcinogenic Effects			Carcinogenic Effects		
Chemical	Dose	Oral Reference Dose (RfDo)	Hazard Quotient (HQ)	CDIc	Oral Slope Factor (SFo)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	7.58E-02	1.0E+00	7.6E-02			
Arsenic (Maximum)	1.27E-03	3.0E-04	**4.2E+00**	6.79E-04	2.8E+00	**1.9E-03**
Arsenic (Maximum-Inorganic)	2.54E-05	3.0E-04	8.5E-02	1.36E-05	2.8E+00	**3.8E-05**
Cadmium (Maximum)	2.32E-04	8.0E-04	2.9E-01			
Cobalt (Maximum)	8.78E-05	1.4E-03	6.3E-02			
Copper (Maximum)	2.07E-03	3.0E-02	6.9E-02			
Iron (Maximum)	9.22E-02	8.0E-01	1.2E-01			
Lead (Maximum)	3.68E-05	3.6E-03	1.0E-02			
Manganese (Maximum)	1.69E-03	1.4E-01	1.2E-02			
Nickel (Maximum)	1.82E-04	1.3E-03	1.4E-01			
Zinc (Maximum)	1.16E-02	3.0E-01	3.9E-02			
PAHs						
Phenanthrene (Maximum)	1.11E-05	4.0E-02	2.8E-04			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	8.16E-02	1.0E+00	8.2E-02			
Arsenic (Maximum)	1.36E-03	3.0E-04	**4.5E+00**	1.73E-04	2.8E+00	**4.9E-04**
Arsenic (Maximum-Inorganic)	2.73E-05	3.0E-04	9.1E-02	3.47E-06	2.8E+00	9.7E-06
Cadmium (Maximum)	2.50E-04	8.0E-04	3.1E-01			
Cobalt (Maximum)	9.45E-05	1.4E-03	6.7E-02			
Copper (Maximum)	2.23E-03	3.0E-02	7.4E-02			
Iron (Maximum)	9.93E-02	8.0E-01	1.2E-01			
Lead (Maximum)	3.96E-05	3.6E-03	1.1E-02			
Manganese (Maximum)	1.82E-03	1.4E-01	1.3E-02			
Nickel (Maximum)	1.96E-04	1.3E-03	1.5E-01			
Zinc (Maximum)	1.25E-02	3.0E-01	4.2E-02			
PAHs						
Phenanthrene (Maximum)	1.19E-05	2.0E-02	6.0E-04			
Risk Based Standards			**1.0E+00**			**1.0 E-05**

CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	1.26E-01	1.0E+00	1.3E-01			
Arsenic (Maximum)	2.11E-03	3.0E-04	**7.0E+00**	2.11E-04	2.8E+00	**5.9E-04**
Arsenic (Maximum-Inorganic)	4.21E-05	3.0E-04	1.4E-01	4.21E-06	2.8E+00	**1.2E-05**
Cadmium (Maximum)	3.85E-04	8.0E-04	4.8E-01			
Cobalt (Maximum)	1.46E-04	1.4E-03	1.0E-01			
Copper (Maximum)	3.44E-03	3.0E-02	1.1E-01			
Iron (Maximum)	1.53E-01	8.0E-01	1.9E-01			
Lead (Maximum)	6.11E-05	3.6E-03	1.7E-02			
Manganese (Maximum)	2.81E-03	1.4E-01	2.0E-02			
Nickel (Maximum)	3.02E-04	1.3E-03	2.3E-01			
Zinc (Maximum)	1.92E-02	3.0E-01	6.4E-02			
PAHs						
Phenanthrene (Maximum)	1.84E-05	2.0E-02	9.2E-04			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	1.40E-01	1.0E+00	1.4E-01			
Arsenic (Maximum)	2.35E-03	3.0E-04	**7.8E+00**	1.42E-04	2.8E+00	**4.0E-04**
Arsenic (Maximum-Inorganic)	4.69E-05	3.0E-04	1.6E-01	2.83E-06	2.8E+00	7.9E-06
Cadmium (Maximum)	4.29E-04	8.0E-04	5.4E-01			
Cobalt (Maximum)	1.62E-04	1.4E-03	1.2E-01			
Copper (Maximum)	3.83E-03	3.0E-02	1.3E-01			
Iron (Maximum)	1.71E-01	8.0E-01	2.1E-01			
Lead (Maximum)	6.81E-05	3.6E-03	1.9E-02			
Manganese (Maximum)	3.13E-03	1.4E-01	2.2E-02			
Nickel (Maximum)	3.36E-04	1.3E-03	2.6E-01			
Zinc (Maximum)	2.14E-02	3.0E-01	7.1E-02			
PAHs						
Phenanthrene (Maximum)	2.05E-05	2.0E-02	1.0E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				5.26E-04	2.8E+00	**1.5E-03**
Arsenic (Maximum-Inorganic)				1.05E-05	2.8E+00	**2.9E-05**
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

TABLE B14: RECREATOR INGESTION OF INTERTIDAL OYSTERS (1 meal/week)

Pathway: Ingestion of Oysters

Dose = $[\Sigma\ [C_{Seafood} \times IR_{Seafood} \times AF_{GIT} \times D_{Seafood} \times D_3]] / (BW \times 365 \times LE)^{ab}$

	Noncarcinogenic Effects			Carcinogenic Effects		
Chemical	**Dose**	**Oral Reference Dose (RfDo)**	**Hazard Quotient (HQ)**	**CDIc**	**Oral Slope Factor (SFo)**	**ILCR**
	(mg/kg/day)	**(mg/kg/day)**	**(unitless)**	**(mg/kg/day)**	**$(mg/kg/day)^{-1}$**	**(unitless)**
ADULT						
Metals						
Aluminium (Maximum)	1.64E-02	1.0E+00	1.6E-02			
Arsenic (Maximum)	9.93E-04	3.0E-04	**3.3E+00**	5.32E-04	2.8E+00	**1.5E-03**
Arsenic (95% UCLM)	6.99E-04	3.0E-04	**2.3E+00**	3.75E-04	2.8E+00	**1.0E-03**
Arsenic (Maximum - Inorganic)	1.99E-05	3.0E-04	6.6E-02	1.06E-05	2.8E+00	**3.0E-05**
Arsenic (95% UCLM - Inorganic)	1.40E-05	3.0E-04	4.7E-02	7.49E-06	2.8E+00	**2.1E-05**
Cadmium (Maximum)	1.26E-03	8.0E-04	**1.6E+00**			
Cadmium (95% UCLM)	8.23E-04	8.0E-04	1.0E+00			
Cobalt (Maximum)	2.57E-05	1.4E-03	1.8E-02			
Copper (Maximum)	1.91E-02	3.0E-02	6.4E-01			
Copper (95% UCLM)	1.32E-02	3.0E-02	4.4E-01			
Iron (Maximum)	2.86E-01	8.0E-01	3.6E-01			
Lead (Maximum)	1.68E-05	3.6E-03	4.7E-03			
Manganese (Maximum)	6.07E-03	1.4E-01	4.3E-02			
Nickel (Maximum)	2.22E-05	1.3E-03	1.7E-02			
Zinc (Maximum)	1.72E-01	3.0E-01	5.7E-01			
Zinc (95% UCLM)	1.22E-01	3.0E-01	4.1E-01			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	1.76E-02	1.0E+00	1.8E-02			
Arsenic (Maximum)	1.07E-03	3.0E-04	**3.6E+00**	1.36E-04	2.8E+00	**3.8E-04**
Arsenic (95% UCLM)	7.53E-04	3.0E-04	**2.5E+00**	9.56E-05	2.8E+00	**2.7E-04**
Arsenic (Maximum - Inorganic)	2.14E-05	3.0E-04	7.1E-02	2.72E-06	2.8E+00	**7.6E-06**
Arsenic (95% UCLM - Inorganic)	1.51E-05	3.0E-04	5.0E-02	1.91E-06	2.8E+00	5.4E-06
Cadmium (Maximum)	1.36E-03	8.0E-04	**1.7E+00**			
Cadmium (95% UCLM)	8.87E-04	8.0E-04	**1.1E+00**			
Cobalt (Maximum)	2.77E-05	1.4E-03	2.0E-02			
Copper (Maximum)	2.06E-02	3.0E-02	6.9E-01			
Copper (95% UCLM)	1.42E-02	3.0E-02	4.7E-01			
Iron (Maximum)	3.08E-01	8.0E-01	3.8E-01			
Lead (Maximum)	1.81E-05	3.6E-03	5.0E-03			
Manganese (Maximum)	6.54E-03	1.4E-01	4.7E-02			
Nickel (Maximum)	2.39E-05	1.3E-03	1.8E-02			
Zinc (Maximum)	1.85E-01	3.0E-01	6.2E-01			
Zinc (95% UCLM)	1.31E-01	3.0E-01	4.4E-01			
Risk Based Standards			**1.0E+00**			**1.0 E-05**

CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	2.72E-02	1.0E+00	2.7E-02			
Arsenic (Maximum)	1.65E-03	3.0E-04	**5.5E+00**	1.65E-04	2.8E+00	**4.6E-04**
Arsenic (95% UCLM)	1.16E-03	3.0E-04	**3.9E+00**	1.16E-04	2.8E+00	**3.3E-04**
Arsenic (Maximum - Inorganic)	3.30E-05	3.0E-04	1.1E-01	3.30E-06	2.8E+00	**9.2E-06**
Arsenic (95% UCLM - Inorganic)	2.32E-05	3.0E-04	7.7E-02	2.32E-06	2.8E+00	6.5E-06
Cadmium (Maximum)	2.10E-03	8.0E-04	**2.6E+00**			
Cadmium (95% UCLM)	1.37E-03	8.0E-04	**1.7E+00**			
Cobalt (Maximum)	4.27E-05	1.4E-03	3.0E-02			
Copper (Maximum)	3.17E-02	3.0E-02	**1.1E+00**			
Copper (95% UCLM)	2.19E-02	3.0E-02	7.3E-01			
Iron (Maximum)	4.75E-01	8.0E-01	5.9E-01			
Lead (Maximum)	2.80E-05	3.6E-03	7.8E-03			
Manganese (Maximum)	1.01E-02	1.4E-01	7.2E-02			
Nickel (Maximum)	3.68E-05	1.3E-03	2.8E-02			
Zinc (Maximum)	2.85E-01	3.0E-01	9.5E-01			
Zinc (95% UCLM)	2.02E-01	3.0E-01	6.7E-01			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	3.03E-02	1.0E+00	3.0E-02			
Arsenic (Maximum)	1.84E-03	3.0E-04	**6.1E+00**	1.11E-04	2.8E+00	**3.1E-04**
Arsenic (95% UCLM)	1.29E-03	3.0E-04	**4.3E+00**	7.82E-05	2.8E+00	**2.2E-04**
Arsenic (Maximum - Inorganic)	3.67E-05	3.0E-04	1.2E-01	2.22E-06	2.8E+00	**6.2E-06**
Arsenic (95% UCLM - Inorganic)	2.59E-05	3.0E-04	8.6E-02	1.56E-06	2.8E+00	4.4E-06
Cadmium (Maximum)	2.34E-03	8.0E-04	**2.9E+00**			
Cadmium (95% UCLM)	1.52E-03	8.0E-04	**1.9E+00**			
Cobalt (Maximum)	4.76E-05	1.4E-03	3.4E-02			
Copper (Maximum)	3.54E-02	3.0E-02	**1.2E+00**			
Copper (95% UCLM)	2.44E-02	3.0E-02	8.1E-01			
Iron (Maximum)	5.29E-01	8.0E-01	6.6E-01			
Lead (Maximum)	3.12E-05	3.6E-03	8.7E-03			
Manganese (Maximum)	1.12E-02	1.4E-01	8.0E-02			
Nickel (Maximum)	4.10E-05	1.3E-03	3.2E-02			
Zinc (Maximum)	3.17E-01	3.0E-01	**1.1E+00**			
Zinc (95% UCLM)	2.26E-01	3.0E-01	7.5E-01			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				4.12E-04	2.8E+00	**1.2E-03**
Arsenic (95% UCLM)				2.90E-04	2.8E+00	**8.1E-04**
Arsenic (Maximum - Inorganic)				8.23E-06	2.8E+00	**2.3E-05**
Arsenic (95% UCLM - Inorganic)				5.80E-06	2.8E+00	**1.6E-05**
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

"---" Not applicable, not available

TABLE B15: RECREATOR DERMAL CONTACT WITH INTERTIDAL SEDIMENT (1 day/week)						
Pathway: Dermal Contact with Intertidal Sediment						
$Dose = (C_S \times (SA_H \times SL_H + SA_{A\&L} \times SL_O) \times AF_{Dermal} \times EF \times D_1 \times D_2 \times D_3) / (BW \times LE)^{ab}$						
Chemical	Noncarcinogenic Effects			Carcinogenic Effects		
	Dose	Dermal Reference Dose (RfDd)	Hazard Quotient (HQ)	Dose	Dermal Slope Factor (SFd)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	3.56E-06	1.0E-01	3.6E-05			
Arsenic (Maximum)	2.55E-07	1.2E-04	2.1E-03	1.37E-07	6.8E+00	9.3E-07
Iron (Maximum)	2.26E-03	1.20E-01	1.9E-02			
Manganese (Maximum)	8.34E-08	5.6E-03	1.5E-05			
PAHs						
Naphthalene (Maximum)	7.85E-08	1.6E-02	4.9E-06			
Phenanthrene (Maximum)	2.06E-07	2.9E-02	7.0E-06			
Risk Based Standards			**1.0E+00**			**1.0E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	3.75E-06	1.0E-01	3.7E-05			
Arsenic (Maximum)	2.68E-07	1.2E-04	2.2E-03	3.41E-08	6.8E+00	2.3E-07
Iron (Maximum)	2.38E-03	1.20E-01	2.0E-02			
Manganese (Maximum)	8.77E-08	5.6E-03	1.6E-05			
PAHs						
Naphthalene (Maximum)	8.26E-08	1.6E-02	5.2E-06			
Phenanthrene (Maximum)	2.16E-07	2.9E-02	7.4E-06			
Risk Based Standards			**1.0E+00**			**1.0E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	4.67E-06	1.0E-01	4.7E-05			
Arsenic (Maximum)	3.35E-07	1.2E-04	2.7E-03	3.35E-08	6.8E+00	2.3E-07
Iron (Maximum)	2.97E-03	1.20E-01	2.5E-02			
Manganese (Maximum)	1.09E-07	5.6E-03	2.0E-05			
PAHs						
Naphthalene (Maximum)	1.03E-07	1.6E-02	6.4E-06			
Phenanthrene (Maximum)	2.70E-07	2.9E-02	9.2E-06			
Risk Based Standards			**1.0E+00**			**1.0E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	6.14E-06	1.0E-01	6.1E-05			
Arsenic (Maximum)	4.40E-07	1.2E-04	3.6E-03	2.66E-08	6.8E+00	1.8E-07
Iron (Maximum)	3.90E-03	1.20E-01	3.2E-02			
Manganese (Maximum)	1.44E-07	5.6E-03	2.6E-05			
PAHs						
Naphthalene (Maximum)	1.35E-07	1.6E-02	8.5E-06			
Phenanthrene (Maximum)	3.54E-07	2.9E-02	1.2E-05			
Risk Based Standards			**1.0E+00**			**1.0E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				9.41E-08	6.8E+00	6.4E-07
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

"---" Not applicable, not available

TABLE B16: RECREATOR DERMAL CONTACT WITH INTERTIDAL PRECIPITATE (FERRICRETE) (1 day/week)						
Pathway: Dermal Contact with Intertidal Seep Ferricrete						
$Dose = (C_S \times (SA_H \times SL_H + SA_{A\&L} \times SL_O) \times AF_{Dermal} \times EF \times D_1 \times D_2 \times D_3) / (BW \times LE)$[ab]						
Chemical	Noncarcinogenic Effects			Carcinogenic Effects		
	Dose	Dermal Reference Dose (RfDd)	Hazard Quotient (HQ)	Dose	Dermal Slope Factor (SFd)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	2.66E-06	1.0E-01	2.7E-05			
Arsenic (Maximum)	1.58E-07	1.2E-04	1.3E-03	8.45E-08	6.8E+00	5.8E-07
Iron (Maximum)	7.43E-03	1.20E-01	6.2E-02			
Manganese (Maximum)	4.65E-08	5.60E-03	8.3E-06			
Molybdenum (Maximum)	6.54E-07	1.90E-03	3.4E-04			
Risk Based Standards			**1.0E+00**			**1.0E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	2.80E-06	1.0E-01	2.8E-05			
Arsenic (Maximum)	1.66E-07	1.2E-04	1.3E-03	2.11E-08	6.8E+00	1.4E-07
Iron (Maximum)	7.82E-03	1.20E-01	6.5E-02			
Manganese (Maximum)	4.89E-08	5.60E-03	8.7E-06			
Molybdenum (Maximum)	6.87E-07	1.90E-03	3.6E-04			
Risk Based Standards			**1.0E+00**			**1.0E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	3.49E-06	1.0E-01	3.5E-05			
Arsenic (Maximum)	2.07E-07	1.2E-04	1.7E-03	2.07E-08	6.8E+00	1.4E-07
Iron (Maximum)	9.75E-03	1.20E-01	8.1E-02			
Manganese (Maximum)	6.10E-08	5.60E-03	1.1E-05			
Molybdenum (Maximum)	8.58E-07	1.90E-03	4.5E-04			
Risk Based Standards			**1.0E+00**			**1.0E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	4.59E-06	1.0E-01	4.6E-05			
Arsenic (Maximum)	2.72E-07	1.2E-04	2.2E-03	1.64E-08	6.8E+00	1.1E-07
Iron (Maximum)	1.28E-02	1.20E-01	1.1E-01			
Manganese (Maximum)	8.01E-08	5.60E-03	1.4E-05			
Molybdenum (Maximum)	1.13E-06	1.90E-03	5.9E-04			
Risk Based Standards			**1.0E+00**			**1.0E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				5.82E-08	6.8E+00	4.0E-07
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

TABLE B17: RECREATOR DERMAL CONTACT WITH INTERTIDAL WATER (SEEP, TIDE POOL, AND OCEAN WATER)(1 day/week)						
Pathway: Dermal Contact with Intertidal Water						
Dose = $(C_W \times PC \times SA \times CF \times D \times D_1 \times D_2 \times D_3) / (BW \times LE)$ [ab]						
	Noncarcinogenic Effects			Carcinogenic Effects		
Chemical	Dose	Dermal Reference Dose (RfDd)	Hazard Quotient (HQ)	Dose	Dermal Slope Factor (SFd)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	1.68E-04	1.00E-01	1.7E-03			
Arsenic (Maximum)	4.40E-08	1.23E-04	3.6E-04	2.36E-08	6.8E+00	1.6E-07
Cadmium (Maximum)	2.17E-08	8.00E-06	2.7E-03			
Iron (Maximum)	1.08E-02	1.20E-01	9.0E-02			
Manganese (Maximum)	3.24E-05	5.6E-03	5.8E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	1.74E-04	1.00E-01	1.7E-03			
Arsenic (Maximum)	4.58E-08	1.23E-04	3.7E-04	5.81E-09	6.8E+00	4.0E-08
Cadmium (Maximum)	2.26E-08	8.00E-06	2.8E-03			
Iron (Maximum)	1.12E-02	1.20E-01	9.3E-02			
Manganese (Maximum)	3.37E-05	5.6E-03	6.0E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	2.03E-04	1.00E-01	2.0E-03			
Arsenic (Maximum)	5.33E-08	1.23E-04	4.3E-04	5.33E-09	6.8E+00	3.6E-08
Cadmium (Maximum)	2.63E-08	8.00E-06	3.3E-03			
Iron (Maximum)	1.30E-02	1.20E-01	1.1E-01			
Manganese (Maximum)	3.93E-05	5.6E-03	7.0E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	2.37E-04	1.00E-01	2.4E-03			
Arsenic (Maximum)	6.23E-08	1.23E-04	5.1E-04	3.76E-09	6.8E+00	2.6E-08
Cadmium (Maximum)	3.08E-08	8.00E-06	3.8E-03			
Iron (Maximum)	1.52E-02	1.20E-01	1.3E-01			
Manganese (Maximum)	4.59E-05	5.6E-03	8.2E-03			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				1.49E-08	6.8E+00	1.0E-07
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

CF = Conversion Factor (0.001)

TABLE B18: RECREATOR INHALATION OF INTERTIDAL SEDIMENT PARTICLES (1 day/week)						
Pathway: Inadvertent Ingestion of Intertidal Sediment Particles						
Dose = $(C_S \times P_{Air} \times IR_A \times AF_{Inh} \times D \times D_1 \times D_2 \times D_3) / (BW \times LE)$[ab]						
Chemical	Noncarcinogenic Effects			Carcinogenic Effects		
	Dose	Inhalation Reference Dose (RfDi)	Hazard Quotient (HQ)	Dose	Inhalation Slope Factor (SFi)	ILCR
	(mg/kg/day)	(mg/kg/day)	(unitless)	(mg/kg/day)	$(mg/kg/day)^{-1}$	(unitless)
ADULT						
Metals						
Aluminium (Maximum)	2.53E-08	1.0E+00	2.5E-08			
Arsenic (Maximum)	6.04E-11	3.0E-04	2.0E-07	3.24E-11	2.8E+01	9.1E-10
Iron (Maximum)	1.15E-07	8.0E-01	1.4E-07			
Manganese (Maximum)	5.92E-10	1.4E-05	4.1E-05			
PAHs						
Naphthalene (Maximum)	5.58E-12	2.0E-02	2.8E-10			
Phenanthrene (Maximum)	8.12E-12	4.0E-02	2.0E-10			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TEEN (12-19 YR)						
Metals						
Aluminium (Maximum)	2.25E-08	1.0E+00	2.2E-08			
Arsenic (Maximum)	5.37E-11	3.0E-04	1.8E-07	6.82E-12	2.8E+01	1.9E-10
Iron (Maximum)	1.02E-07	8.0E-01	1.3E-07			
Manganese (Maximum)	5.26E-10	1.4E-05	3.7E-05			
PAHs						
Naphthalene (Maximum)	4.95E-12	2.0E-02	2.5E-10			
Phenanthrene (Maximum)	7.21E-12	4.0E-02	1.8E-10			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
CHILD (5-11 YR)						
Metals						
Aluminium (Maximum)	4.08E-08	1.0E+00	4.1E-08			
Arsenic (Maximum)	9.74E-11	3.0E-04	3.2E-07	9.74E-12	2.8E+01	2.7E-10
Iron (Maximum)	1.85E-07	8.0E-01	2.3E-07			
Manganese (Maximum)	9.54E-10	1.4E-05	6.7E-05			
PAHs						
Naphthalene (Maximum)	8.99E-12	2.0E-02	4.5E-10			
Phenanthrene (Maximum)	1.31E-11	4.0E-02	3.3E-10			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
TODDLER (7 MOS-4 YR)						
Metals						
Aluminium (Maximum)	8.13E-08	1.0E+00	8.1E-08			
Arsenic (Maximum)	1.94E-10	3.0E-04	6.5E-07	1.17E-11	2.8E+01	3.3E-10
Iron (Maximum)	3.69E-07	8.0E-01	4.6E-07			
Manganese (Maximum)	1.90E-09	1.4E-05	1.3E-04			
PAHs						
Naphthalene (Maximum)	1.79E-11	2.0E-02	9.0E-10			
Phenanthrene (Maximum)	2.61E-11	4.0E-02	6.5E-10			
Risk Based Standards			**1.0E+00**			**1.0 E-05**
ILCR 7MOS TO 19YR						
Arsenic (Maximum)				2.83E-11	2.8E+01	7.9E-10
Risk Based Standards						**1.0E-05**

Notes:

[a] Refer to Table H6 for explanation of acronyms used in equation.

[b] D3 and LE employed only for the assessment of carcinogens.

mg/kg/day = milligrams per kilogram body weight per day.

TABLE B19: RECREATOR NON-CARCINOGENIC HAZARD INDICES (1 day/week, 1 shellfish meal/week)

Pathway: All Pathways Combined

Chemical	HQ Intertidal Sediment Ingestion	HQ Intertidal Precipitate (Ferricrete) Ingestion	HQ Intertidal Clam Ingestion	HQ Intertidal Oyster Ingestion	HQ Intertidal Water Ingestion	HQ Intertidal Sediment Dermal	HQ Intertidal Precipitate (Ferricrete) Dermal	HQ Intertidal Water Dermal	HQ Intertidal Sediment Inhalation	Combined Pathway Hazard Index (Intertidal Area Use - Including Shellfish Ingestion)	Combined Pathway Hazard Index (Intertidal Area Use - Excluding Shellfish Ingestion)
ADULT											
Metals											
Aluminium (Maximum)	4.2E-04	3.1E-04	7.6E-02	1.6E-02	9.2E-04	3.6E-05	2.7E-05	1.7E-03	2.5E-08	4.9E-02	3.0E-03
Arsenic [a,b]	3.3E-03	2.0E-03	8.5E-02	4.7E-02	8.0E-04	2.1E-03	1.3E-03	3.6E-04	2.0E-07	7.1E-02	5.5E-03
Cadmium			2.9E-01	1.0E+00	1.5E-04			2.7E-03		6.6E-01	2.9E-03
Cobalt (Maximum)			6.3E-02	1.8E-02						4.1E-02	
Copper			6.9E-02	4.4E-01						2.5E-01	
Iron (Maximum)	2.4E-03	7.8E-03	1.2E-01	3.6E-01	1.8E-02	1.9E-02	6.2E-02	9.0E-02	1.4E-07	3.9E-01	1.5E-01
Lead (Maximum)			1.0E-02	4.7E-03						7.5E-03	
Manganese (Maximum)	4.1E-04	2.3E-04	1.2E-02	4.3E-02	7.4E-03	1.5E-05	8.3E-06	5.8E-03	4.1E-05	4.1E-02	1.4E-02
Molybdenum (Maximum)		1.5E-04					3.4E-04			2.5E-04	2.5E-04
Nickel (Maximum)			1.4E-01	1.7E-02						7.8E-02	
Zinc			3.9E-02	4.1E-01						2.2E-01	
PAHs											
Naphthalene (Maximum)	4.6E-06					4.9E-06			2.8E-10		
Phenanthrene (Maximum)	3.3E-06		2.8E-04			7.0E-06			2.0E-10	1.4E-04	5.2E-06
TEEN (12-19 YR)											
Metals											
Aluminium (Maximum)	4.9E-04	3.7E-04	8.2E-02	1.8E-02	1.1E-03	3.7E-05	2.8E-05	1.7E-03	2.2E-08	5.3E-02	3.3E-03
Arsenic [a,b]	3.9E-03	2.4E-03	9.1E-02	5.0E-02	9.5E-04	2.2E-03	1.3E-03	3.7E-04	1.8E-07	7.7E-02	6.3E-03
Cadmium			3.1E-01	**1.1E+00**	1.8E-04			2.8E-03		7.1E-01	3.0E-03
Cobalt (Maximum)			6.7E-02	2.0E-02						4.4E-02	
Copper			7.4E-02	4.7E-01						2.7E-01	
Iron (Maximum)	2.8E-03	9.2E-03	1.2E-01	3.8E-01	2.2E-02	2.0E-02	6.5E-02	9.3E-02	1.3E-07	4.2E-01	1.6E-01
Lead (Maximum)			1.1E-02	5.0E-03						8.0E-03	
Manganese (Maximum)	4.8E-04	2.7E-04	1.3E-02	4.7E-02	8.8E-03	1.6E-05	8.7E-06	6.0E-03	3.7E-05	4.5E-02	1.5E-02
Molybdenum (Maximum)		1.8E-04					3.6E-04			2.7E-04	2.7E-04
Nickel (Maximum)			1.5E-01	1.8E-02						8.4E-02	
Zinc			4.2E-02	4.4E-01						2.4E-01	
PAHs											
Naphthalene (Maximum)	5.4E-06					5.2E-06			2.5E-10		
Phenanthrene (Maximum)	4.0E-06		6.0E-04			7.4E-06			1.8E-10	3.0E-04	5.7E-06
CHILD (5-11 YR)											
Metals											
Aluminium (Maximum)	8.9E-04	6.7E-04	1.3E-01	2.7E-02	2.0E-03	4.7E-05	6.7E-04	2.0E-03	4.1E-08	8.2E-02	5.1E-03
Arsenic [a,b]	7.1E-03	4.4E-03	1.4E-01	7.7E-02	1.7E-03	2.7E-03	1.7E-03	4.3E-04	3.2E-07	1.2E-01	1.0E-02
Cadmium			4.8E-01	**1.7E+00**	3.2E-04			3.3E-03		**1.1E+00**	3.6E-03
Cobalt (Maximum)			1.0E-01	3.0E-02						6.7E-02	
Copper			1.1E-01	7.3E-01						4.2E-01	
Iron (Maximum)	5.1E-03	1.7E-02	1.9E-01	5.9E-01	4.0E-02	2.5E-02	8.1E-02	1.1E-01	2.3E-07	6.0E-01	2.1E-01
Lead (Maximum)			1.7E-02	7.8E-03						1.2E-02	
Manganese (Maximum)	8.7E-04	4.9E-04	2.0E-02	7.2E-02	1.6E-02	2.0E-05	1.1E-05	7.0E-03	6.7E-05	7.0E-02	2.4E-02
Molybdenum (Maximum)		3.3E-04					4.5E-04			3.9E-04	3.9E-04
Nickel (Maximum)			2.3E-01	2.8E-02						1.3E-01	
Zinc			6.4E-02	6.7E-01						3.7E-01	
PAHs											
Naphthalene (Maximum)	9.9E-06					6.4E-06			4.5E-10		
Phenanthrene (Maximum)	7.2E-06		9.2E-04			9.2E-06			3.3E-10	4.7E-04	8.2E-06

TODDLER (7 MOS-4 YR)											
Metals											
Aluminium (Maximum)	7.1E-03	5.3E-03	1.4E-01	3.0E-02	3.9E-03	6.1E-05	4.6E-05	2.4E-03	8.1E-08	9.8E-02	1.3E-02
Arsenic [a,b]	5.7E-02	3.5E-02	1.6E-01	8.6E-02	3.4E-03	3.6E-03	2.2E-03	5.1E-04	6.5E-07	1.7E-01	5.3E-02
Cadmium			5.4E-01	**1.9E+00**	6.4E-04			3.8E-03		**1.2E+00**	4.5E-03
Cobalt (Maximum)			1.2E-01	3.4E-02						7.5E-02	
Copper			1.3E-01	8.1E-01						4.7E-01	
Iron (Maximum)	4.0E-02	1.3E-01	2.1E-01	6.6E-01	7.9E-02	3.2E-02	1.1E-01	1.3E-01	4.6E-07	8.0E-01	3.6E-01
Lead (Maximum)			1.9E-02	8.7E-03						1.4E-02	
Manganese (Maximum)	7.0E-03	3.9E-03	2.2E-02	8.0E-02	3.2E-02	2.6E-05	1.4E-05	8.2E-03	1.3E-04	9.7E-02	4.6E-02
Molybdenum (Maximum)		2.6E-03					5.9E-04			1.6E-03	1.6E-03
Nickel (Maximum)			2.6E-01	3.2E-02						1.5E-01	
Zinc			7.1E-02	7.5E-01						4.1E-01	
PAHs											
Naphthalene (Maximum)	7.9E-05					8.5E-06			9.0E-10		
Phenanthrene (Maximum)	5.7E-05		1.0E-03			1.2E-05			6.5E-10	5.5E-04	3.5E-05

Notes:

[a] For shellfish ingestion, HQ is for maximum inorganic arsenic (assumed 2% of total arsenic) tissue concentration for clams and 95% UCLM inorganic arsenic (assumed 2% of total arsenic) tissue concentration for oysters.

[b] For sediment exposures, HQs were based on maximum arsenic concentration.

[c] For intertidal hazard indices, shellfish ingestion assumed to comprise half clams and half oysters, and incidental ingestion and dermal contact assumed to comprise half sediment and half precipitate (ferricrete). For other exposure media (water, precip.) HQs were based on maximum concentrations.

Bold and shaded - HQ exceeds CSR risk based standard of 1

TABLE B20: RECREATOR NON-CARCINOGENIC HAZARD INDICES (3 days/week, 1 shellfish meal/week)

Pathway: All Pathways Combined

Chemical	HQ Intertidal Sediment Ingestion	HQ Intertidal Precipitate (Ferricrete) Ingestion	HQ Intertidal Clam Ingestion	HQ Intertidal Oyster Ingestion	HQ Intertidal Water Ingestion	HQ Intertidal Sediment Dermal	HQ Intertidal Precipitate (Ferricrete) Dermal	HQ Intertidal Water Dermal	HQ Intertidal Sediment Inhalation	Combined Pathway Hazard Index (Intertidal Area Use - Including Shellfish Ingestion)	Combined Pathway Hazard Index (Intertidal Area Use - Excluding Shellfish Ingestion)
ADULT											
Metals											
Aluminium (Maximum)	1.2E-03	9.3E-04	7.6E-02	1.6E-02	2.8E-03	1.1E-04	8.0E-05	5.0E-03	7.6E-08	5.5E-02	9.0E-03
Arsenic [a,b]	9.9E-03	6.1E-03	8.5E-02	4.7E-02	2.4E-03	6.2E-03	3.8E-03	1.1E-03	6.0E-07	8.2E-02	1.7E-02
Cadmium			2.9E-01	1.0E+00	4.5E-04			8.1E-03		6.7E-01	8.6E-03
Cobalt (Maximum)			6.3E-02	1.8E-02						4.1E-02	
Copper			6.9E-02	4.4E-01						2.5E-01	
Iron (Maximum)	7.1E-03	2.3E-02	1.2E-01	3.6E-01	5.5E-02	5.7E-02	1.9E-01	2.7E-01	4.3E-07	7.0E-01	4.6E-01
Lead (Maximum)			1.0E-02	4.7E-03						7.5E-03	
Manganese (Maximum)	1.2E-03	6.8E-04	1.2E-02	4.3E-02	2.2E-02	4.5E-05	2.5E-05	1.7E-02	1.2E-04	6.8E-02	4.1E-02
Molybdenum (Maximum)		4.6E-04					1.0E-03			7.5E-04	7.5E-04
Nickel (Maximum)			1.4E-01	1.7E-02						7.8E-02	
Zinc			3.9E-02	4.1E-01						2.2E-01	
PAHs											
Naphthalene (Maximum)	1.4E-05					1.5E-05			8.4E-10		
Phenanthrene (Maximum)	1.0E-05		2.8E-04			2.1E-05			6.1E-10	1.5E-04	1.6E-05
TEEN (12-19 YR)											
Metals											
Aluminium (Maximum)	1.5E-03	1.1E-03	8.2E-02	1.8E-02	3.3E-03	1.1E-04	8.4E-05	5.2E-03	6.7E-08	5.9E-02	9.9E-03
Arsenic [a,b]	1.2E-02	7.3E-03	9.1E-02	5.0E-02	2.9E-03	6.5E-03	4.0E-03	1.1E-03	5.4E-07	8.9E-02	1.9E-02
Cadmium			3.1E-01	**1.1E+00**	5.3E-04			8.5E-03		7.2E-01	9.0E-03
Cobalt (Maximum)			6.7E-02	2.0E-02						4.4E-02	
Copper			7.4E-02	4.7E-01						2.7E-01	
Iron (Maximum)	8.4E-03	2.8E-02	1.2E-01	3.8E-01	6.6E-02	6.0E-02	2.0E-01	2.8E-01	3.8E-07	7.4E-01	4.9E-01
Lead (Maximum)			1.1E-02	5.0E-03						8.0E-03	
Manganese (Maximum)	1.4E-03	8.0E-04	1.3E-02	4.7E-02	2.6E-02	4.7E-05	2.6E-05	1.8E-02	1.1E-04	7.6E-02	4.6E-02
Molybdenum (Maximum)		5.4E-04					1.1E-03			8.1E-04	8.1E-04
Nickel (Maximum)			1.5E-01	1.8E-02						8.4E-02	
Zinc			4.2E-02	4.4E-01						2.4E-01	
PAHs											
Naphthalene (Maximum)	1.6E-05					1.5E-05			7.4E-10		
Phenanthrene (Maximum)	1.2E-05		6.0E-04			2.2E-05			5.4E-10	3.2E-04	1.7E-05
CHILD (5-11 YR)											
Metals											
Aluminium (Maximum)	2.7E-03	2.0E-03	1.3E-01	2.7E-02	5.9E-03	1.4E-04	2.0E-03	6.1E-03	1.2E-07	9.2E-02	1.5E-02
Arsenic [a,b]	2.1E-02	1.3E-02	1.4E-01	7.7E-02	5.2E-03	8.2E-03	1.3E-02	1.3E-03	9.7E-07	1.4E-01	3.4E-02
Cadmium			4.8E-01	**1.7E+00**	9.6E-04			9.9E-03		**1.1E+00**	1.1E-02
Cobalt (Maximum)			1.0E-01	3.0E-02						6.7E-02	
Copper			1.1E-01	7.3E-01						4.2E-01	
Iron (Maximum)	1.5E-02	5.0E-02	1.9E-01	5.9E-01	1.2E-01	7.4E-02	2.4E-01	3.3E-01	6.9E-07	1.0E+00	6.4E-01
Lead (Maximum)			1.7E-02	7.8E-03						1.2E-02	
Manganese (Maximum)	2.6E-03	1.5E-03	2.0E-02	7.2E-02	4.8E-02	5.9E-05	3.3E-05	2.1E-02	2.0E-04	1.2E-01	7.1E-02
Molybdenum (Maximum)		9.8E-04					1.4E-03			1.2E-03	1.2E-03
Nickel (Maximum)			2.3E-01	2.8E-02						1.3E-01	
Zinc			6.4E-02	6.7E-01						3.7E-01	
PAHs											
Naphthalene (Maximum)	3.0E-05					1.9E-05			1.3E-09		
Phenanthrene (Maximum)	2.2E-05		9.2E-04			2.8E-05			9.8E-10	4.8E-04	2.5E-05

TODDLER (7 MOS-4 YR)											
Metals											
Aluminium (Maximum)	2.1E-02	1.6E-02	1.4E-01	3.0E-02	1.2E-02	1.8E-04	1.4E-04	7.1E-03	8.1E-08	1.2E-01	3.8E-02
Arsenic [a,b]	1.7E-01	1.1E-01	1.6E-01	8.6E-02	1.0E-02	1.1E-02	6.6E-03	1.5E-03	6.5E-07	2.8E-01	1.6E-01
Cadmium			5.4E-01	**1.9E+00**	1.9E-03			1.2E-02		**1.2E+00**	1.3E-02
Cobalt (Maximum)			1.2E-01	3.4E-02						7.5E-02	
Copper			1.3E-01	8.1E-01						4.7E-01	
Iron (Maximum)	1.2E-01	4.0E-01	2.1E-01	6.6E-01	2.4E-01	9.7E-02	3.2E-01	3.8E-01	4.6E-07	**1.5E+00**	**1.1E+00**
Lead (Maximum)			1.9E-02	8.7E-03						1.4E-02	
Manganese (Maximum)	2.1E-02	1.2E-02	2.2E-02	8.0E-02	9.5E-02	7.7E-05	4.3E-05	8.2E-03	4.0E-04	1.7E-01	1.2E-01
Molybdenum (Maximum)		7.9E-03					1.8E-03			4.8E-03	4.8E-03
Nickel (Maximum)			2.6E-01	3.2E-02						1.5E-01	
Zinc			7.1E-02	7.5E-01						4.1E-01	
PAHs											
Naphthalene (Maximum)	2.4E-04					2.5E-05			2.7E-09		
Phenanthrene (Maximum)	1.7E-04		1.0E-03			3.6E-05			2.0E-09	6.2E-04	1.0E-04

Notes:

[a] For shellfish ingestion, HQ is for maximum inorganic arsenic (assumed 2% of total arsenic) tissue concentration for clams and 95% UCLM inorganic arsenic (assumed 2% of total arsenic) tissue concentration for oysters.

[b] For sediment exposures, HQs were based on maximum arsenic concentration.

[c] For intertidal hazard indices, shellfish ingestion assumed to comprise half clams and half oysters, and incidental ingestion and dermal contact assumed to comprise half sediment and half precipitate (ferricrete). For other exposure media (water, precip.) HQs were based on maximum concentrations.

Bold and shaded - HQ exceeds CSR risk based standard of 1

TABLE B21: RECREATOR NON-CARCINOGENIC HAZARD INDICES (5 days/week, 1 shellfish meal/week)

Pathway: All Pathways Combined

Chemical	HQ Intertidal Sediment Ingestion	HQ Intertidal Precipitate (Ferricrete) Ingestion	HQ Intertidal Clam Ingestion	HQ Intertidal Oyster Ingestion	HQ Intertidal Water Ingestion	HQ Intertidal Sediment Dermal	HQ Intertidal Precipitate (Ferricrete) Dermal	HQ Intertidal Water Dermal	HQ Intertidal Sediment Inhalation	Combined Pathway Hazard Index (Intertidal Area Use - Including Shellfish Ingestion)	Combined Pathway Hazard Index (Intertidal Area Use - Excluding Shellfish Ingestion)
ADULT											
Metals											
Aluminium (Maximum)	2.1E-03	1.6E-03	7.6E-02	1.6E-02	4.6E-03	1.8E-04	1.3E-04	8.4E-03	1.3E-07	6.1E-02	1.5E-02
Arsenic [a,b]	1.7E-02	1.0E-02	8.5E-02	4.7E-02	4.0E-03	1.0E-02	6.4E-03	1.8E-03	1.0E-06	9.3E-02	2.8E-02
Cadmium [c]			2.9E-01	1.0E+00	7.5E-04			1.4E-02		6.7E-01	1.4E-02
Cobalt (Maximum)			6.3E-02	1.8E-02						4.1E-02	
Copper [c]			6.9E-02	4.4E-01						2.5E-01	
Iron (Maximum)	1.2E-02	3.9E-02	1.2E-01	3.6E-01	9.2E-02	9.4E-02	3.1E-01	4.5E-01	7.2E-07	1.0E+00	7.7E-01
Lead (Maximum)			1.0E-02	4.7E-03						7.5E-03	
Manganese (Maximum)	2.0E-03	1.1E-03	1.2E-02	4.3E-02	3.7E-02	7.4E-05	4.2E-05	2.9E-02	2.1E-04	9.6E-02	6.8E-02
Molybdenum (Maximum)		7.6E-04					1.7E-03			1.2E-03	1.2E-03
Nickel (Maximum)			1.4E-01	1.7E-02						7.8E-02	
Zinc [c]			3.9E-02	4.1E-01						2.2E-01	
PAHs											
Naphthalene (Maximum)	2.3E-05					2.5E-05			1.4E-09		
Phenanthrene (Maximum)	1.7E-05		2.8E-04			3.5E-05			1.0E-09	1.6E-04	2.6E-05
TEEN (12-19 YR)											
Metals											
Aluminium (Maximum)	2.5E-03	1.8E-03	8.2E-02	1.8E-02	5.4E-03	1.9E-04	1.4E-04	8.7E-03	1.1E-07	6.6E-02	1.6E-02
Arsenic [a,b]	2.0E-02	1.2E-02	9.1E-02	5.0E-02	4.8E-03	1.1E-02	6.7E-03	1.9E-03	8.9E-07	1.0E-01	3.1E-02
Cadmium [c]			3.1E-01	**1.1E+00**	8.8E-04			1.4E-02		7.3E-01	1.5E-02
Cobalt (Maximum)			6.7E-02	2.0E-02						4.4E-02	
Copper [c]			7.4E-02	4.7E-01						2.7E-01	
Iron (Maximum)	1.4E-02	4.6E-02	1.2E-01	3.8E-01	1.1E-01	9.9E-02	3.3E-01	4.7E-01	6.4E-07	**1.1E+00**	8.2E-01
Lead (Maximum)			1.1E-02	5.0E-03						8.0E-03	
Manganese (Maximum)	2.4E-03	1.3E-03	1.3E-02	4.7E-02	4.4E-02	7.8E-05	4.4E-05	3.0E-02	1.8E-04	1.1E-01	7.6E-02
Molybdenum (Maximum)		9.0E-04					1.8E-03			1.4E-03	1.4E-03
Nickel (Maximum)			1.5E-01	1.8E-02						8.4E-02	
Zinc [c]			4.2E-02	4.4E-01						2.4E-01	
PAHs											
Naphthalene (Maximum)	2.7E-05					2.6E-05			1.2E-09		
Phenanthrene (Maximum)	2.0E-05		6.0E-04			3.7E-05			9.0E-10	3.3E-04	2.8E-05
CHILD (5-11 YR)											
Metals											
Aluminium (Maximum)	4.5E-03	3.3E-03	1.3E-01	2.7E-02	9.9E-03	2.3E-04	3.3E-03	1.0E-02	2.0E-07	1.0E-01	2.6E-02
Arsenic [a,b]	3.6E-02	2.2E-02	1.4E-01	7.7E-02	8.6E-03	1.4E-02	8.4E-03	2.2E-03	1.6E-06	1.6E-01	5.1E-02
Cadmium [c]			4.8E-01	**1.7E+00**	1.6E-03			1.6E-02		**1.1E+00**	1.8E-02
Cobalt (Maximum)			1.0E-01	3.0E-02						6.7E-02	
Copper [c]			1.1E-01	7.3E-01						4.2E-01	
Iron (Maximum)	2.5E-02	8.3E-02	1.9E-01	5.9E-01	2.0E-01	1.2E-01	4.1E-01	5.4E-01	1.2E-06	**1.5E+00**	**1.1E+00**
Lead (Maximum)			1.7E-02	7.8E-03						1.2E-02	
Manganese (Maximum)	4.4E-03	2.4E-03	2.0E-02	7.2E-02	8.0E-02	9.8E-05	5.4E-05	3.5E-02	3.3E-04	1.6E-01	1.2E-01
Molybdenum (Maximum)		1.6E-03					2.3E-03			1.9E-03	1.9E-03
Nickel (Maximum)			2.3E-01	2.8E-02						1.3E-01	
Zinc [c]			6.4E-02	6.7E-01						3.7E-01	
PAHs											
Naphthalene (Maximum)	4.9E-05					3.2E-05			2.2E-09		
Phenanthrene (Maximum)	3.6E-05		9.2E-04			4.6E-05			1.6E-09	5.0E-04	4.1E-05

TODDLER (7 MOS-4 YR)											
Metals											
Aluminium (Maximum)	3.6E-02	2.7E-02	1.4E-01	3.0E-02	2.0E-02	3.1E-04	2.3E-04	1.2E-02	4.1E-07	1.5E-01	6.3E-02
Arsenic [a,b]	2.8E-01	1.8E-01	1.6E-01	8.6E-02	1.7E-02	1.8E-02	1.1E-02	2.5E-03	3.2E-06	3.9E-01	2.6E-01
Cadmium [c]			5.4E-01	**1.9E+00**	3.2E-03			1.9E-02		**1.2E+00**	2.2E-02
Cobalt (Maximum)			1.2E-01	3.4E-02						7.5E-02	
Copper [c]			1.3E-01	8.1E-01						4.7E-01	
Iron (Maximum)	2.0E-01	6.6E-01	2.1E-01	6.6E-01	4.0E-01	1.6E-01	5.3E-01	6.3E-01	2.3E-06	**2.2E+00**	**1.8E+00**
Lead (Maximum)			1.9E-02	8.7E-03						1.4E-02	
Manganese (Maximum)	3.5E-02	1.9E-02	2.2E-02	8.0E-02	1.6E-01	1.3E-04	7.2E-05	4.1E-02	6.7E-04	2.8E-01	2.3E-01
Molybdenum (Maximum)		1.3E-02					3.0E-03			8.0E-03	8.0E-03
Nickel (Maximum)			2.6E-01	3.2E-02						1.5E-01	
Zinc [c]			7.1E-02	7.5E-01						4.1E-01	
PAHs											
Naphthalene (Maximum)	3.9E-04					4.2E-05			4.5E-09		
Phenanthrene (Maximum)	2.9E-04		1.0E-03			6.1E-05			3.3E-09	6.9E-04	1.7E-04

Notes:

[a] For shellfish ingestion, HQ is for maximum inorganic arsenic (assumed 2% of total arsenic) tissue concentration for clams and 95% UCLM inorganic arsenic (assumed 2% of total arsenic) tissue

[b] For sediment exposures, HQs were based on maximum arsenic concentration.

[c] For intertidal hazard indices, shellfish ingestion assumed to comprise half clams and half oysters, and incidental ingestion and dermal contact assumed to comprise half sediment and half precipitate (ferricrete). For other exposure media (water, precip.) HQs were based on maximum concentrations.

Bold and shaded - HQ exceeds CSR risk based standard of 1

TABLE B22: RECREATOR INCREMENTAL LIFETIME CANCER RISKS (1 day/week, 1 shellfish meal/week)											
Pathway: All Pathways Combined											
Chemical	ILCR Intertidal Sediment Ingestion	ILCR Intertidal Precipitate (Ferricrete) Ingestion	ILCR Intertidal Clam Ingestion	ILCR Intertidal Oyster Ingestion	ILCR Intertidal Water Ingestion	ILCR Intertidal Sediment Dermal	ILCR Intertidal Precipitate (Ferricrete) Dermal	ILCR Intertidal Water Dermal	ILCR Intertidal Sediment Inhalation	Combined ILCR (Intertidal Area Use - Including Shellfish Ingestion)	Combined ILCR (Intertidal Area Use - Excluding Shellfish Ingestion)
ADULT											
Metals											
Arsenic [a,b]	1.5E-06	9.2E-07	**3.8E-05**	**2.1E-05**	3.6E-07	9.3E-07	5.8E-07	1.6E-07	9.1E-10	**3.2E-05**	2.5E-06
TEEN (12-19 YR)											
Metals											
Arsenic [a,b]	4.2E-07	2.6E-07	9.7E-06	5.4E-06	1.0E-07	2.3E-07	1.4E-07	4.0E-08	1.9E-10	8.2E-06	6.7E-07
CHILD (5-11 YR)											
Metals											
Arsenic [a,b]	6.0E-07	3.7E-07	**1.2E-05**	6.5E-06	1.5E-07	2.3E-07	1.4E-07	3.6E-08	2.7E-10	1.0E-05	8.5E-07
TODDLER (7 MOS-4 YR)											
Metals											
Arsenic [a,b]	2.9E-06	1.8E-06	7.9E-06	4.4E-06	1.7E-07	1.8E-07	1.1E-07	2.6E-08	3.3E-10	8.8E-06	2.7E-06
7MOS TO 19YR											
Metals											
Arsenic [a,b]	3.9E-06	2.4E-06	**2.9E-05**	**1.6E-05**	4.2E-07	6.4E-07	4.0E-07	1.0E-07	7.9E-10	**2.7E-05**	4.2E-06

Notes:

[a] For shellfish ingestion, ILCR is for maximum inorganic arsenic (assumed 2% of total arsenic) tissue concentration for clams and 95% UCLM inorganic arsenic (2% of total arsenic) tissue concentration for oysters.

[b] For intertidal hazard indices, shellfish ingestion assumed to comprise half clams and half oysters, and incidental ingestion and dermal contact assumed to comprise sediment and half precipitate (ferricrete).

Bold and shaded - ILCR exceeds CSR risk based standard of 1E-05 (1 in 100,000)

TABLE B23: RECREATOR INCREMENTAL LIFETIME CANCER RISKS (3 days/week, 1 shellfish meal/week)											
Pathway: All Pathways Combined											
Chemical	ILCR Intertidal Sediment Ingestion	ILCR Intertidal Precipitate (Ferricrete) Ingestion	ILCR Intertidal Clam Ingestion	ILCR Intertidal Oyster Ingestion	ILCR Intertidal Water Ingestion	ILCR Intertidal Sediment Dermal	ILCR Intertidal Precipitate (Ferricrete) Dermal	ILCR Intertidal Water Dermal	ILCR Intertidal Sediment Inhalation	Combined ILCR (Intertidal Area Use - Including Shellfish Ingestion)	Combined ILCR (Intertidal Area Use - Excluding Shellfish Ingestion)
ADULT											
Metals											
Arsenic [a,b]	4.5E-06	2.8E-06	**3.8E-05**	**2.1E-05**	1.1E-06	2.8E-06	1.7E-06	4.8E-07	2.7E-09	**3.7E-05**	7.5E-06
TEEN (12-19 YR)											
Metals											
Arsenic [a,b]	1.3E-06	7.8E-07	9.7E-06	5.4E-06	3.1E-07	7.0E-07	4.3E-07	1.2E-07	5.7E-10	9.5E-06	2.0E-06
CHILD (5-11 YR)											
Arsenic [a,b]	1.8E-06	1.1E-06	**1.2E-05**	6.5E-06	4.4E-07	6.9E-07	4.2E-07	1.1E-07	8.2E-10	**1.2E-05**	2.6E-06
TODDLER (7 MOS-4 YR)											
Metals											
Arsenic [a,b]	8.6E-06	5.3E-06	7.9E-06	4.4E-06	5.2E-07	5.4E-07	3.4E-07	7.7E-08	9.9E-10	**1.4E-05**	8.0E-06
7MOS TO 19YR											
Metals											
Arsenic [a,b]	**1.2E-05**	7.2E-06	**2.9E-05**	**1.6E-05**	1.3E-06	1.9E-06	1.2E-06	3.1E-07	2.4E-09	**3.5E-05**	**1.3E-05**

Notes:

[a] For shellfish ingestion, ILCR is for maximum inorganic arsenic (assumed 2% of total arsenic) tissue concentration for clams and 95% UCLM inorganic arsenic (2% of total arsenic) tissue concentration for oysters.

[b] For intertidal hazard indices, shellfish ingestion assumed to comprise half clams and half oysters, and incidental ingestion and dermal contact assumed to comprise sediment and half precipitate (ferricrete).

Bold and shaded - ILCR exceeds CSR risk based standard of 1E-05 (1 in 100,000)

TABLE B24: RECREATOR INCREMENTAL LIFETIME CANCER RISKS (5 days/week, 1 shellfish meal/week)											
Pathway: All Pathways Combined											
Chemical	ILCR Intertidal Sediment Ingestion	ILCR Intertidal Precipitate (Ferricrete) Ingestion	ILCR Intertidal Clam Ingestion	ILCR Intertidal Oyster Ingestion	ILCR Intertidal Water Ingestion	ILCR Intertidal Sediment Dermal	ILCR Intertidal Precipitate (Ferricrete) Dermal	ILCR Intertidal Water Dermal	ILCR Intertidal Sediment Inhalation	Combined ILCR (Intertidal Area Use - Including Shellfish Ingestion)	Combined ILCR (Intertidal Area Use - Excluding Shellfish Ingestion)
ADULT											
Metals											
Arsenic [a,b]	7.5E-06	4.6E-06	**3.8E-05**	**2.1E-05**	1.8E-06	4.7E-06	2.9E-06	8.0E-07	4.5E-09	**4.2E-05**	**1.2E-05**
TEEN (12-19 YR)											
Metals											
Arsenic [a,b]	2.1E-06	1.3E-06	9.7E-06	5.4E-06	5.1E-07	1.2E-06	7.2E-07	2.0E-07	9.5E-10	**1.1E-05**	3.3E-06
CHILD (5-11 YR)											
Metals											
Arsenic [a,b]	3.0E-06	1.8E-06	**1.2E-05**	6.5E-06	7.3E-07	1.1E-06	7.1E-07	1.8E-07	1.4E-09	**1.3E-05**	4.3E-06
TODDLER (7 MOS-4 YR)											
Metals											
Arsenic [a,b]	**1.4E-05**	8.9E-06	7.9E-06	4.4E-06	8.7E-07	9.1E-07	5.6E-07	1.3E-07	1.6E-09	**2.0E-05**	**1.3E-05**
7MOS TO 19YR											
Metals											
Arsenic [a,b]	**1.9E-05**	**1.2E-05**	**2.9E-05**	**1.6E-05**	2.1E-06	3.2E-06	2.0E-06	5.1E-07	4.0E-09	**4.4E-05**	**2.1E-05**

Notes:

[a] For shellfish ingestion, ILCR is for maximum inorganic arsenic (assumed 2% of total arsenic) tissue concentration for clams and 95% UCLM inorganic arsenic (2% of total arsenic) tissue concentration for oysters.

[b] For intertidal hazard indices, shellfish ingestion assumed to comprise half clams and half oysters, and incidental ingestion and dermal contact assumed to comprise sediment and half precipitate (ferricrete).

Bold and shaded - ILCR exceeds CSR risk based standard of 1E-05 (1 in 100,000)

Appendix A
Union Bay Clam Select Metals Data
For Intertidal Clam Samples

	Clam As (ug/g ww)	Clam Cd (ug/g ww)	Clam Cu (ug/g ww)	Clam Zn (ug/g ww)
	2.86	0.523	1.17	11.9
	1.53	0.0364	3.34	21.3
	1.2	0.041	4.14	23.3
	1.56	0.0265	3.55	25.9
	1.4	0.0409	4.67	26.1
Maximum	**2.86**	**0.523**	**4.67**	**26.1**
Mean	1.71	0.134	3.37	21.7

Appendix A
Union Bay Oyster Select Metals Data
For Intertidal Oyster Samples

	Oyster As (ug/g ww)	Oyster Cd (ug/g ww)	Oyster Cu (ug/g ww)	Oyster Zn (ug/g ww)
	1.11	1.67	22.8	213
	1.24	1.56	20.1	257
	2.24	2.85	36.2	411
	2.1	2.61	43.1	387
	1.74	0.808	13.2	188
	1.12	1.29	12.4	182
	0.943	1.290	22.90	244.0
	1.96	0.947	20	144
	0.75	1.01	20.5	163
	0.738	1.39	36.5	179
	0.721	1.21	30.7	186
	0.658	1.41	18.1	107
Maximum	**2.24**	**2.85**	**43.1**	**411**
Mean	1.28	1.50	24.7	222

Data File					Variable:	Oyster As		
Raw Statistics				Normal Distribution Test				
Number of Valid Samples			12	Shapiro-Wilk Test Statisitic				0.869233
Number of Unique Samples			12	Shapiro-Wilk 5% Critical Value				0.859
Minimum			0.658	Data are normal at 5% significance level				
Maximum			2.24					
Mean			1.276667	95% UCL (Assuming Normal Distribution)				
Median			1.115	Student's-t UCL				1.577808
Standard Deviation			0.580874					
Variance			0.337415	Gamma Distribution Test				
Coefficient of Variation			0.454993	A-D Test Statistic				0.547532
Skewness			0.620177	A-D 5% Critical Value				0.731813
				K-S Test Statistic				0.174837
Gamma Statistics				K-S 5% Critical Value				0.245872
k hat			5.523993	Data follow gamma distribution				
k star (bias corrected)			4.19855	at 5% significance level				
Theta hat			0.231113					
Theta star			0.304073	95% UCLs (Assuming Gamma Distribution)				
nu hat			132.5758	Approximate Gamma UCL				1.636659
nu star			100.7652	Adjusted Gamma UCL				1.701213
Approx.Chi Square Value (.05)			78.60136					
Adjusted Level of Significance			0.02896	Lognormal Distribution Test				
Adjusted Chi Square Value			75.61874	Shapiro-Wilk Test Statisitic				0.902128
				Shapiro-Wilk 5% Critical Value				0.859
Log-transformed Statistics				Data are lognormal at 5% significance level				
Minimum of log data			-0.41855					
Maximum of log data			0.806476	95% UCLs (Assuming Lognormal Distribution)				
Mean of log data			0.151016	95% H-UCL				1.704794
Standard Deviation of log data			0.448994	95% Chebyshev (MVUE) UCL				2.009035
Variance of log data			0.201595	97.5% Chebyshev (MVUE) UCL				2.326751
				99% Chebyshev (MVUE) UCL				2.950843
				95% Non-parametric UCLs				
				CLT UCL				1.552482
				Adj-CLT UCL (Adjusted for skewness)				1.584559
				Mod-t UCL (Adjusted for skewness)				1.582811
				Jackknife UCL				1.577808
				Standard Bootstrap UCL				1.540437
				Bootstrap-t UCL				1.628533
RECOMMENDATION				Hall's Bootstrap UCL				1.534438
Data are normal (0.05)				Percentile Bootstrap UCL				1.551833
				BCA Bootstrap UCL				1.579833
Use Student's-t UCL				95% Chebyshev (Mean, Sd) UCL				2.007584
				97.5% Chebyshev (Mean, Sd) UCL				2.323853
				99% Chebyshev (Mean, Sd) UCL				2.945101

Oyster Cadmium Statistics

Data File					Variable:	Oyster Cd		
Raw Statistics				Normal Distribution Test				
Number of Valid Samples			12	Shapiro-Wilk Test Statisitic				0.834701
Number of Unique Samples			11	Shapiro-Wilk 5% Critical Value				0.859
Minimum			0.808	Data not normal at 5% significance level				
Maximum			2.85					
Mean			1.50375	95% UCL (Assuming Normal Distribution)				
Median			1.34	Student's-t UCL				1.828043
Standard Deviation			0.625533					
Variance			0.391291	Gamma Distribution Test				
Coefficient of Variation			0.415982	A-D Test Statistic				0.533134
Skewness			1.391286	A-D 5% Critical Value				0.73114
				K-S Test Statistic				0.187389
Gamma Statistics				K-S 5% Critical Value				0.245654
k hat			7.513314	Data follow gamma distribution				
k star (bias corrected)			5.690541	at 5% significance level				
Theta hat			0.200145					
Theta star			0.264254	95% UCLs (Assuming Gamma Distribution)				
nu hat			180.3195	Approximate Gamma UCL				1.857445
nu star			136.573	Adjusted Gamma UCL				1.919382
Approx.Chi Square Value (.05)			110.5667					
Adjusted Level of Significance			0.02896	Lognormal Distribution Test				
Adjusted Chi Square Value			106.9988	Shapiro-Wilk Test Statisitic				0.933523
				Shapiro-Wilk 5% Critical Value				0.859
Log-transformed Statistics				Data are lognormal at 5% significance level				
Minimum of log data			-0.213193					
Maximum of log data			1.047319	95% UCLs (Assuming Lognormal Distribution)				
Mean of log data			0.33994	95% H-UCL				1.88595
Standard Deviation of log data			0.373228	95% Chebyshev (MVUE) UCL				2.209808
Variance of log data			0.139299	97.5% Chebyshev (MVUE) UCL				2.518233
				99% Chebyshev (MVUE) UCL				3.124075
				95% Non-parametric UCLs				
				CLT UCL				1.800771
				Adj-CLT UCL (Adjusted for skewness)				1.878264
				Mod-t UCL (Adjusted for skewness)				1.840131
				Jackknife UCL				1.828043
				Standard Bootstrap UCL				1.786812
				Bootstrap-t UCL				2.114982
RECOMMENDATION				Hall's Bootstrap UCL				3.80404
Data follow gamma distribution (0.05)				Percentile Bootstrap UCL				1.7975
				BCA Bootstrap UCL				1.8675
Use Approximate Gamma UCL				95% Chebyshev (Mean, Sd) UCL				2.290862
				97.5% Chebyshev (Mean, Sd) UCL				2.631445
				99% Chebyshev (Mean, Sd) UCL				3.300456

Data File					Variable:	Oyster Cu		
Raw Statistics				Normal Distribution Test				
Number of Valid Samples			12	Shapiro-Wilk Test Statisitic				0.913059
Number of Unique Samples			12	Shapiro-Wilk 5% Critical Value				0.859
Minimum			12.4	Data are normal at 5% significance level				
Maximum			43.1					
Mean			24.70833	95% UCL (Assuming Normal Distribution)				
Median			21.65	Student's-t UCL				29.75139
Standard Deviation			9.727604					
Variance			94.62629	Gamma Distribution Test				
Coefficient of Variation			0.393697	A-D Test Statistic				0.386397
Skewness			0.666787	A-D 5% Critical Value				0.731219
				K-S Test Statistic				0.197688
Gamma Statistics				K-S 5% Critical Value				0.245679
k hat			7.280667	Data follow gamma distribution				
k star (bias corrected)			5.516056	at 5% significance level				
Theta hat			3.393691					
Theta star			4.479348	95% UCLs (Assuming Gamma Distribution)				
nu hat			174.736	Approximate Gamma UCL				30.62757
nu star			132.3853	Adjusted Gamma UCL				31.66644
Approx.Chi Square Value (.05)			106.7999					
Adjusted Level of Significance			0.02896	Lognormal Distribution Test				
Adjusted Chi Square Value			103.2961	Shapiro-Wilk Test Statisitic				0.945705
				Shapiro-Wilk 5% Critical Value				0.859
Log-transformed Statistics				Data are lognormal at 5% significance level				
Minimum of log data			2.517696					
Maximum of log data			3.763523	95% UCLs (Assuming Lognormal Distribution)				
Mean of log data			3.136896	95% H-UCL				31.58954
Standard Deviation of log data			0.39257	95% Chebyshev (MVUE) UCL				37.09984
Variance of log data			0.154111	97.5% Chebyshev (MVUE) UCL				42.46154
				99% Chebyshev (MVUE) UCL				52.99355
				95% Non-parametric UCLs				
				CLT UCL				29.32728
				Adj-CLT UCL (Adjusted for skewness)				29.90483
				Mod-t UCL (Adjusted for skewness)				29.84148
				Jackknife UCL				29.75139
				Standard Bootstrap UCL				29.18148
				Bootstrap-t UCL				30.77142
RECOMMENDATION				Hall's Bootstrap UCL				29.67943
Data are normal (0.05)				Percentile Bootstrap UCL				29.2
				BCA Bootstrap UCL				29.8
Use Student's-t UCL				95% Chebyshev (Mean, Sd) UCL				36.94863
				97.5% Chebyshev (Mean, Sd) UCL				42.24502
				99% Chebyshev (Mean, Sd) UCL				52.64875

Oyster Zinc Statistics

Data File					Variable:	Oyster Zn		
Raw Statistics				Normal Distribution Test				
Number of Valid Samples			12	Shapiro-Wilk Test Statisitic				0.85438
Number of Unique Samples			12	Shapiro-Wilk 5% Critical Value				0.859
Minimum			107	Data not normal at 5% significance level				
Maximum			411					
Mean			221.75	95% UCL (Assuming Normal Distribution)				
Median			187	Student's-t UCL				269.5278
Standard Deviation			92.15908					
Variance			8493.295	Gamma Distribution Test				
Coefficient of Variation			0.415599	A-D Test Statistic				0.502651
Skewness			1.245422	A-D 5% Critical Value				0.731222
				K-S Test Statistic				0.204167
Gamma Statistics				K-S 5% Critical Value				0.24568
k hat			7.270968	Data follow gamma distribution				
k star (bias corrected)			5.508781	at 5% significance level				
Theta hat			30.498					
Theta star			40.25391	95% UCLs (Assuming Gamma Distribution)				
nu hat			174.5032	Approximate Gamma UCL				274.9148
nu star			132.2107	Adjusted Gamma UCL				284.2465
Approx.Chi Square Value (.05)			106.643					
Adjusted Level of Significance			0.02896	Lognormal Distribution Test				
Adjusted Chi Square Value			103.1419	Shapiro-Wilk Test Statisitic				0.943988
				Shapiro-Wilk 5% Critical Value				0.859
Log-transformed Statistics				Data are lognormal at 5% significance level				
Minimum of log data			4.672829					
Maximum of log data			6.018593	95% UCLs (Assuming Lognormal Distribution)				
Mean of log data			5.331211	95% H-UCL				280.6739
Standard Deviation of log data			0.383671	95% Chebyshev (MVUE) UCL				329.3059
Variance of log data			0.147203	97.5% Chebyshev (MVUE) UCL				376.1536
				99% Chebyshev (MVUE) UCL				468.177
				95% Non-parametric UCLs				
				CLT UCL				265.5097
				Adj-CLT UCL (Adjusted for skewness)				275.7298
				Mod-t UCL (Adjusted for skewness)				271.1219
				Jackknife UCL				269.5278
				Standard Bootstrap UCL				264.4405
				Bootstrap-t UCL				304.0607
RECOMMENDATION				Hall's Bootstrap UCL				478.8539
Data follow gamma distribution (0.05)				Percentile Bootstrap UCL				266
				BCA Bootstrap UCL				274.1667
Use Approximate Gamma UCL				95% Chebyshev (Mean, Sd) UCL				337.7143
				97.5% Chebyshev (Mean, Sd) UCL				387.8921
				99% Chebyshev (Mean, Sd) UCL				486.4568

APPENDIX C

Laboratory Water and Sediment Toxicity Test Reports

Revised Problem Formulation and
Preliminary Quantitative Risk Assessment,
Union Bay Waste Coal Pile, BC Site 4291
Seacor Project: 201.01022.01 & 201.01069.01

November 2005

Laboratory Report

Seacor Environmental Inc.

Ground Water Toxicity Testing Program

September 2005 Samples

PREPARED FOR:

Seacor Environmental Inc
Victoria, BC

PREPARED BY:

EVS environment consultants

A Member of the Golder Group of Companies

GROUND WATER TOXICITY TESTING PROGRAM

SEPTEMBER 2005 SAMPLES

LABORATORY REPORT

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04-1424-076

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TABLE OF CONTENTS

TABLE OF CONTENTS i
LIST OF TABLES ii
ACKNOWLEDGEMENTS iii

1.0 INTRODUCTION 1

2.0 METHODS 2

2.1 Echinoderm (*Dendraster excentricus*) Fertilization Toxicity Test 2
2.2 7-d Topsmelt (*Atherinops affinis*) Survival and Growth Toxicity Test 2
2.3 Statistical Analysis 3
2.4 Quality Assurance/Quality Control (QA/QC) 3

3.0 RESULTS 6

3.0 RESULTS 6

3.1 Echinoderm (*Dendraster excentricus*) Fertilization Toxicity Test 6
3.2 7-d Topsmelt (*Atherinops affinis*) Survival and Growth Toxicity Test 7
3.3 Quality Assurance/Quality Control (QA/QC) 8

4.0 REFERENCES 17

APPENDIX I Raw Data and Statistical Analyses: *Dendraster excentricus* Fertilization Toxicity Test

APPENDIX II Raw Data and Statistical Analyses: 7-d *Atherinops affinis* Survival and Growth Toxicity Test

APPENDIX III Chain-of-Custody Forms

LIST OF TABLES

Table 1: Echinoderm (*Dendraster excentricus*) fertilization toxicity test methods. **4**

Table 2: 7-d topsmelt (*Atherinops affinis*) survival and growth toxicity test methods. **5**

Table 3: Summary of results for the *D. excentricus* toxicity test for samples BH16 and BH20. **9**

Table 4: Summary of results for the *D. excentricus* toxicity test for samples SW 9 and SW 11. **10**

Table 5 Summary of results for the *D. excentricus* toxicity test for samples SW 12. **11**

Table 6: Summary of results for the 7-d *A. affinis* toxicity test for samples BH16. **12**

Table 7: Summary of results for the 7-d *A. affinis* toxicity test for samples BH20. **13**

Table 8: Summary of results for the 7-d *A. affinis* toxicity test for samples SW9. **14**

Table 9: Summary of results for the 7-d *A. affinis* toxicity test for samples SW11. **15**

Table 10: Summary of results for the 7-d *A. affinis* toxicity test for samples SW12. **16**

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1.0 INTRODUCTION

Five ground water samples, identified as SW9, SW11, SW12, BH20 and BH16, were collected for toxicity testing on September 17, 2005 by Seacor Environmental Inc., Victoria, BC. The samples were received at EVS Environment Consultants Laboratory (a member of the Golder Group of Companies) on September 19, 2005. The samples were collected in 20-L collapsible carboys and transported in coolers with ice packs. The samples were stored in the dark at 4ºC prior to testing.

The samples were tested for toxicity using the echinoderm (*Dendraster excentricus*) fertilization and the 7-d topsmelt (*Atherinops affinis*) survival and growth toxicity tests. Two rounds of toxicity testing were conducted on the same samples using different dilution series. The first round of tests was initiated on September 20, 2005 involving all five samples tested with both species. The second round of tests was initiated on September 27 and 29, 2005 for the topsmelt and echinoderm toxicity tests, respectively. Only four (BH16, BH20, SW9 and SW11) out of the five samples were tested in the second round of testing.

This report describes the methods and results of these toxicity tests. The raw data and statistical analyses for the tests are provided in Appendices I and II. The chain-of-custody forms are provided in Appendix III.

2.0 METHODS

Two rounds of testing were conducted on the same samples collected on September 17, 2005. All five samples (BH16, BH20, SW9, SW11 and SW12) were tested with both species in the first round of tests using a 50% dilution series of five sample concentrations. The test concentrations were prepared for all the samples after salinity-adjustments.

The second round of testing was initiated for both species using four (BH16, BH20, SW9 and SW11) of the five samples collected. Samples BH16 and BH20 were initiated using the following dilution series: 0.001, 0.003, 0.01, 0.032, 0.1 and the highest concentration between 4.6 – 5.0 % (v/v). Samples SW9 and SW11 were initiated using the following: dilution series: 0.01, 0.032, 0.1, 0.32, 1.0 and the highest concentration between 5.6 – 6.2 % (v/v). In general, all the toxicity tests for both species were conducted following standard test procedures described in the subsequent sections and tables presented in this report.

2.1 ECHINODERM (*DENDRASTER EXCENTRICUS*) FERTILIZATION TOXICITY TEST

The echinoderm (*Dendraster excentricus*) fertilization toxicity test was conducted in accordance with Environment Canada (1992 with 1997 amendments). Test conditions and methods are summarized in Table 2.

This fertilization test involves exposing echinoderm sperm to a series of test concentrations for ten minutes followed by the addition of echinoderm eggs. Fertilization occurs for ten minutes, after the addition of eggs. Following the ten minutes exposure time, the eggs are preserved and the numbers of fertilized and unfertilized eggs in each replicate are counted. These observations are assessed in comparison to the negative control.

2.2 7-D TOPSMELT (*ATHERINOPS AFFINIS*) SURVIVAL AND GROWTH TOXICITY TEST

A static-renewal 7-d toxicity test using topsmelt (*A. affinis*) were conducted in accordance with United States Environmental Protection Agency (1995). Test conditions and methods are summarized in Table 3.

This 7-day test exposes topsmelt larvae to different concentrations of a given sample. Solutions are renewed daily and fish are fed twice daily. Both survival and growth endpoints are determined at test termination. These observations are assessed in comparison to control.

2.3 STATISTICAL ANALYSIS

Statistical analyses for all tests were conducted using the computer software program TOXCALC (version 5.0.23; Tidepool Scientific Software, 1994). Statistical endpoints measured include the No Observed Effect Concentration (NOEC), Lowest Observed Effect Concentration (LOEC), and Effective and Inhibiting Concentrations (i.e., EC50, EC20, IC50, and IC20).

The first round of *D. excentricus* toxicity testing showed complete inhibition of fertilization in all sample concentrations tested for all the samples. Based on data observation and with the client's approval, there was no need to account for the data from the first round of testing for this species and, therefore, no statistical analyses were performed.

2.4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This study followed a comprehensive QA/QC Program to ensure full documentation and minimize possible errors in computation and reporting of results. The following general QA/QC guidelines were applied in this test: use of negative controls, use of positive controls, replication, instrument calibration, water quality maintenance and record-keeping, and use of standard operating procedures (SOPs). To ensure that the generated data and reporting met quality standards, all data and statistical analyses were reviewed by a member of our QA/QC Committee prior to reporting the results.

Toxicity testing was carried out in accordance with applicable test methodologies and/or standards of practice. Our liability is limited solely to the cost of re-testing in the event of non-compliance with such test specifications or standards of practice. Golder/EVS accepts no responsibility or liability for the interpretation or use of these testing results by others, nor for any delay, loss, damage or interruptions of testing, collection, preparation, and delivery of samples or test results resulting from events or circumstances beyond our control.

Table 1: Echinoderm (*Dendraster excentricus*) fertilization toxicity test methods.

TEST PARAMETER	TEST CONDITION
Test type	Static
Test duration	10:10 min
Test chamber	16 X 125 mm test tubes
Test solution volume	10 mL
Number of replicate chambers per treatment	4
Number of eggs per test chamber	2000
Age of test organisms	< 4 hours after spawning
Sample manipulations (e.g. pre-aeration, pH adjustment, filtration)	Salinity-adjusted to 30 ± 2 ppt with hyper saline brine [HSB].
Control/dilution water	UV-sterilized and 0.5μm-filtered natural sea water from Vancouver Aquarium, BC
Renewal of dilutions	None
Aeration	None during testing
Water quality parameters and frequency	Temperature, pH, dissolved oxygen, and salinity
Temperature	15 ± 1°C
Salinity	30 ± 2
Lighting	Ambient laboratory illumination (moderate intensity)
Reference toxicant	Initiated concurrently with test; same test methods as above using SDS to generate an EC50 value; results compared to lab mean ± 2 SD
Endpoint	Fertilization of eggs
Test validity	≥ 50% and ≤ 100% mean control fertilization
Reference protocols	Environment Canada (1992), (EPS/1/RM/27 with 1997 amendments)

Table 2: 7-d topsmelt (*Atherinops affinis*) survival and growth toxicity test methods.

TEST PARAMETER	TEST CONDITION
Test type	Static-renewal.
Test duration	7 d
Test solution volume	200 mL
Number of replicate chambers per treatment	5
Number of organisms per test chamber	5
Age of test organisms at test initiation	9-10 d
Food	Newly hatched *Artemia nauplii* (<24 hours old).
Feeding Regime	Twice daily (40 *Artemia nauplii* / fish) morning and afternoon; no feeding at test termination.
Sample manipulations (e.g. pre-aeration, pH adjustment, filtration)	Salinity-adjusted to 30 ± 2 ppt with hyper saline brine [HSB].
Control/dilution water	UV-sterilized and 0.45μm-filtered natural seawater obtained from Vancouver Aquarium, BC.
Renewal of dilutions	80% solution renewal daily.
Aeration	None required.
Water quality parameters and frequency	Temperature, pH, dissolved oxygen, and salinity daily.
Temperature	20 ± 1°C
Salinity	30 ± 2 ppt
Illumination	Overhead full-spectrum fluorescent lights; 50 – 100 ft-c; 16:8 light:dark photoperiod.
Reference toxicant	Initiated concurrently with sample using copper (Cu) to generate LC50 and IC50 values; results compared to lab mean ± 2 SD.
Endpoints	Survival and growth (dry weight – number of survivors and total weight of survivors divided by the initial count).
Test validity	≥ 80% mean control survival; ≥ 0.85 mg / fish mean dry weight for surviving control fish.
Reference protocols	US EPA (1995) (EPA/600/R-95/136).

3.0 RESULTS

Summaries of results for the *Dendraster excentricus* and *Atherinops affinis* toxicity tests are provided in Tables 3 - 10. The first round of *D. excentricus* toxicity testing showed complete inhibition of fertilization in all of the concentrations tested for all the samples except SW12. Consequently, data from this first round of testing for four of the five samples are not particularly useful for the client's overall project study objectives and, therefore, only *D. excentricus* data for sample SW12 are presented in this report from the first round of tests.

Daily test monitoring data, and results of the statistical and chemical analyses are provided in Appendices I and II.

3.1 ECHINODERM (*DENDRASTER EXCENTIRCUS*) FERTILIZATION TOXICITY TEST

3.1.1 Round 1 (Test Initiated September 20, 2005)

The first round of echinoderm fertilization toxicity test showed a mean negative control fertilization rate of 84.2%. The brine control showed a mean fertilization rate of 80.8%.

Sample SW12 exhibited no adverse effects to echinoderm fertilization in any of the samples concentrations tested relative to the negative control ($p \leq 0.05$).

3.1.2 Round 2 (Test Initiated September 29, 2005)

The second round of echinoderm fertilization toxicity test showed a mean negative control fertilization rate of 92.5%. The brine control showed a mean fertilization rate of 91.2%.

All four samples, BH16, BH20, SW9 and SW11, showed statistically significant fertilization effects in mostly the highest sample concentrations tested relative to the negative control ($p \leq 0.05$) (see Tables 3 and 4).

The highest sample concentration tested for samples BH16 and BH20 was approximately 4.6 %(v/v). Sample BH16 showed statistically significant fertilization effects in the two highest sample concentrations tested relative to the negative control ($p \leq 0.05$). BH20 showed statistically significant adverse effects in the highest three concentrations, including an interrupted significant response in the 0.003 %(v/v) test concentration, relative to the negative control ($p \leq 0.05$).

The highest sample concentration tested for samples SW9 and SW11 was 6.0% (v/v). Both samples showed an interrupted dose-response with statistically significant effects present in the lowest and higher sample concentrations relative to the negative control ($p \leq 0.05$).

3.2 7-D TOPSMELT (*ATHERINOPS AFFINIS*) SURVIVAL AND GROWTH TOXICITY TEST

3.2.1 Round 1 (Test Initiated September 20, 2005)

The first round of 7-d *A. affinis* toxicity testing showed a mean negative control survival range of 92 - 96%, and mean dry weight range of 0.99 – 1.14 mg. The brine control showed mean survival and mean dry weight of 88% and 0.91 mg, respectively.

All five samples, BH16, BH20, SW9, SW11 and SW12, showed significant adverse effects to both survival and growth endpoints in all concentrations tested relative to the negative control ($p \leq 0.05$). Samples BH16 and BH20 showed complete mortality in all sample concentrations tested. Samples SW11 and SW12 showed complete mortality in all but the lowest sample concentration tested (6.0% v/v) (see Tables 5 – 9).

3.2.2 Round 2 (Test Initiated September 27, 2005)

The second round of testing for the 7-d *A. affinis* toxicity test showed a mean negative control survival range of 96 - 100%, and mean dry weight range of 1.10 – 1.28 mg. The brine control showed mean survival and mean dry weight of 100.0% and 1.38 mg, respectively (see Tables 5 – 9).

The highest sample concentration tested for samples BH16 and BH20 was 5.0 and 4.6 % (v/v), respectively. Both samples showed statistically significant adverse effects on either survival or growth in the highest concentration only; no statistically significant response were observed for both endpoints in the remaining sample concentrations tested relative to the negative control ($p \leq 0.05$).

The highest sample concentrations tested for samples SW9 and SW11 was 5.6 and 6.0 % (v/v), respectively. Both samples showed no statistically significant survival or growth effects in any of the concentrations tested relative to the negative control ($p \leq 0.05$).

3.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All tests met all specified negative control criteria for test validity outlined in Environment Canada (1992) and the United States Environmental Protection Agency (1995) protocols. Water quality measurements were all within the recommended ranges.

The reference toxicant tests for all species met all passing criteria as specified by Environment Canada (1992) and the United States Environmental Protection Agency (1995). Point estimates for the tests were within two standard deviations of the laboratory mean, indicating that the tests were within acceptable limits of variability.

Table 3: Summary of results for the *D. excentricus* toxicity test for samples BH16 and BH20.

BH16 (initiated 29-Sep-05)		
Treatment (%v/v)	**Proportion Fertilized (%) Mean ± SD[1]**	
D-Control	92.5 ± 3.9	
Brine-Control	91.2 ± 6.7	
0.001	89.8 ± 3.9	
0.003	91.8 ± 4.0	
0.010	89.2 ± 2.9	
0.032	87.5 ± 2.1	
0.100	54.0 ± 9.4	*
4.600	15.2 ± 1.7	*
LOEC	0.1	
NOEC	0.03	
IC50 (95% CL)[2]	0.5(0.0-1.1)	
IC20 (95% CL)[2]	0.1(0.0-0.1)	
BH20 (initiated 29-Sep-05)		
Treatment (%v/v)	**Proportion Fertilized (%) Mean ± SD[1]**	
D-Control	92.5 ± 3.9	
Brine-Control	91.2 ± 6.7	
0.001	84.5 ± 6.4	
0.003	83.0 ± 3.9	*
0.010	86.8 ± 4.4	
0.032	76.8 ± 6.3	*
0.100	79.0 ± 5.0	*
4.600	3.2 ± 2.6	*
LOEC	0.003	
NOEC	0.001	
IC50 (95% CL)[2]	1.2(1.0-1.4)	
IC20 (95% CL)[2]	0.2(0.0-0.4)	

[1] n = 4 replicates per treatment; ~2000 eggs per 10 mL (CDN)

[2] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 4: Summary of results for the *D. excentricus* toxicity test for samples SW 9 and SW 11.

SW 9 (initiated 29-Sep-05)				
Treatment (%v/v)	**Proportion Fertilized (%) Mean ± SD[1]**			
D-Control	92.5	±	3.9	
Brine-Control	91.2	±	6.7	
0.010	84.0	±	5.5	*
0.032	87.5	±	1.3	
0.100	87.5	±	5.5	
0.320	88.0	±	5.0	
1.000	90.0	±	2.4	
6.000	58.5	±	6.6	*
LOEC	0.01			
NOEC	<0.01			
IC50 (95% CL)[2]	>6			
IC20 (95% CL)[2]	2.6(1.7-3.7)			
SW 11 (initiated 29-Sep-05)				
Treatment (%v/v)	**Proportion Fertilized (%) Mean ± SD[1]**			
D-Control	92.5	±	3.9	
Brine-Control	91.2	±	6.7	
0.010	69.8	±	8.0	*
0.032	92.5	±	2.1	
0.100	84.5	±	7.2	
0.320	84.0	±	7.6	
1.000	64.2	±	7.4	*
6.000	17.5	±	6.0	*
LOEC	0.01			
NOEC	<0.01			
IC50 (95% CL)[2]	2.2(1.6-2.9)			
IC20 (95% CL)[2]	0.6(0.2-0.9)			

[1] n = 4 replicates per treatment; ~2000 eggs per 10 mL (CDN)

[2] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 5 Summary of results for the *D. excentricus* toxicity test for samples SW 12.

SW 12 (initiated 20-Sep-05)	
Treatment (%v/v)	**Proportion Fertilized (%) Mean ± SD[1]**
D-Control	84.2 ± 3.1
Brine-Control	80.8 ± 5.4
6.2	81.8 ± 2.4
12.3	82.0 ± 2.2
24.6	83.0 ± 4.3
49.2	79.5 ± 3.1
98.4	80.8 ± 4.3
LOEC	>98.4
NOEC	98.4
IC50 (95% CL)[2]	>98.4
IC20 (95% CL)[2]	>98.4

Table 6: Summary of results for the 7-d *A. affinis* toxicity test for samples BH16.

BH16 (initiated 20-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.07	±	0.11	
Brine-control	88.0	±	11.0		0.91	±	0.22	
5.0	0.0	±	0.0	*	0.0	±	0.0	*
10.0	0.0	±	0.0	*	0.0	±	0.0	*
20.0	0.0	±	0.0	*	0.0	±	0.0	*
41.0	0.0	±	0.0	*	0.0	±	0.0	*
81.6	0.0	±	0.0	*	0.0	±	0.0	*
NOEC	<5.0				<5.0			
LOEC	5.0				5.0			
EC20 (95% CL) [2]	<5.0				NA			
IC20 (95% CL)[2]	NA				1.0(1.0-1.0)			
IC50 (95% CL)[2]	NA				2.5 (2.5 -2.5)			
BH16 (initiated 27-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	100.0	±	0.0		1.28	±	0.06	
Brine-control	100.0	±	0.0		1.38	±	0.14	
0.001	100.0	±	0.0		1.13	±	0.61	
0.0032	96.0	±	8.9		1.32	±	0.07	
0.010	92.0	±	17.9		1.45	±	0.32	
0.032	92.0	±	11.0		1.45	±	0.28	
0.1	95.0	±	11.2		1.34	±	0.20	
5.0	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	0.1				0.1			
LOEC	5.0				5.0			
EC50 (95% CL) [2]	0.5 (0.4 - 0.7)[3]				NA			
IC20 (95% CL)[2]	NA				1.1(0.3 -1.1)			
IC50 (95% CL)[2]	NA				2.6 (2.1 -2.2.6)			

[1] n=5 replicates per treatment

[2] CL = Confidence limits

[3] EC20 is not calculable

nc = not calculable

NA = Not applicable

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 7: Summary of results for the 7-d *A. affinis* toxicity test for samples BH20.

BH20 (initiated 20-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.01	±	0.18	
Brine-control	88.0	±	11.0		0.91	±	0.22	
4.5	0.0	±	0.0	*	0.00	±	0.00	*
9.0	0.0	±	0.0	*	0.00	±	0.00	*
18.0	0.0	±	0.0	*	0.00	±	0.00	*
36.0	0.0	±	0.0	*	0.00	±	0.00	*
72.5	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	<4.5				<4.5			
LOEC	4.5				4.5			
EC20 (95% CL) [2]	<4.5				NA			
IC20 (95% CL)[2]	NA				0.9 (0.9 – 0.9)			
IC50 (95% CL)[2]	NA				2.2 (2.2 – 2.2)			
BH20 (initiated 27-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.29	±	0.30	
Brine-control	100.0	±	0.0		1.38	±	0.14	
0.001	100.0	±	0.0		1.44	±	0.21	
0.0032	100.0	±	0.0		1.45	±	0.25	
0.010	92.0	±	11.0		1.28	±	0.27	
0.032	100.0	±	0.0		1.23	±	0.16	
0.1	100.0	±	0.0		1.60	±	0.21	
5.0	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	0.1				0.1			
LOEC	4.6				4.6			
EC50 (95% CL) [2]	0.6 (0.6 - 0.7)[3]				NA			
IC20 (95% CL)[2]	NA				0.9 (0.3 – 1.0)			
IC50 (95% CL)[2]	NA				2.3 (1.9 - 2.4)			

[1] n=5 replicates per treatment

[2] CL = Confidence limits

[3] EC20 is not calculable

nc = not calculable

NA = Not applicable

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 8: Summary of results for the 7-d *A. affinis* toxicity test for samples SW9.

SW9 (initiated 20-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.02	±	0.17	
Brine-control	88.0	±	11.0		0.91	±	0.22	
5.5	56.0	±	16.7	*	0.55	±	0.24	*
11.1	24.0	±	26.1	*	0.21	±	0.22	*
22.0	0.0	±	0.0	*	0.00	±	0.00	*
44.0	0.0	±	0.0	*	0.00	±	0.00	*
88.5	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	<5.5				<5.5			
LOEC	5.5				5.5			
EC20 (95% CL) [2]	4.2 (2.0 – 5.4)				NA			
IC20 (95% CL)[2]	NA				2.4 (1.9 – 6.0)			
IC50 (95% CL)[2]	NA				6.1 (3.8 - 8.9)			
SW9 (initiated 27-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.10	±	0.20	
Brine-control	100.0	±	0.0		1.38	±	0.14	
0.01	96.0	±	8.9		1.11	±	0.20	
0.032	92.0	±	11.0		1.22	±	0.37	
0.1	100.0	±	0.0		1.17	±	0.14	
0.32	96.0	±	8.9		1.07	±	0.16	
1.0	96.0	±	8.9		1.32	±	0.31	
5.6	100.0	±	0.0		1.31	±	0.42	
NOEC	5.6				5.6			
LOEC	>5.6				>5.6			
EC20 (95% CL) [2]	>5.6				NA			
IC20 (95% CL)[2]	NA				>5.6			
IC50 (95% CL)[2]	NA				>5.6			

[1] n=5 replicates per treatment

[2] CL = Confidence limits

nc = not calculable

NA = Not applicable

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 9: Summary of results for the 7-d *A. affinis* toxicity test for samples SW11.

SW11 (initiated 20-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	92.0	±	11.0		0.99	±	0.23	
Brine Control	88.0	±	11.0		0.91	±	0.22	
6.0	60.0	±	24.5	*	0.60	±	0.24	*
12.0	0.0	±	0.0	*	0.00	±	0.00	*
24.0	0.0	±	0.0	*	0.00	±	0.00	*
47.0	0.0	±	0.0	*	0.00	±	0.00	*
94.0	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	< 6.0				< 6.0			
LOEC	6.0				6.0			
EC50 (95% CL) [2]	7.1 (6.0 - 8.2)[3]				NA			
IC20 (95% CL)[2]	NA				3.0 (1.4 – 8.2)			
IC50 (95% CL)[2]	NA				7.0 (3.7 - 9.4)			
SW11 (initiated 27-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	100.0	±	0.0		1.24	±	0.15	
Brine-control	100.0	±	0.0		1.38	±	0.14	
0.01	100.0	±	0.0		1.12	±	0.24	
0.032	100.0	±	0.0		1.58	±	0.93	
0.1	100.0	±	0.0		1.17	±	0.22	
0.32	100.0	±	0.0		1.15	±	0.28	
1.0	100.0	±	0.0		1.16	±	0.12	
6.2	88.0	±	26.8		0.99	±	0.32	
NOEC	6.2				6.2			
LOEC	>6.2				>6.2			
EC20 (95% CL) [2]	>6.2				NA			
IC20 (95% CL)[2]	NA				4.3 (nc)			
IC50 (95% CL)[2]	NA				>6.2			

[1] n=5 replicates per treatment

[2] CL = Confidence limits

[3] EC20 is not calculable

nc = not calculable

NA = Not applicable

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 10: Summary of results for the 7-d *A. affinis* toxicity test for samples SW12.

SW12 (initiated 20-Sep-05)								
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	100.0	±	0.0		1.14	±	0.15	
Brine Control	88.0	±	11.0		0.91	±	0.22	
6.0	96.0	±	8.9		1.00	±	0.17	
12.0	96.0	±	8.9		0.97	±	0.18	
24.0	96.0	±	8.9		0.93	±	0.16	
47.0	92.0	±	11.0		0.93	±	0.22	
94.0	80.0	±	0.0	*	0.94	±	0.09	
NOEC	50.0				50.0			
LOEC	100.0				>50.0			
EC20 (95% CL) [2]	>100				NA			
IC20 (95% CL)[2]	NA				>100			
IC50 (95% CL)[2]	NA				>100			

[1] n=5 replicates per treatment

[2] CL = Confidence limits

nc = not calculable

NA = Not applicable

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

4.0 REFERENCES

APHA (American Public Health Association). 1998. Standard Methods for the Examination of Water and Wastewater. 20th edition. American Public Health Association, American Water Works Association and Water Environment Federation, Washington, DC.

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USEPA (United States Environmental Protection Agency). 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to West Coast marine and estuarine organisms. 1st edition. US Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, OH. EPA/600/R-95/136. 661 pp.

APPENDIX I

Raw Data and Statistical Analyses: *Dendraster excentricus* Fertilization Toxicity Test

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacor
Lab Project No. 04-1424-0076
Lab Work Order No. 0500396

Lab Analysts JRY, SRS, MEL
Test Initiation Date 20 Sept 05

SAMPLE

Identification SW12
Amount Received 1x20L
Date Collected 17 Sept 05
Date Received 19 Sept 05
Temperature (°C) 14.5
pH 8.0 ① → 8.2
Dissolved Oxygen (mg/L) 8.4 ① → 7.9
Conductivity (µmhos/cm) —
Salinity (ppt) 28 ① → 29
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

① brine adjustment

TEST SPECIES

Organism Dendraster excentricus
Source Westwind Sealab
Date Received 20 Sept 05
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 20 Sept 05
IC50 (and 95% CL) 6.9 (5.1-8.1)
Reference Toxicant Warning Limits (mean ± 2SD) and CV
3.9 ± 3.8 mg/L SDS CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type 0.5µm filtered, UV sterilized SW
Temperature (°C) 15.5
pH 7.8
Dissolved Oxygen (mg/L) 8.4
Salinity (ppt) 29
Other —

TEST CONDITIONS

Temperature Range (°C) 14.0 – 16.0
pH Range 7.8 → 8.2
Dissolved Oxygen Range (mg/L) 7.8 → 8.2
Salinity Range (ppt) 29
Sperm:Egg Ratio 2000:1
Test Duration 10:10
Other —

TEST RESULTS

IC25: >98.4% (v/v)
IC50: >98.4% (v/v)
LOEC: >98.4% (v/v)
NOEC: 98.4% (v/v)

Data Verified By [signature]
Date Verified Nov. 28/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500396
Logbook Echinoid #13 Pages 77-80

Test Initiation Date/Time 20Sep05 / 1729
Test Species Dendraster excentricus
Source/Date Received Westwind Seclab / 20Sep05
Test Duration 10:10

Sample ID	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SW Control	15.5	7.8	29	8.4	
Brine Control	16.0	8.0	29	8.1	
Technician Initials	JM	JM	JM	JM	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030301 Salinity II-A-030306 DO II-A-20

Sample Description

Data Verified By Ralph Date Verified Nov-24/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Sea Cor
EVS Project No. 04-1424-076
EVS Work Order No. 0505396
Logbook Echinoid #13 Pages 77-80

Test Initiation Date/Time 20Sep05 / 1729
Test Species Dendraster excentricus
Source/Date Received Westwind Seclab / 20Sep05
Test Duration 10:10

Sample ID SW12 Y.(V/A)	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
6.15	14.0	8.0	29	7.9	
12.3	15.0	8.0	29	7.8	
25 49.6	15.0	8.0	29	7.8	
49.2	14.5	8.1	29	7.8	
98.4	14.5	8.2	29	7.9	
Technician Initials	OM	OM	OM	OM	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030301 Salinity II-A-030306 DO II-A-20

Sample Description Colorless, no odor

Data Verified By Qualified Date Verified 11-29-05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor

Lab Project No. 04 1424 076

Lab Work Order No. 0500396

Logbook #13 Pages 77 - 80

Test Initiation Date/Time 20 Sept 05 / 1729

Test Species Dendraster excentricus

Source/Date Received Westwind Seatab

Test Duration 10:10

Sperm:Egg Ratio 2000:1

Sample ID (SW12 (%v/v))	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
98.4	A	81	19	~~75/25~~ 80/20 dup	SRS
	B	84	16		dup
	C	84	16		dup
	D	75	25		dup
49.2	A	81	19		dup
	B	75	25		dup
	C	80	20		dup
	D	82	18		dup
24.6	A	77	23		dup
	B	85	15		dup
	C	83	17		dup
	D	87	13		dup
12.3	A	84	16	80/20 dup. Avg: 82/18	SRS
	B	81	19		dup
	C	80	20		dup
	D	85	15		dup
6.15	A	85	15	75/25 dup Avg: 80/20	SRS
	B	85	15	85	dup
	C	80	20		dup
	D	82	18		dup
Control	A	87	13		dup
	B	84	16		dup
	C	86	14		dup
	D	80	20		dup

Data Verified By Qualified

Date Verified Nov. 28/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor

Lab Project No. 04 1424 076

Lab Work Order No. 0500396

Logbook #13 Pages 77 - 80

Test Initiation Date/Time 20 Sept 05 / 17:29

Test Species Dendraster excentricus

Source/Date Received Westwind Sealab

Test Duration 10:10

Sperm:Egg Ratio 2000:1

Sample ID	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
Brine Control	A	74	26	76 / 24 ave Avg: 75/25	MK
	B	80	20		MK
	C	88	12		MK
	D	80	20		MK
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By Qalpi Q Date Verified Nov. 28/05

Test: SC-Sperm Cell Fertilization test					Test ID: 0500396d		
Species: DE-Dendraster excentricus					Protocol: EPS1/RM/27-EC 92 (Sperm Cell)		
Sample ID: SW12					Sample Type: GW-groundwater		
Start Date: 9/20/2005 17:29			End Date: 9/20/2005		Lab ID: BCEVS-EVS Environment Consultants		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	87	13	
	2	2	D-Control	100	84	16	
	3	3	D-Control	100	86	14	
	4	4	D-Control	100	80	20	
	5	1	B-Control	100	75	25	
	6	2	B-Control	100	80	20	
	7	3	B-Control	100	88	12	
	8	4	B-Control	100	80	20	
	9	1	6.150	100	82	18	
	10	2	6.150	100	80	20	
	11	3	6.150	100	85	15	
	12	4	6.150	100	80	20	
	13	1	12.300	100	85	15	
	14	2	12.300	100	80	20	
	15	3	12.300	100	81	19	
	16	4	12.300	100	82	18	
	17	1	24.600	100	87	13	
	18	2	24.600	100	83	17	
	19	3	24.600	100	85	15	
	20	4	24.600	100	77	23	
	21	1	49.200	100	82	18	
	22	2	49.200	100	80	20	
	23	3	49.200	100	75	25	
	24	4	49.200	100	81	19	
	25	1	98.400	100	75	25	
	26	2	98.400	100	84	16	
	27	3	98.400	100	84	16	
	28	4	98.400	100	80	20	

Comments: Seacor Environmental Engineering 04-1424-076 (0500396)

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/20/2005 17:29	Test ID:	0500396d	Sample ID:	SW12
End Date:	9/20/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:	9/17/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076 (0500396)				

Conc-%	1	2	3	4
D-Control	0.8700	0.8400	0.8600	0.8000
B-Control	0.7500	0.8000	0.8800	0.8000
6.15	0.8200	0.8000	0.8500	0.8000
12.3	0.8500	0.8000	0.8100	0.8200
24.6	0.8700	0.8300	0.8500	0.7700
49.2	0.8200	0.8000	0.7500	0.8100
98.4	0.7500	0.8400	0.8400	0.8000

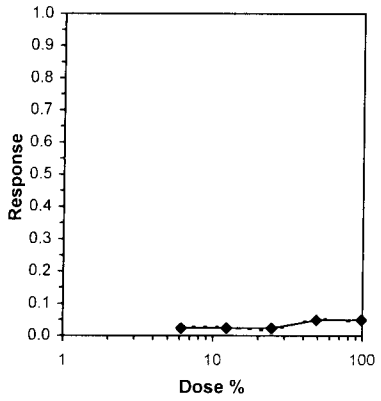
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8425	0.0310	0.8425	0.8000	0.8700	3.674	4				0.8425	1.0000
B-Control	0.8075	0.0538	0.8075	0.7500	0.8800	6.659	4					
6.15	0.8175	0.0236	0.8175	0.8000	0.8500	2.890	4	1.063	2.410	0.0567	0.8225	0.9763
12.3	0.8200	0.0216	0.8200	0.8000	0.8500	2.634	4	0.956	2.410	0.0567	0.8225	0.9763
24.6	0.8300	0.0432	0.8300	0.7700	0.8700	5.205	4	0.531	2.410	0.0567	0.8225	0.9763
49.2	0.7950	0.0311	0.7950	0.7500	0.8200	3.911	4	2.019	2.410	0.0567	0.8013	0.9510
98.4	0.8075	0.0427	0.8075	0.7500	0.8400	5.290	4	1.488	2.410	0.0567	0.8013	0.9510

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9263	0.884	-0.6452	-0.4556
Bartlett's Test indicates equal variances (p = 0.83)	2.13863	15.0863		
The control means are not significantly different (p = 0.30)	1.12815	2.44691		

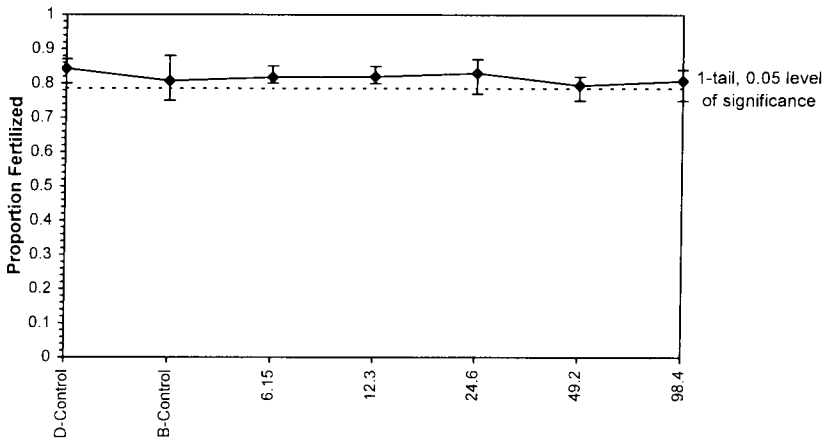
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	98.4	>98.4		1.01626	0.0567	0.0673	0.00111	0.00111	0.44542	5, 18

Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	>98.4			
IC10	>98.4			
IC15	>98.4			
IC20	>98.4			
IC25	>98.4			
IC40	>98.4			
IC50	>98.4			



Dose-Response Plot



Reviewed by:

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacor
Lab Project No. 04-1424-076
Lab Work Order No. 0500396

Lab Analysts JRY, SRS, MEL
Test Initiation Date 20 Sept 05

SAMPLE

Identification SDS Reflex
Amount ~~Received~~ Rec'd 1L
Date ~~Collected~~ Rec'd 05 Aug 05
Date Received —
Temperature (°C) —
pH —
Dissolved Oxygen (mg/L) —
Conductivity (µmhos/cm) —
Salinity (ppt) —
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

TEST SPECIES

Organism Dendraster excentricus
Source Westcoast Sea Lab
Date Received 20 Sept 05
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 20 Sept 05
IC50 (and 95% CL) 6.9 (5.1-8.1)
Reference Toxicant Warning Limits (mean ± 2SD) and CV
3.9 ± 3.8 mg/L SDS CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type 0.5 µm filtered, UV sterilized SW
Temperature (°C) 15.5
pH 7.8
Dissolved Oxygen (mg/L) 8.4
Salinity (ppt) 29
Other —

TEST CONDITIONS

Temperature Range (°C) 15.5
pH Range 7 8
Dissolved Oxygen Range (mg/L) 8.4
Salinity Range (ppt) 29
Sperm:Egg Ratio 2000:1
Test Duration 10:10
Other —

TEST RESULTS

IC25: 3.3 ± 0.4 mg/L SDS 95% CL: 1.8 - 4.0 mg/L SDS
IC50: 6.9 ± 0.5 mg/L SDS 95% CL: 5.1 - 8.1 mg/L SDS
20EC: 1.8 mg/L SDS
NOEC: 1.0 mg/L SDS

Data Verified By [signature]
Date Verified Nov. 28/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Sea Co:-
EVS Project No. 04-1424-076
EVS Work Order No. 0505396
Logbook Echinoid #13 Pages 77-80

Test Initiation Date/Time 20Sep05 / 1729
Test Species Dendraster excentricus
Source/Date Received Westwind Seafood / 20Sep05
Test Duration 10:10

Sample ID mg/L SDS	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SW Control	15.5	7.8	29	8.4	
1.0	15.5	7.8	29	8.4	
1.8	15.5	7.8	29	8.4	
3.2	15.5	7.8	29	8.4	
5.0	15.5	7.8	29	8.4	
10.0	15.5	7.8	29	8.4	
Technician Initials	am	am	am	am	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030301 Salinity II-A-030306 DO II-A-20

Sample Description

Data Verified By Qualified Date Verified Nov-24-05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNTS (CONTROLS)

Client Seacon
Lab Project No. 04-1424-076
Lab Work Order No. 05000396
Logbook Echinoid #13 Pages 77-80

Test Initiation Date/Time 20Sept05 1729
Test Species Dendraster excentricus
Test Duration ~~tweet~~ SRS 10:10
Sperm:Egg Ratio 2000:1

Concentration SDS (mg/L)	Replicate	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Tech. Initials
Reference Toxicant					
100	A	24	76		SRS
	B	22	78		"
	C	30	70		"
	D	37	63	35/65 in Avg: 36/64	"
5.6	A	41 ~~47~~ ~~34~~	59 ~~39~~ ~~49~~		SRS
	B	~~65~~ in jar	53		"
	C	57	42	not flipped	"
	D	49	51		"
3.2	A	57	43		"
	B	64	36		"
	C	65	35		"
	D	65	35		"
1.8	A	72	28		"
	B	61	39		"
	C	68	32		"
	D	74	26		"
1.0	A	77	23		"
	B	78	22		"
	C	80	20		"
	D	74	26		"
Control Seawater					
Control	A	50	20		"
	B	83	17		"
	C	87	13		"
	D	82	18		SRS

Data Verified By Qualified Date Verified Nov 24/05

Test: SC-Sperm Cell Fertilization test
Test ID: rtdesds54a
Species: DE-Dendraster excentricus
Protocol: EPS1/RM/27-EC 92 (Sperm Cell)
Sample ID: REF-Ref Toxicant
Sample Type: SDS-Sodium dodecyl sulfate
Start Date: 9/20/2005 17:29
End Date: 9/20/2005
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	80	20	
	2	2	D-Control	100	83	17	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	82	18	
	5	1	1.000	100	77	23	
	6	2	1.000	100	78	22	
	7	3	1.000	100	80	20	
	8	4	1.000	100	74	26	
	9	1	1.800	100	72	28	
	10	2	1.800	100	61	39	
	11	3	1.800	100	68	32	
	12	4	1.800	100	74	26	
	13	1	3.200	100	57	43	
	14	2	3.200	100	64	36	
	15	3	3.200	100	65	35	
	16	4	3.200	100	65	35	
	17	1	5.600	100	41	59	
	18	2	5.600	100	47	53	
	19	3	5.600	100	58	42	
	20	4	5.600	100	49	51	
	21	1	10.000	100	24	76	
	22	2	10.000	100	22	78	
	23	3	10.000	100	30	70	
	24	4	10.000	100	36	64	

Comments: Seacor Environmental Engineering 04-1424-076 (0500396)

Reviewed by: Nov 28/05

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/20/2005 17:29	Test ID:	rtdesds54a	Sample ID:	REF-Ref Toxicant
End Date:	9/20/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SDS-Sodium dodecyl sulfate
Sample Date:		Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076 (0500396)				

Conc-mg/L	1	2	3	4
D-Control	0.8000	0.8300	0.8700	0.8200
1	0.7700	0.7800	0.8000	0.7400
1.8	0.7200	0.6100	0.6800	0.7400
3.2	0.5700	0.6400	0.6500	0.6500
5.6	0.4100	0.4700	0.5800	0.4900
10	0.2400	0.2200	0.3000	0.3600

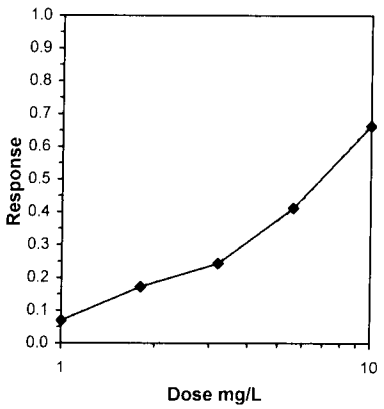
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8300	0.0294	0.8300	0.8000	0.8700	3.547	4				0.8300	1.0000
1	0.7725	0.0250	0.7725	0.7400	0.8000	3.236	4	1.614	2.410	0.0859	0.7725	0.9307
*1.8	0.6875	0.0574	0.6875	0.6100	0.7400	8.345	4	4.000	2.410	0.0859	0.6875	0.8283
*3.2	0.6275	0.0386	0.6275	0.5700	0.6500	6.155	4	5.684	2.410	0.0859	0.6275	0.7560
*5.6	0.4875	0.0704	0.4875	0.4100	0.5800	14.444	4	9.613	2.410	0.0859	0.4875	0.5873
*10	0.2800	0.0632	0.2800	0.2200	0.3600	22.588	4	15.437	2.410	0.0859	0.2800	0.3373

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.97638		0.884		0.07029	-0.1835
Bartlett's Test indicates equal variances (p = 0.51)					4.31507		15.0863			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	1	1.8	1.34164		0.08587	0.10345	0.16394	0.00254	7.3E-11	5, 18

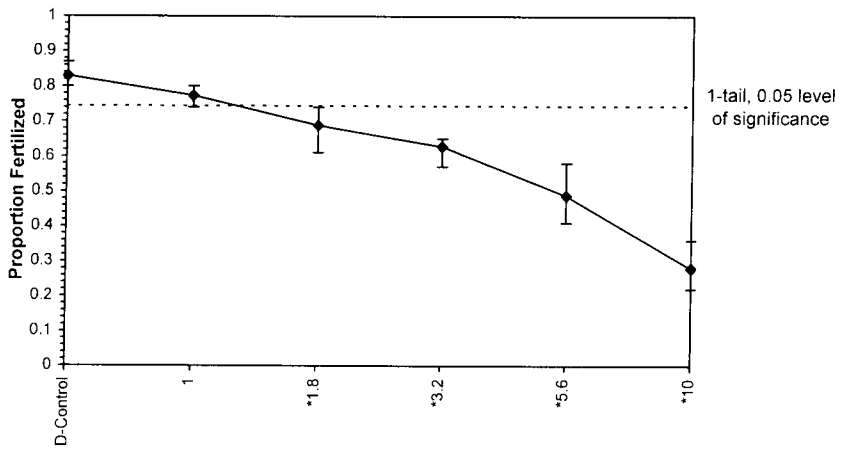
Log-Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew	
IC05*	0.6492	0.2258	0.2127	1.4020	0.5486	
IC10	1.2124	0.1874	0.7037	1.9316	0.4395	
IC15	1.6074	0.2672	1.0959	2.5503	0.5292	
IC20	2.2819	0.4438	1.1741	3.6630	-0.0835	
IC25	3.2683	0.3650	1.7689	3.9524	-1.6148	
IC40	5.3800	0.4803	4.0957	6.7672	0.0703	
IC50	6.8896	0.4891	5.1425	8.1210	-0.2089	mg/L SDS

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: Nov-28-05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental Engineering
EVS Project No.: 04-1424-076
EVS Work Order No.: 0500396

EVS Analysts: SRS, JAP, JRY, MFL
Test Initiation Date: 29 Sept 05 / 1759

SAMPLE

Identification: BH16
Amount Received: 1x20L
Date Collected: 17 Sept. 05
Date Received: 19 Sept 05
Temperature (°C): 16.0
pH: 6.8
Dissolved Oxygen (mg/L): 7.0
Conductivity (µmhos/cm): —
Salinity (ppt): 14ᵖ29
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —
0 Salinity adjusted

TEST SPECIES

Organism: Dendraster excentricus
Source: Westwind Sea Lab
Date Received: 29 Sept 05
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 29 Sept 05
IC50 (and 95% CL): 6.0 (5.1 - 6.8) mg/L
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.1 ± 4.0 mg/L CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type: Uvsterilized, 0.5µm filtered SW
Temperature (°C): 15
pH: 8.0
Dissolved Oxygen (mg/L): 8.2
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 - 16.0
pH Range: 6.8 - 8.0
Dissolved Oxygen Range (mg/L): 7.0 - 7.9
Salinity Range (ppt): 28 - 29
Sperm:Egg Ratio: 300:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC50: 0.5 (0.0 - 1.1) % v/v
IC25: 0.1 (0.1 - 0.1) % v/v
NOEC: 0.032 % v/v
LOEC: 0.1 % v/v

Data Verified By: C. McPherson
Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 05C0396
Logbook #13 Pages 80-82

Test Initiation Date/Time Sept 29/05 @ 1759
Test Species Dendraster excentricus
Source/Date Received Westwind Sealab (Sept 29/05)
Test Duration 10:10

Sample ID BH16 (1:(V/V))	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
0.001	16.0	8.0	28	~~9.9~~ 7.0	
0.0032	16.0	8.0	28	~~9.3~~ 7.4	
0.01	16.0	8.0	29	~~9.4~~ 7.4	
0.032	16.0	8.0	29	~~9.3~~ 7.5	
0.1	16.0	~~7.9~~ SAP 8.0	29	~~9.2~~ 7.9	
4.6	16.0	6.8	29	~~8.3~~ 7.0	
Technician Initials	JM	SAP	JAP	JM	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030301 Salinity II-A-080306 DO II-A-3

Sample Description clear colorless, turned yellow after salinity adjustment

Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Seacor
EVS Project No.: 04-424-076
EVS Work Order No.: 0500396
Logbook: #13 Pages: 80-82

Test Initiation Date/Time: Sept 29.05/17:59
Test Species: Dendraster excentricus
Source/Date Received: Westwind Seclab / Sept 29/05
Test Duration: 10:10
Sperm:Egg Ratio: SMX: 300:1

Sample ID BH16(0-4N)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
0.001	A	86	14		
	B	87	13		
	C	94	6		
	D	92	8		
0.0032	A	94	6		
	B	86	14		
	C	~~98~~ 92 EE defective	8		
	D	95	5		
0.01	A	85	15		
	B	91	9		
	C	90	10		
	D	91	9		
0.0032 SAP	A	90	10		
	B	88	12		
	C	85	15		
	D	87	13		
0.1	A	62	38		
	B	44	56		
	C	62	38		
	D	48	52		
4.6	A	17	83	Lots of Particulates	
	B	16	84		
	C	13	87		
	D	15	85		

Data Verified By: C. McPherson Nov 7/05
Date Verified:

Part cells counted

Eff Blank A 21/79
B 15/85
C 20/80
D 15/85

Test: SC-Sperm Cell Fertilization test
Species: DE-Dendraster excentricus
Sample ID: BH16
Start Date: 9/29/2005 17:59 End Date: 9/29/2005

Test ID: 0500396a
Protocol: EPS1/RM/27-EC 92 (Sperm Cell)
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	98	2	
	2	2	D-Control	100	91	9	
	3	3	D-Control	100	92	8	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	84	16	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	89	11	
	8	4	B-Control	100	100	0	
	9	1	0.001	100	86	14	
	10	2	0.001	100	87	13	
	11	3	0.001	100	94	6	
	12	4	0.001	100	92	8	
	13	1	0.003	100	94	6	
	14	2	0.003	100	86	14	
	15	3	0.003	100	92	8	
	16	4	0.003	100	95	5	
	17	1	0.010	100	85	15	
	18	2	0.010	100	91	9	
	19	3	0.010	100	90	10	
	20	4	0.010	100	91	9	
	21	1	0.032	100	90	10	
	22	2	0.032	100	88	12	
	23	3	0.032	100	85	15	
	24	4	0.032	100	87	13	
	25	1	0.100	100	62	38	
	26	2	0.100	100	44	56	
	27	3	0.100	100	62	38	
	28	4	0.100	100	48	52	
	29	1	4.600	100	17	83	
	30	2	4.600	100	16	84	
	31	3	4.600	100	13	87	
	32	4	4.600	100	15	85	

Comments: Seacor Environmental Engineering 04-1424-076(0500396)

Reviewed by: CAM Nov 9/05

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/29/2005 17:59	Test ID:	0500396a	Sample ID:	BH16
End Date:	9/29/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:	9/17/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076(0500396)				

Conc-%	1	2	3	4
D-Control	0.9800	0.9100	0.9200	0.8900
B-Control	0.8400	0.9200	0.8900	1.0000
0.001	0.8600	0.8700	0.9400	0.9200
0.0032	0.9400	0.8600	0.9200	0.9500
0.01	0.8500	0.9100	0.9000	0.9100
0.032	0.9000	0.8800	0.8500	0.8700
0.1	0.6200	0.4400	0.6200	0.4800
4.6	0.1700	0.1600	0.1300	0.1500

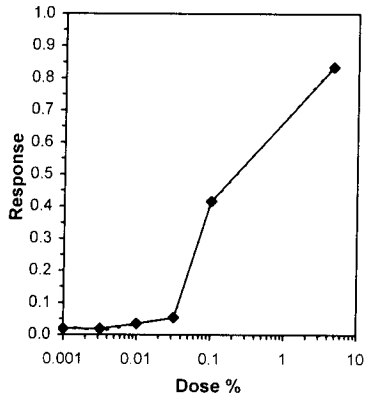
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9250	0.0387	0.9250	0.8900	0.9800	4.187	4				0.9250	1.0000
B-Control	0.9125	0.0670	0.9125	0.8400	1.0000	7.345	4					
0.001	0.8975	0.0386	0.8975	0.8600	0.9400	4.303	4	0.841	2.451	0.0802	0.9075	0.9811
0.0032	0.9175	0.0403	0.9175	0.8600	0.9500	4.394	4	0.229	2.451	0.0802	0.9075	0.9811
0.01	0.8925	0.0287	0.8925	0.8500	0.9100	3.218	4	0.994	2.451	0.0802	0.8925	0.9649
0.032	0.8750	0.0208	0.8750	0.8500	0.9000	2.379	4	1.529	2.451	0.0802	0.8750	0.9459
*0.1	0.5400	0.0938	0.5400	0.4400	0.6200	17.372	4	11.775	2.451	0.0802	0.5400	0.5838
*4.6	0.1525	0.0171	0.1525	0.1300	0.1700	11.199	4	23.627	2.451	0.0802	0.1525	0.1649

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98064	0.896	-0.1606	0.45907
Bartlett's Test indicates equal variances (p = 0.09)	10.9528	16.8119		
The control means are not significantly different (p = 0.76)	0.32297	2.44691		

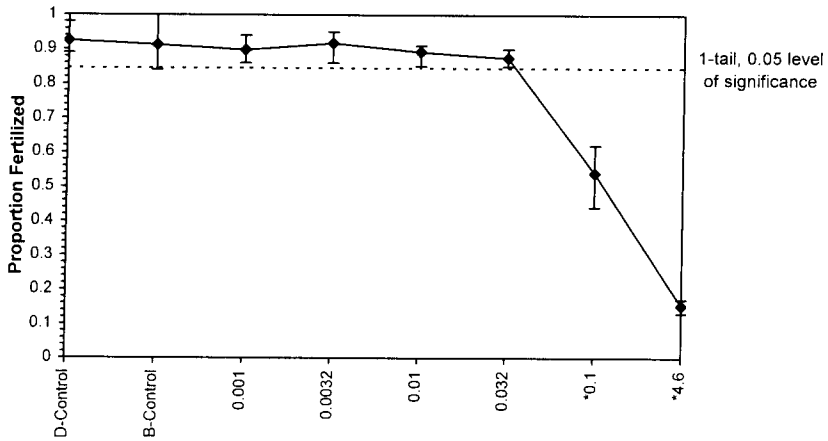
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.032	0.1	0.05657	3125	0.08015	0.08665	0.34475	0.00214	1.9E-16	6, 21

Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05	0.0272	0.0122	0.0000	0.0426	-0.6686	
IC10	0.0404	0.0046	0.0277	0.0493	-3.3553	
IC15	0.0496	0.0035	0.0384	0.0612	-0.4097	
IC20	0.0589	0.0040	0.0476	0.0725	0.0027	
IC25	0.0683	0.0048	0.0567	0.0857	0.2379	
IC40	0.0969	0.0785	0.0791	0.5480	1.4970	
IC50	0.5232	0.1911	0.0000	1.1099	-0.1559	%v/v



Dose-Response Plot



Reviewed by: CM 11/7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacor Environmental Engineering
EVS Project No. 09-1424-076
EVS Work Order No. 0500396

EVS Analysts SRS, JAP, JRX, MFL
Test Initiation Date 29 Sept 05 / 1759

SAMPLE

Identification BH20
Amount Received 1x20L
Date Collected 17 Sept. 05
Date Received 19 Sept 05
Temperature (°C) 16.0
pH 7.0
Dissolved Oxygen (mg/L) 6.9
Conductivity (µmhos/cm) —
Salinity (ppt) 53 ① 29
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

① Salinity Adjusted.

TEST SPECIES

Organism Dendraster excentricus
Source Westwind Sealab
Date Received 29 Sept 05
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 29 Sept 05
IC50 (and 95% CL) 6.0 (5.1 - 6.8) mg/L
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.1 ± 4.0 mg/L CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type Unsterilized, 0.5µm filtered SW
Temperature (°C) 15
pH 8.0
Dissolved Oxygen (mg/L) 8.2
Salinity (ppt) 28
Other —

TEST CONDITIONS

Temperature Range (°C) 15.0 - 16.0
pH Range 7.0 - 8.0
Dissolved Oxygen Range (mg/L) 6.9 - 7.5
Salinity Range (ppt) 28 - 29
Sperm:Egg Ratio 300:1
Test Duration 10:10
Other —

TEST RESULTS

IC50: 1.2 (1.0 - 1.4) % v/v
IC25: 0.3 (0.1 - 0.5) % v/v
NOEC: 0.001
LOEC: 0.0032

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-0076
EVS Work Order No. 0500396
Logbook # 13 Pages 80-82

Test Initiation Date/Time Sept 29/05 @ 1759
Test Species Dendraster excentricus
Source/Date Received Westwind sealab (sept 29/05)
Test Duration 10:10

Sample ID BH20(% (v/v))	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
0.001	16.0	8.0	28	~~5.4~~ 7.0	
0.0032	16.0	8.0	28	8.9 7.4	
0.01	16.0	8.0	28	9.0 7.5	
0.032	16.0	8.0	29	9.2 7.4	
0.1	16.0	8.0	29	9.1 7.1	
4.6	16.0	7.0	29	8.0 6.9	
Technician Initials	JM	SAP	SAP	JM	

WQ Instruments Used: Temp. Hg Thermometer (Calibrated) pH II-A-030301 Salinity II-A-030306 DO II-A-3
Sample Description Clear, colorless. After adding adjusted sample became yellow + turbid
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor
EVS Project No. 04-424-076
EVS Work Order No. 0500396
Logbook # 13 Pages 80-82

Test Initiation Date/Time Sept 29.05/17:59
Test Species Dendraster excentricus
Source/Date Received Weston Seeds / Sept. 29/05
Test Duration 10:10
Sperm:Egg Ratio SAM 300:1

Sample ID BH20 (8%VN)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
0.001	A	82	18		
	B	82	18		
	C	94	6		
	D	80	20		
0.0032	A	81	19		
	B	83	17		
	C	86	14		
	D	90	20		
0.01	A	83	17		
	B	91	9		
	C	90	10		
	D	83	17		
SAM 0.0032	A	79	21		
	B	69	31		
	C	75	25		
	D	84	16		
0.1	A	84	16		
	B	80	20		
	C	72	28		
	D	80	20		
4.6	A	2	98	Lots of particulates	
	B	7	93		
	C	1	99		
	D	3	97		

Data Verified By C. McPherson Nov 9/05
Date Verified Particulates as well

BLANK EGG A 2198
B 3194
C 01100
D 2198

Test: SC-Sperm Cell Fertilization test | Test ID: 0500396b
Species: DE-Dendraster excentricus | Protocol: EPS1/RM/27-EC 92 (Sperm Cell)
Sample ID: BH20 | Sample Type: GW-groundwater
Start Date: 9/29/2005 17:59 | End Date: 9/29/2005 | Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	98	2	
	2	2	D-Control	100	91	9	
	3	3	D-Control	100	92	8	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	84	16	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	89	11	
	8	4	B-Control	100	100	0	
	9	1	0.001	100	82	18	
	10	2	0.001	100	82	18	
	11	3	0.001	100	94	6	
	12	4	0.001	100	80	20	
	13	1	0.003	100	81	19	
	14	2	0.003	100	83	17	
	15	3	0.003	100	86	14	
	16	4	0.003	110	90	20	
	17	1	0.010	100	83	17	
	18	2	0.010	100	91	9	
	19	3	0.010	100	90	10	
	20	4	0.010	100	83	17	
	21	1	0.032	100	79	21	
	22	2	0.032	100	69	31	
	23	3	0.032	100	75	25	
	24	4	0.032	100	84	16	
	25	1	0.100	100	84	16	
	26	2	0.100	100	80	20	
	27	3	0.100	100	72	28	
	28	4	0.100	100	80	20	
	29	1	4.600	100	2	98	
	30	2	4.600	100	7	93	
	31	3	4.600	100	1	99	
	32	4	4.600	100	3	97	

Comments: Seacor Environmental Engineering 04-1424-076(0500396)

Reviewed by: 9/05

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/29/2005 17:59	Test ID:	0500396b	Sample ID:	BH20
End Date:	9/29/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:	9/17/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076(0500396)				

Conc-%	1	2	3	4
D-Control	0.9800	0.9100	0.9200	0.8900
B-Control	0.8400	0.9200	0.8900	1.0000
0.001	0.8200	0.8200	0.9400	0.8000
0.0032	0.8100	0.8300	0.8600	0.8182
0.01	0.8300	0.9100	0.9000	0.8300
0.032	0.7900	0.6900	0.7500	0.8400
0.1	0.8400	0.8000	0.7200	0.8000
4.6	0.0200	0.0700	0.0100	0.0300

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9250	0.0387	0.9250	0.8900	0.9800	4.187	4				0.9250	1.0000
B-Control	0.9125	0.0670	0.9125	0.8400	1.0000	7.345	4					
0.001	0.8450	0.0640	0.8450	0.8000	0.9400	7.578	4	2.426	2.451	0.0808	0.8473	0.9160
*0.0032	0.8295	0.0219	0.8295	0.8100	0.8600	2.640	4	2.895	2.451	0.0808	0.8473	0.9160
0.01	0.8675	0.0435	0.8675	0.8300	0.9100	5.014	4	1.744	2.451	0.0808	0.8473	0.9160
*0.032	0.7675	0.0634	0.7675	0.6900	0.8400	8.266	4	4.777	2.451	0.0808	0.7788	0.8419
*0.1	0.7900	0.0503	0.7900	0.7200	0.8400	6.371	4	4.094	2.451	0.0808	0.7788	0.8419
*4.6	0.0325	0.0263	0.0325	0.0100	0.0700	80.922	4	27.067	2.451	0.0808	0.0325	0.0351

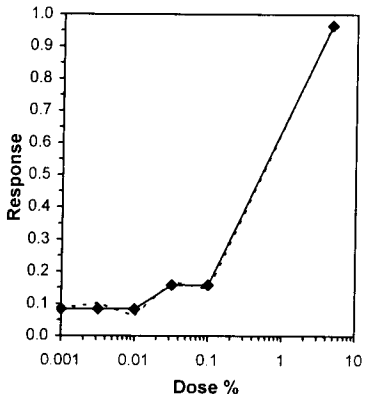
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97736	0.896	0.35838	-0.0812
Bartlett's Test indicates equal variances (p = 0.58)	4.69823	16.8119		
The control means are not significantly different (p = 0.76)	0.32297	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.001	0.0032	0.00179	100000	0.08083	0.08739	0.38078	0.00217	8.1E-17	6, 21

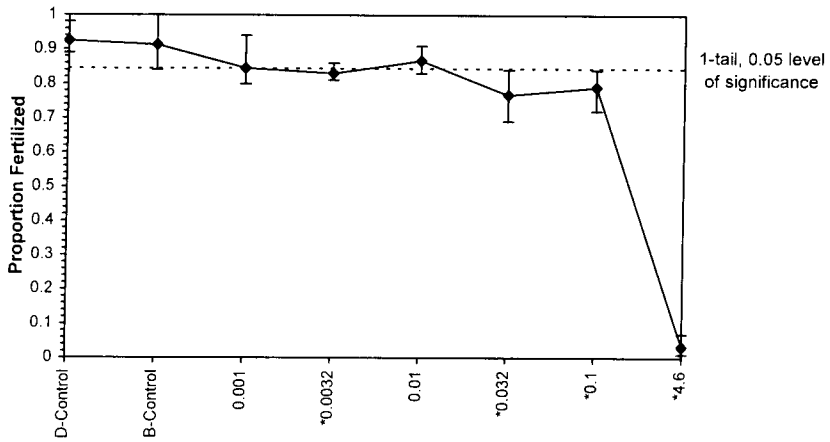
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05*	0.0006	0.0012	0.0003	0.0037	7.5175	
IC10	0.0147	0.0118	0.0000	0.0358	3.7671	
IC15	0.0296	0.0541	0.0122	0.2803	0.7636	
IC20	0.1970	0.0594	0.0000	0.3731	-0.3795	
IC25	0.3240	0.0596	0.1428	0.5061	-0.2030	
IC40	0.7919	0.0667	0.5853	1.0003	-0.2766	
IC50	1.1924	0.0715	0.9630	1.4195	-0.3113	%v/v

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: CdM 10/9/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental Engineering
EVS Project No.: 09-1424-076
EVS Work Order No.: 0500396

EVS Analysts: SRS, JAP, JRY, MEL
Test Initiation Date: 29 Sept 05 / 1759

SAMPLE

Identification: SW9
Amount Received: 1x20L
Date Collected: 17 Sept. 05
Date Received: 19 Sept 05
Temperature (°C): 16.0
pH: 7.8
Dissolved Oxygen (mg/L): 7.0
Conductivity (µmhos/cm): —
Salinity (ppt): 21①28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

① Salinity Adjusted

TEST SPECIES

Organism: Dendraster excentricus
Source: Westwind SeaLab
Date Received: 29 Sept 05
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 29 Sept 05
IC50 (and 95% CL): 6.0 (5.1 - 6.8) mg/L
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.1 ± 4.0 mg/L CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type: Unfiltered, 0.5µm filtered SW
Temperature (°C): 15
pH: 8.0
Dissolved Oxygen (mg/L): 8.2
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 - 16.0
pH Range: 7.8 - 8.0
Dissolved Oxygen Range (mg/L): 7.0 - 7.5
Salinity Range (ppt): 28 - 29
Sperm:Egg Ratio: 300:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC50: > 6 % v/v
IC25: 3.4 (2.2 - 5.0) % v/v
NOEC: < 0.01
LOEC: 0.01

Data Verified By: C. McPherson
Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500356
Logbook #13 Pages 80-82

Test Initiation Date/Time Sept 29/05 @ 1759
Test Species D. excentricus
Source/Date Received Westwind Seclab (Sept 29/05)
Test Duration 10:10

Sample ID SW9 %(v/v)	Temperature (°C)	pH	Salinity (ppt)	Dissolved ① Oxygen (mg/L)	Comments
0.01	16.0	8.0	28	~~8~~ 7.0	
0.032	16.0	8.0	28	~~8~~ 7.1	
0.1	16.0	8.0	28	~~8~~ 7.1	
0.32	16.0	8.0	28	~~8~~ 7.3	
1	16.0	8.0	29	~~8~~ 7.5	
6	16.0	7.8	28	~~8~~ 7.0	
Technician Initials	JM	SAP	SAP	JM	

① DO removed via salinity adjustment to water

WQ Instruments Used: Temp: Calibrated Hg Thermometer pH II-A-030301 Salinity II A030306 DO II-A-3

Sample Description Yellow, turbid + deposits

Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor
EVS Project No. 04-424-076
EVS Work Order No. 0500396
Logbook # 13 Pages 80-82

Test Initiation Date/Time Sept 29, 05/17:59
Test Species Dendraster excentricus
Source/Date Received Westward Seafood / Sept. 29/05
Test Duration 10:10
Sperm:Egg Ratio 5mX: 300:1

Sample ID SW9	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
0.01	A	83	17		
	B	77	23	Est.	
	C	86	14		
	D	90	10		
0.032	A	89	11		
	B	88	12		
	C	86	14		
	D	87	13		
0.1	A	85	15		
	B	81	19		
	C	91	9		
	D	93	7		
0.32	A	91	9		
	B	82	18		
	C	86	14		
	D	93	7		
1.0	A	92	8		
	B	89	11		
	C	92	8		
	D	87	13		
6.0	A	56	44	Some Particulates	
	B	68	32		
	C	57	43		
	D	53	47		

Data Verified By C. McPherson Nov 7/05 Date Verified 4/5 Some Particulates.

Eff6 Blanks A 5/95
B 5/95
C 3/97
D 2/98

Test: SC-Sperm Cell Fertilization test | Test ID: 0500396c
Species: DE-Dendraster excentricus | Protocol: EPS1/RM/27-EC 92 (Sperm Cell)
Sample ID: SW9 | Sample Type: GW-groundwater
Start Date: 9/29/2005 17:59 | End Date: 9/29/2005 | Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	98	2	
	2	2	D-Control	100	91	9	
	3	3	D-Control	100	92	8	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	84	16	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	89	11	
	8	4	B-Control	100	100	0	
	9	1	0.010	100	83	17	
	10	2	0.010	100	77	23	
	11	3	0.010	100	86	14	
	12	4	0.010	100	90	10	
	13	1	0.032	100	89	11	
	14	2	0.032	100	88	12	
	15	3	0.032	100	86	14	
	16	4	0.032	100	87	13	
	17	1	0.100	100	85	15	
	18	2	0.100	100	81	19	
	19	3	0.100	100	91	9	
	20	4	0.100	100	93	7	
	21	1	0.320	100	91	9	
	22	2	0.320	100	82	18	
	23	3	0.320	100	86	14	
	24	4	0.320	100	93	7	
	25	1	1.000	100	92	8	
	26	2	1.000	100	89	11	
	27	3	1.000	100	92	8	
	28	4	1.000	100	87	13	
	29	1	6.000	100	56	44	
	30	2	6.000	100	68	32	
	31	3	6.000	100	57	43	
	32	4	6.000	100	53	47	

Comments: Seacor Environmental Engineering 04-1424-076(0500396)

Reviewed by: Nov 9/05

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/29/2005 17:59	Test ID:	0500396c	Sample ID:	SW9
End Date:	9/29/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:	9/17/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076(0500396)				

Conc-%	1	2	3	4
D-Control	0.9800	0.9100	0.9200	0.8900
B-Control	0.8400	0.9200	0.8900	1.0000
0.01	0.8300	0.7700	0.8600	0.9000
0.032	0.8900	0.8800	0.8600	0.8700
0.1	0.8500	0.8100	0.9100	0.9300
0.32	0.9100	0.8200	0.8600	0.9300
1	0.9200	0.8900	0.9200	0.8700
6	0.5600	0.6800	0.5700	0.5300

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9250	0.0387	0.9250	0.8900	0.9800	4.187	4				0.9250	1.0000
B-Control	0.9125	0.0670	0.9125	0.8400	1.0000	7.345	4					
*0.01	0.8400	0.0548	0.8400	0.7700	0.9000	6.521	4	2.591	2.451	0.0804	0.8740	0.9449
0.032	0.8750	0.0129	0.8750	0.8600	0.8900	1.475	4	1.524	2.451	0.0804	0.8740	0.9449
0.1	0.8750	0.0551	0.8750	0.8100	0.9300	6.294	4	1.524	2.451	0.0804	0.8740	0.9449
0.32	0.8800	0.0497	0.8800	0.8200	0.9300	5.644	4	1.372	2.451	0.0804	0.8740	0.9449
1	0.9000	0.0245	0.9000	0.8700	0.9200	2.722	4	0.762	2.451	0.0804	0.8740	0.9449
*6	0.5850	0.0656	0.5850	0.5300	0.6800	11.209	4	10.364	2.451	0.0804	0.5850	0.6324

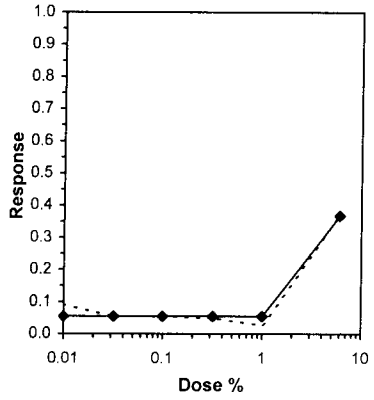
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97285	0.896	0.29523	-0.241
Bartlett's Test indicates equal variances (p = 0.31)	7.16972	16.8119		
The control means are not significantly different (p = 0.76)	0.32297	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<0.01	0.01			0.08042	0.08694	0.05327	0.00215	1.7E-08	6, 21

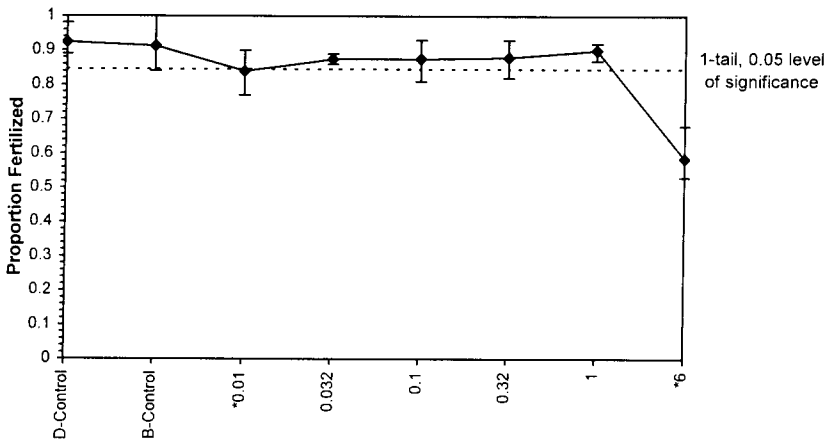
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05*	0.0091	0.5463	0.0034	1.9598	0.4129	
IC10	1.3942	0.2376	0.8370	1.9654	-2.2251	
IC15	1.9257	0.2337	1.2403	2.7380	0.3259	
IC20	2.5752	0.3201	1.6753	3.6984	0.6556	
IC25	3.3688	0.4583	2.1922	5.0123	0.9880	
IC40	>6					
IC50	>6					%v/v

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: CdM Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacor Environmental Engineering
EVS Project No. 09-1424-076
EVS Work Order No. 0500396

EVS Analysts SRS, JAP, JRX, MEL
Test Initiation Date 29 Sept 05 / 1759

SAMPLE

Identification SLW11
Amount Received 1x 20L
Date Collected 17 Sept. 05
Date Received 19 Sept 05
Temperature (°C) 16.0
pH 7.4
Dissolved Oxygen (mg/L) 7.0
Conductivity (µmhos/cm) —
Salinity (ppt) 26 ① 29
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

① Salinity adjusted

TEST SPECIES

Organism Dendraster excentricus
Source Westwind Sealab
Date Received 29 Sept 05
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 29 Sept 05
IC50 (and 95% CL) 6.0 (5.1 - 6.8) mg/L
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.1 ± 4.0 mg/L CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type Unsterilized, 0.5µm filtered SLW
Temperature (°C) 15
pH 8.0
Dissolved Oxygen (mg/L) 8.2
Salinity (ppt) 28
Other —

TEST CONDITIONS

Temperature Range (°C) 15.0 - 16.0
pH Range 7.4 — 8.0
Dissolved Oxygen Range (mg/L)
Salinity Range (ppt) 28 - 29
Sperm:Egg Ratio 300:1
Test Duration 10:10
Other —

TEST RESULTS

IC50: 2.2 (1.6 - 2.9) % v/v
IC25: 0.8 (0.5 - 1.2) % v/v
NOEC: <0.01 % v/v
LOEC: 0.01 % v/v

Data Verified By _____ Date Verified _____

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500396
Logbook #13 Pages 80-82

Test Initiation Date/Time Sept 29/05 @ 1759
Test Species D. excentricus
Source/Date Received Westwind Sealab (Sept 29/05)
Test Duration 10:10

Sample ID SW11 %(v/v)	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
0.01	16.0	8.0	28	~~8.5~~ 7.0	
0.032	16.0	8.0	28	~~7.0~~ 7.3	
0.1	16.0	8.0	29	~~7.1~~ 7.2	
0.32	16.0	8.0	29	~~7.1~~ 7.2	
1	16.0	7.9	29	~~8.5~~ 7.0	
6	16.0	7.4	29	~~8.7~~ 7.0	
Technician Initials	JM	JAP	JAP	JM	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-03030 Salinity II-A-03006 DO II-A-3
Sample Description Clear Colourless
Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor
EVS Project No. 04-424-076
EVS Work Order No. 0500396
Logbook # 13 Pages 80-82

Test Initiation Date/Time Sept 29 05/17:59
Test Species Dendraster excentricus
Source/Date Received Westward Seafab / Sept 29 05
Test Duration 10:10
Sperm:Egg Ratio SMX: 300:1

Sample ID SW11 (SMN)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
0.01	A	58	42		SAP
	B	~~78~~ 72 SAP	~~8~~ 28 SAP		
	C	~~72~~ 26 SAP	~~28~~ SAP	73 / 19	
	D	26	24		
0.032	A	93	7		
	B	95	5		
	C	92	8		
	D	90	10		
0.1	A	90	10	84 / 16	
	B	74	26	75 / 25	
	C	86	14		
	D	88	12		
0.32	A	73	27	76 / 24	
	B	89	11	89 / 11	
	C	85	15		
	D	89	11		
1.0	A	56	44	64 / 36	
	B	64	36		
	C	63	37		
	D	74	26	71 / 29	
6.0	A	10	90		
	B	16	84		
	C	24	76		
	D	20	80		

Data Verified By C. McPherson Date Verified Nov 7/05

EF BLANK A 0/100
B 1/99
C 0/100
D 0/100

Test: SC-Sperm Cell Fertilization test | Test ID: 0500396
Species: DE-Dendraster excentricus | Protocol: EPS1/RM/27-EC 92 (Sperm Cell)
Sample ID: SW11 | Sample Type: GW-groundwater
Start Date: 9/29/2005 17:59 | End Date: 9/29/2005 | Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	98	2	
	2	2	D-Control	100	91	9	
	3	3	D-Control	100	92	8	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	84	16	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	89	11	
	8	4	B-Control	100	100	0	
	9	1	0.010	100	58	42	
	10	2	0.010	100	72	28	
	11	3	0.010	100	73	19	
	12	4	0.010	100	76	24	
	13	1	0.032	100	93	7	
	14	2	0.032	100	95	5	
	15	3	0.032	100	92	8	
	16	4	0.032	100	90	10	
	17	1	0.100	100	90	10	
	18	2	0.100	100	74	26	
	19	3	0.100	100	86	14	
	20	4	0.100	100	88	12	
	21	1	0.320	100	73	27	
	22	2	0.320	100	89	11	
	23	3	0.320	100	85	15	
	24	4	0.320	100	89	11	
	25	1	1.000	100	56	44	
	26	2	1.000	100	64	36	
	27	3	1.000	100	63	37	
	28	4	1.000	100	74	26	
	29	1	6.000	100	10	90	
	30	2	6.000	100	16	84	
	31	3	6.000	100	24	76	
	32	4	6.000	100	20	80	

Comments: Seacor Environmental Engineering 04-1424-076(0500396)

Reviewed by: CAM Nov 9/04

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/29/2005 17:59	Test ID:	500396	Sample ID:	SW11
End Date:	9/29/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:	9/17/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076(0500396)				

Conc-%	1	2	3	4
D-Control	0.9800	0.9100	0.9200	0.8900
B-Control	0.8400	0.9200	0.8900	1.0000
0.01	0.5800	0.7200	0.7300	0.7600
0.032	0.9300	0.9500	0.9200	0.9000
0.1	0.9000	0.7400	0.8600	0.8800
0.32	0.7300	0.8900	0.8500	0.8900
1	0.5600	0.6400	0.6300	0.7400
6	0.1000	0.1600	0.2400	0.2000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9250	0.0387	0.9250	0.8900	0.9800	4.187	4				0.9250	1.0000
B-Control	0.9125	0.0670	0.9125	0.8400	1.0000	7.345	4					
*0.01	0.6975	0.0802	0.6975	0.5800	0.7600	11.492	4	5.059	2.451	0.1102	0.8269	0.8939
0.032	0.9250	0.0208	0.9250	0.9000	0.9500	2.250	4	0.000	2.451	0.1102	0.8269	0.8939
0.1	0.8450	0.0719	0.8450	0.7400	0.9000	8.506	4	1.779	2.451	0.1102	0.8269	0.8939
0.32	0.8400	0.0757	0.8400	0.7300	0.8900	9.014	4	1.890	2.451	0.1102	0.8269	0.8939
*1	0.6425	0.0741	0.6425	0.5600	0.7400	11.534	4	6.281	2.451	0.1102	0.6425	0.6946
*6	0.1750	0.0597	0.1750	0.1000	0.2400	34.127	4	16.676	2.451	0.1102	0.1750	0.1892

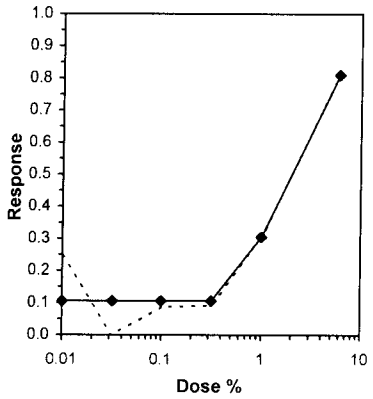
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93497	0.896	-0.6801	-0.109
Bartlett's Test indicates equal variances (p = 0.51)	5.29727	16.8119		
The control means are not significantly different (p = 0.76)	0.32297	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<0.01	0.01			0.11025	0.11919	0.2784	0.00405	1.0E-12	6, 21

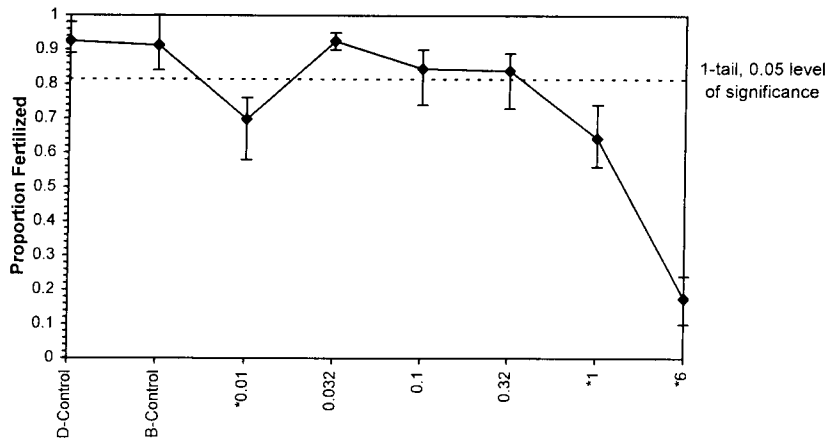
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05*	0.0047	0.0236	0.0027	0.0089	14.1013	
IC10*	0.0094	0.1663	0.0054	0.6373	0.2316	
IC15	0.4466	0.1024	0.0009	0.6751	-1.7978	
IC20	0.6055	0.1044	0.2351	0.9424	0.3410	
IC25	0.7818	0.1281	0.4836	1.2320	0.7332	
IC40	1.5285	0.1953	0.9033	2.1144	0.0105	
IC50	2.2397	0.2077	1.5861	2.9079	-0.0503	%v/v

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: 11/7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0SD02396
Logbook #13 Pages 80-82

Test Initiation Date/Time Sept 29/05 @ 1754
Test Species D. excentricus
Source/Date Received Westwind Sealab (Sept 29/05)
Test Duration 10:10

Sample ID	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
Seawater control	15.0	8.0	28	8.2	
Brine control	15.0	8.3	28	7.4	
Technician Initials	am	am	am	am	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030301 Salinity II-A-038806 DO II-A-3

Sample Description

Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor
EVS Project No. 04-424-076
EVS Work Order No. 0500396
Logbook # 13 Pages 80-82

Test Initiation Date/Time Sept 29, 05 / 17:59
Test Species Dendraster excentricus
Source/Date Received Weshwind Seedlab / Sept 29/05
Test Duration 10'10
Sperm:Egg Ratio SAP 1:300:1

Sample ID	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
BRINE Control	A	84	16		SRS
	B	92	8		↓
	C	SAP ~~97~~ 89	SAP ~~3~~ 11		SAP
	D	100	0		↓
SW Control	A	98	2		JAP
	B	91	9		SRS
	SRS ~~D~~	92	8		↓
	SRS ~~D~~ C	89	11		
Egg Blank	A	SAP ~~99~~ 1	X SAP 99		SAP
	B	0	100		↓
	C	0	100		
	D	0	100		↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacor Environmental Engineering
EVS Project No. 04-1424-076
EVS Work Order No. 0500396

EVS Analysts SRS, SAP, JRX, MFL
Test Initiation Date 29 Sept 05 / 1759

SAMPLE

Identification SDS Reflox Soln # 05-SDS-11
Amount ~~Received~~ Prep'd 1L
Date ~~Collected~~ Prep'd 08 Sept 05
Date Received —
Temperature (°C) —
pH —
Dissolved Oxygen (mg/L) —
Conductivity (µmhos/cm) —
Salinity (ppt) —
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

TEST SPECIES

Organism Dendraster excentricus
Source Westwind Sealab
Date Received 29 Sept 05
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 29 Sept 05
IC50 (and 95% CL) 6.0 (5.1 - 6.8) mg/L
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.1 ± 4.0 mg/L CV = 49%

DILUTION/CONTROL WATER (initial water quality)

Water Type UV sterilized; 0.5 µm filtered SW
Temperature (°C) 15
pH 8.0
Dissolved Oxygen (mg/L) 8.2
Salinity (ppt) 28
Other —

TEST CONDITIONS

Temperature Range (°C) 15.0
pH Range 8.0
Dissolved Oxygen Range (mg/L) 8.2
Salinity Range (ppt) 28
Sperm:Egg Ratio 300:1
Test Duration 10:10
Other —

TEST RESULTS

IC50: 6.0 (5.1 - 6.8) mg/L SDS
IC25: 4.2 (3.0 - 5.1) mg/L SDS
NOEC: 3.2 mg/L SDS
LOEC: 5.6 mg/L SDS

Data Verified By C. McPherson
Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500396
Logbook # 13 Pages 80-82

Test Initiation Date/Time Sept 29, 2005 @ 1759
Test Species Dendraster excentricus
Source/Date Received Westwind Scalab (Sept 29/05)
Test Duration 10:10

Sample ID SDS (mg/L)	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
Control	15.0	8.0	28	8.2	
1.0	15.0	8.0	28	8.2	
1.8	15.0	8.0	28	8.2	
3.2	15.0	8.0	28	8.2	
5.6	15.0	8.0	28	8.2	
10.0	15.0	8.0	28	8.2	
Technician Initials	AM	AM	SAP	AM	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030301 Salinity II-A-030306 DO II-A-3

Sample Description

Data Verified By C. McPherson Date Verified Mon 7/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNTS (CONTROLS)

Client: Seacar
Lab Project No.: 04-1424-076
Lab Work Order No.: 0500396
Logbook: #13 Pages: 80-82
Test Initiation Date/Time: Sept 29, 05
Test Species: D. excentricus
Test Duration: Sept 29 10:10
Sperm:Egg Ratio: 300:1

Concentration SDS (mg/L)	Replicate	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Tech. Initials
Reference Toxicant					
1.0	A	94	6		(SRS)
	B	93	7		↓
	C	87	13		↓
	D	95	5		↓
1.8	A	87	13		JAP
	B	85	15		↓
	C	94	6		↓
	D	71	29		↓
3.2	A	95	5		(SRS)
	B	65	35		JAP
	C	79	21		↓
	D	91	9		↓
5.6	A	52	46		JAP
	B	43	57		↓
	C	46	54		↓
	D	67	33		↓
10.0	A	0	100		JAP
	B	2	98		↓
	C	3	97		↓
	D	0	100		↓
Control Seawater	SDS Control				
SDS control	A	82	18		JAP
	B	88 JAP	12 JAP		↓
	C	94	6		SRS
	D	95	5		↓

Data Verified By: C. McPherson
Date Verified: Nov 7/05

Test: SC-Sperm Cell Fertilization test					Test ID: rtdesds054		
Species: DE-Dendraster excentricus					Protocol: EPS1/RM/27-EC 92 (Sperm Cell)		
Sample ID: REF-Ref Toxicant					Sample Type: SDS-Sodium dodecyl sulfate		
Start Date: 9/29/2005 17:59			End Date: 9/29/2005		Lab ID: BCEVS-EVS Environment Consultants		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	88	12	
	3	3	D-Control	100	94	6	
	4	4	D-Control	100	95	5	
	5	1	1.000	100	94	6	
	6	2	1.000	100	93	7	
	7	3	1.000	100	87	13	
	8	4	1.000	100	95	5	
	9	1	1.800	100	87	13	
	10	2	1.800	100	85	15	
	11	3	1.800	100	94	6	
	12	4	1.800	100	71	29	
	13	1	3.200	100	95	5	
	14	2	3.200	100	65	35	
	15	3	3.200	100	79	21	
	16	4	3.200	100	91	9	
	17	1	5.600	100	52	46	
	18	2	5.600	100	43	57	
	19	3	5.600	100	46	54	
	20	4	5.600	100	67	33	
	21	1	10.000	100	0	100	
	22	2	10.000	100	2	98	
	23	3	10.000	100	3	97	
	24	4	10.000	100	0	100	

Comments: Seacor Environmental Engineering 04-1424-076 (0500396)

Reviewed by: CAM Nov 7/05

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	9/29/2005 17:59	Test ID:	rtdesds054	Sample ID:	REF-Ref Toxicant
End Date:	9/29/2005	Lab ID:	BCEVS-EVS Environment C(	Sample Type:	SDS-Sodium dodecyl sulfate
Sample Date:		Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	DE-Dendraster excentricus
Comments:	Seacor Environmental Engineering 04-1424-076 (0500396)				

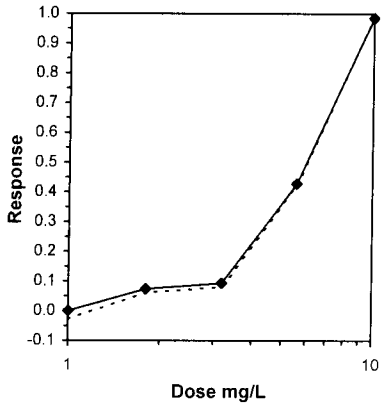
Conc-mg/L	1	2	3	4
D-Control	0.8200	0.8800	0.9400	0.9500
1	0.9400	0.9300	0.8700	0.9500
1.8	0.8700	0.8500	0.9400	0.7100
3.2	0.9500	0.6500	0.7900	0.9100
5.6	0.5200	0.4300	0.4600	0.6700
10	0.0000	0.0200	0.0300	0.0000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8975	0.0602	0.8975	0.8200	0.9500	6.708	4				0.9100	1.0000
1	0.9225	0.0359	0.9225	0.8700	0.9500	3.896	4	-0.413	2.410	0.1460	0.9100	1.0000
1.8	0.8425	0.0964	0.8425	0.7100	0.9400	11.441	4	0.908	2.410	0.1460	0.8425	0.9258
3.2	0.8250	0.1350	0.8250	0.6500	0.9500	16.367	4	1.196	2.410	0.1460	0.8250	0.9066
*5.6	0.5200	0.1068	0.5200	0.4300	0.6700	20.533	4	6.229	2.410	0.1460	0.5200	0.5714
*10	0.0125	0.0150	0.0125	0.0000	0.0300	120.000	4	14.604	2.410	0.1460	0.0125	0.0137

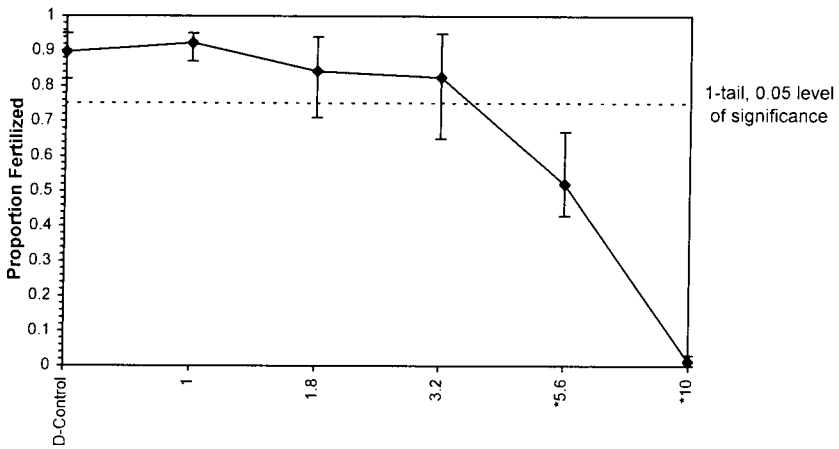
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.97843		0.884		-0.2339	0.45347
Bartlett's Test indicates equal variances (p = 0.04)					11.5406		15.0863			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	3.2	5.6	4.2332		0.14604	0.16272	0.49928	0.00734	4.7E-11	5, 18

Log-Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew	
IC05	1.5092	0.7509	0.9535	4.5307	0.8999	
IC10	3.2375	0.7309	0.4498	3.9131	-0.5278	
IC15	3.5331	0.5090	1.1648	4.2776	-1.4482	
IC20	3.8493	0.3464	2.3877	4.6258	-0.7975	
IC25	4.1875	0.3373	3.0173	5.0725	-0.1099	
IC40	5.3505	0.3714	4.2854	6.3250	0.0380	
IC50	6.0463	0.3031	5.0642	6.8157	-0.1207	mg/L



Dose-Response Plot



Reviewed by: CdM 11/7/05

APPENDIX II

Raw Data and Statistical Analyses: 7-d *Atherinops affinis* Survival and Growth Toxicity Test

Summary of Results for the 7-d Topsmelt Survival and Growth Toxicity Test

Client	Seacor Environment Engineering	**Species**	*Atherinops affinis*
Project No.	04-1424-076	**Initiation Date**	20-Sep-05
WO No.	0500395		

Sample ID:	**BH 16**							
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.07	±	0.11	
5.0	0.0	±	0.0	*	0.00	±	0.00	*
10.0	0.0	±	0.0	*	0.00	±	0.00	*
20.0	0.0	±	0.0	*	0.00	±	0.00	*
41.0	0.0	±	0.0	*	0.00	±	0.00	*
81.6	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	<5.0				<5.0			
LOEC	5.0				5.0			
LC50 (95% CL)[2]	<5.0				NA			
IC25 (95% CL)[2]	NA				<5.0			
IC50 (95% CL)[2]	NA				<5.0			

Sample ID:	**BH 20**							
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.01	±	0.18	
Brine-control[3]	88.0	±	11.0		0.91	±	0.22	
4.5	0.0	±	0.0	*	0.00	±	0.00	*
9.0	0.0	±	0.0	*	0.00	±	0.00	*
18.0	0.0	±	0.0	*	0.00	±	0.00	*
36.0	0.0	±	0.0	*	0.00	±	0.00	*
72.5	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	<4.5				<4.5			
LOEC	4.5				4.5			
LC50 (95% CL)[2]	<4.5				NA			
IC25 (95% CL)[2]	NA				<4.5			
IC50 (95% CL)[2]	NA				<4.5			

Sample ID:	**SW 9**							
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**				**Growth (mg) Mean ± SD[1]**			
D-control	96.0	±	8.9		1.02	±	0.17	
5.5	56.0	±	16.7	*	0.55	±	0.24	*
11.1	24.0	±	26.1	*	0.21	±	0.22	*
22.0	0.0	±	0.0	*	0.00	±	0.00	*
44.0	0.0	±	0.0	*	0.00	±	0.00	*
88.5	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	<5.5				<5.5			
LOEC	5.5				5.5			
EC50 (95% CL)[2]	6.6 (4.6 - 8.2)				NA			
IC25 (95% CL)[2]	NA				<5.5			
IC50 (95% CL)[2]	NA				6.1 (3.8 - 8.9)			

CAM Nov 9/05

Sample ID:	SW 11							
Concentration (%v/v)	Survival (%) Mean ± SD[1]				Growth (mg) Mean ± SD[1]			
D-control	92.0	±	11.0		0.99	±	0.23	
6.0	60.0	±	24.5	*	0.60	±	0.24	*
12.0	0.0	±	0.0	*	0.00	±	0.00	*
24.0	0.0	±	0.0	*	0.00	±	0.00	*
47.0	0.0	±	0.0	*	0.00	±	0.00	*
94.0	0.0	±	0.0	*	0.00	±	0.00	*
NOEC	< 6.0				< 6.0			
LOEC	6.0				6.0			
EC50 (95% CL)[2]	7.1 (6.0 - 8.2)				NA			
IC25 (95% CL)[2]	NA				<6.0			
IC50 (95% CL)[2]	NA				7.0 (3.7 - 9.4)			

Sample ID:	SW12							
Concentration (%v/v)	Survival (%) Mean ± SD[1]				Growth (mg) Mean ± SD[1]			
D-control	100.0	±	0.0		1.14	±	0.15	
6.3	96.0	±	8.9		1.00	±	0.17	
12.5	96.0	±	8.9		0.97	±	0.18	
25.0	96.0	±	8.9		0.93	±	0.16	
50.0	92.0	±	11.0		0.93	±	0.22	
100.0	80.0	±	0.0	*	0.94	±	0.09	
NOEC	50.0				50.0			
LOEC	100.0				>50.0			
EC50 (95% CL)[2]	>100				NA			
IC25 (95% CL)[2]	NA				>100			
IC50 (95% CL)[2]	NA				>100			

[1] n=5 replicates per treatment, 5 fish per replicate

[2] CL = Confidence limits

[3] Brine control applies to all samples tested except sample SW12

nc = not calculable

NA = Not applicable

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Toxicity testing was carried out in accordance with applicable test methodologies and/or standards of practice. Our liability is limited solely to the cost of re-testing in the event of non-compliance with such test specifications or standards of practice. Golder/EVS accepts no responsibility or liability for the interpretation or use of these testing results by others, nor for any delay, loss, damage or interruptions of testing, collection, preparation, and delivery of samples or test results resulting from events or circumstances beyond our control.

CAM Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500395

EVS Analysts TKS. KEM. AXF. SXB
Test Initiation Date 20-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	BH 16	—	—
Amount Received	1 x 20L	—	—
Date Collected	17-Sept-05	—	—
Date Received	19-Sept-05	—	—
Temperature (°C)	20.0 ① → 20.0	—	—
pH	3.3 ① → 4.3	—	—
DO (mg/L)	6.2 ① → 7.0	—	—
Conductivity (µmhos/cm)	—	—	—
Salinity (ppt)	14 ① → 29	—	—
Ammonia (mg/L N)	—	—	—
Chlorine (mg/L Cl)	—	—	—
Other	—	—	—

① Salinity adjusted to 30±2 ppt

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered UV sterilized seawater
Temperature (°C) 19.0
pH 7.8
Dissolved Oxygen (mg/L) 7.8
Salinity 28 ppt

TEST SPECIES INFORMATION

Source ABS
Date Received 20-Sept-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 20-Sept-05
7-d survival LC50 93 (~~77~~ 79-110) ~~mg/L~~ ug/L Cu
7-d growth IC50 87 (62-115) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 127 ± 33 mg/L Cu CV = 13%
7-d growth IC50 130 ± 49 mg/L Cu CV = 19%

TEST CONDITIONS

Temperature Range (°C) 19.0-20.0
pH Range 4.3-8.0
Dissolved Oxygen Range (mg/L) 6.2-7.8
Salinity (ppt) 28-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	<5	5	<5		
Growth		<5	5		~~2.5 (2.5-2.5)~~ <5 CHM	~~1.25 (1.25-1.25)~~ <5 CHM

Other

Data Verified By C. McPherson
Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Secor

Sample ID BH16

EVS Project No. 04-1424-07C

Test Initiation Date/Time 20-Sep 05 / 1600h

EVS Work Order No. 0500395

Source/Date Received ABS / 20-Sep 05

Concentration %(v/v)	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW Control	19.0	19.5	20.0	20.0	20.0	20.0	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0
5	19.0	19.5												
10	19.5	19.0												
20	19.5	19.0												
41	19.5	19.0												
81.6	20.0	19.5												
Tech. Initials	KGH JXS	JXS		JXS		JXS		AXF		AXF		AXF		JXS

Concentration %(v/v)	pH													
	0	1		2		3		4		5		6		7
SW Control	7.8	7.6	7.8	7.7	7.9	7.6	7.9	7.5	7.9	7.6	7.9	7.7	8.0	7.7
5	6.8	6.2												
10	6.6	6.1												
20	6.0	5.9												
41	5.1	4.9												
81.6	4.3	4.3												
Tech. Initials	KGH JXS	JXS		JXS		JXS		AXF		AXF		AXF		JXS

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH IA 030301

Comments

sample color changed from colorless to yellow after salinity adj.

Test Set Up By JXS, LOC, KGH Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Spacer
EVS Project No. 04-0[illegible]1429-076
EVS Work Order No. 0500395

Sample ID BH16
Test Initiation Date/Time 20Sep05 / 1600h
Source/Date Received ABS / 20Sep05

Concentration % (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Sw Control	28	30	29	29	29	29	30	30
5	29							
10	29							
20	29							
~~40~~ 41	29							
81.6	29							
Tech. Initials	RTH JXS	JXS	JXS	AXF	AXF	AXF	JXS	SXB

Concentration % (v/v)	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
Sw Control	7.8	6.4	7.6	6.2	7.6	6.2	7.6	6.3	7.6	6.4	7.6	6.4	7.6	6.6
5	7.6	6.2												
10	7.5	6.8												
20	7.6	6.6												
41	7.6	7.0												
81.6	7.0	7.0												
Tech. Initials	RTH JXS	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	AXF	AXF	JXS	JXS	SXB

WQ Instruments Used: Salinity II 403303 DO II A14

Comments

Test Set Up By JXS, LOC. RTH Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID BH16
Test Species/Batch *Atherinops affinis* /20Sep05
Test Initiation Date/Time 20-Sep05 / 1600h
No. of Organisms/Volume 5/200mL

Concentration % (v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW Control	A	T24	5	5	5	5	5	5	5	* Constant mass test.
	B	T25	5	5	5	5	5	5	5	
	C	T26	5	5	5	5	5	5	5	
	D	T27*	5	5	5	5	5	5	5	
	E	T28	5	5	5	5	5	5	3	
5	A		0	—	—	—	—	—	—	sample is very turbid & orange colour sheen on top
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
10	A		0	—	—	—	—	—	—	sheen at top
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
20	A		0	—	—	—	—	—	—	Sample is yellow turbid orange deposit on the bottom sheen on top
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
Technician Initials		SKB	[illegible]	[illegible]	AXF	AXF	AXF	[illegible]	SKB	

Sample Description See the comments ↗
Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID BH16
Test Species/Batch Atherinops affinis /20Sep05
Test Initiation Date/Time 20-Sep05 / 1600h
No. of Organisms/Volume 5/200mL

Concentration % (v/v)	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
41	A		5	—	—	—	—	—	—	sample yellowish slightly turbid with lots of debris on the bottom sheen on top
	B		5	—	—	—	—	—	—	
	C		5	—	—	—	—	—	—	
	D		5	—	—	—	—	—	—	
	E		5	—	—	—	—	—	—	
81.6	A		5	—	—	—	—	—	—	sample is slightly yellowish with lots of debris on the bottom no sheen on top
	B		5	—	—	—	—	—	—	
	C		5	—	—	—	—	—	—	
	D		5	—	—	—	—	—	—	
	E		5	—	—	—	—	—	—	
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials			TM							

Sample Description see the comments ↗
Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT:	Seacor	TEST TYPE:	7-d Survival and Growth
PROJECT #:	04-1424-076	TEST SPECIES:	*Atherinops affinis*
WORK ORDER #:	0500395	TEST INITIATION DATE:	20-Sep-05
BALANCE TYPE:	Sartorius BP211D		

Pan No.	Rep	Sample ID: BH16 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
T24	A	Control	5	5	5	960.65	965.9	SXB/MFB	
T25	B		5	5	5	961.14	967.02	SXB/MFB	
T26	C		5	5	5	951.07	955.54	SXB/MFB	
T27	D		5	5	5	951.85	957.33	SXB/MFB	
T28	E		5	5	5	951.17	956.96	SXB/MFB	
T34	A	Brine-Control	5	4	4	953.92	958.05	SXB / MFB	
T35	B		5	4	4	950.07	955.72	SXB / MFB	
T36	C		5	5	5	959.4	965.01	SXB / MFB	
T37	D		5	5	5	951.89	956.2	SXB / MFB	
T38	E		5	4	4	955.95	959.02	SXB / MFB	
	A	5	5						
	B		5						
	C		5						
	D		5						
	E		5						
	A	10	5						
	B		5						
	C		5						
	D		5						
	E		5						
	A	20	5						
	B		5						
	C		5						
	D		5						
	E		5						
	A	41	5						
	B		5						
	C		5						
	D		5						
	E		5						
	A	81.6	5						
	B		5						
	C		5						
	D		5						
	E		5						
	(d)	control D					957.30	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CdM
Nov 9/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: BH16
Start Date: 9/20/2005 End Date: 9/27/2005

Test ID: 0500395b16
Protocol: EPAW 95-EPA West Coast
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5		965.9	960.65
	2	2	D-Control	5							5		967.02	961.14
	3	3	D-Control	5							5		955.54	951.07
	4	4	D-Control	5							4		957.33	951.85
	5	5	D-Control	5							5		956.96	951.17
	6	1	B-Control	5							4		958.05	953.92
	7	2	B-Control	5							4		955.72	950.07
	8	3	B-Control	5							5		965.01	959.4
	9	4	B-Control	5							5		956.2	951.89
	10	5	B-Control	5							4		959.02	955.95
	11	1	5.000	5							0			
	12	2	5.000	5							0			
	13	3	5.000	5							0			
	14	4	5.000	5							0			
	15	5	5.000	5							0			
	16	1	10.000	5							0			
	17	2	10.000	5							0			
	18	3	10.000	5							0			
	19	4	10.000	5							0			
	20	5	10.000	5							0			
	21	1	20.000	5							0			
	22	2	20.000	5							0			
	23	3	20.000	5							0			
	24	4	20.000	5							0			
	25	5	20.000	5							0			
	26	1	41.000	5							0			
	27	2	41.000	5							0			
	28	3	41.000	5							0			
	29	4	41.000	5							0			
	30	5	41.000	5							0			
	31	1	81.600	5							0			
	32	2	81.600	5							0			
	33	3	81.600	5							0			
	34	4	81.600	5							0			
	35	5	81.600	5							0			

Comments: Seacor,04-1424-076 (0500395)

Reviewed by: 9/11/05

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/20/2005	Test ID:	0500395b16	Sample ID:	BH16
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

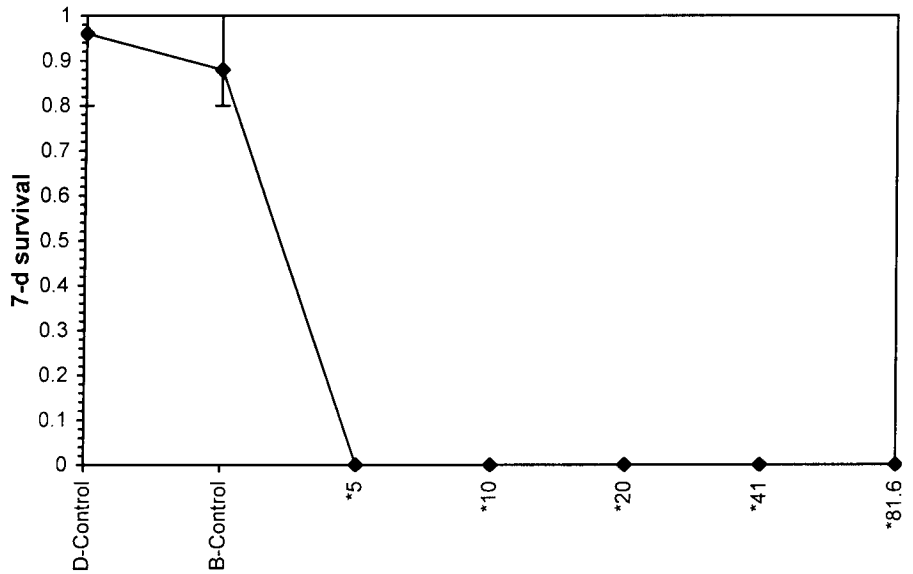
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	0.8000	1.0000
B-Control	0.8000	0.8000	1.0000	1.0000	0.8000
5	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000
41	0.0000	0.0000	0.0000	0.0000	0.0000
81.6	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5		
B-Control	0.8800	0.1095	1.2024	1.1071	1.3453	10.848	5		
*5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5	15.00	16.00
*10	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5	15.00	16.00
*20	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5	15.00	16.00
*41	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5	15.00	16.00
*81.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5	15.00	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.41613	0.9	-3.8705	19.8512
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.24)	1.26491	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	<5	5		

Dose-Response Plot



Reviewed by: CAM Nov 7/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/20/2005	Test ID:	0500395b16	Sample ID:	BH16
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	1.0500	1.1760	0.8940	1.0960	1.1580
B-Control	0.8260	1.1300	1.1220	0.8620	0.6140
5	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000
41	0.0000	0.0000	0.0000	0.0000	0.0000
81.6	0.0000	0.0000	0.0000	0.0000	0.0000

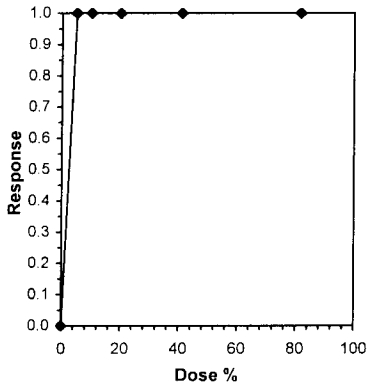
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
D-Control	1.0748	0.1128	1.0748	0.8940	1.1760	10.497	5			1.0748	1.0000
B-Control	0.9108	0.2181	0.9108	0.6140	1.1300	23.949	5				
*5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	15.00	16.00	0.0000	0.0000
*10	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	15.00	16.00	0.0000	0.0000
*20	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	15.00	16.00	0.0000	0.0000
*41	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	15.00	16.00	0.0000	0.0000
*81.6	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	15.00	16.00	0.0000	0.0000

Auxiliary Tests					Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)					0.48429	0.9	-2.1612	13.4772
Equality of variance cannot be confirmed								
The control means are not significantly different (p = 0.17)					1.49328	2.306		
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**				
Steel's Many-One Rank Test	<5	5						

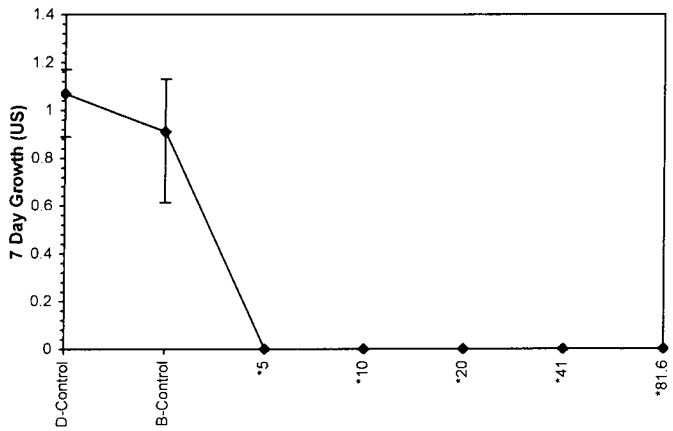
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.2500	0.0000	0.2500	0.2500	1.3656
IC10*	0.5000	0.0000	0.5000	0.5000	-1.3550
IC15*	0.7500	0.0000	0.7500	0.7500	1.3525
IC20*	1.0000	0.0000	1.0000	1.0000	-1.2956
IC25*	1.2500	0.0000	1.2500	1.2500	-0.2581
IC40*	2.0000	0.0000	2.0000	2.0000	2.2530
IC50*	2.5000	0.0000	2.5000	2.5000	#DIV/0!

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Statistical analysis were against the D-control only.

Reviewed by: CAM Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500395

EVS Analysts TKS. KEM. AXF. SXB
Test Initiation Date 20-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	BH 20	→	
Amount Received	1 x 20 L	–	–
Date Collected	17-Sept-05	–	–
Date Received	19-Sept-05	–	–
Temperature (°C)	20.0 ① 20.0	–	–
pH	4.5 ① 5.1	–	–
DO (mg/L)	8.0 ① 7.7	–	–
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	5.3 ① 29	–	–
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

① Salinity adjusted to 30 ± 2 ppt

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered UV sterilized seawater
Temperature (°C) 19.0
pH 7.8
Dissolved Oxygen (mg/L) 7.8
Salinity 28 ppt

TEST SPECIES INFORMATION

Source ABS
Date Received 20-Sept-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 20-Sept-05
7-d survival LC50 93 (~~77~~ 79-110) ~~mg~~ µg/L Cu
7-d growth IC50 87 (62-115) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 127 ± 33 mg/L Cu CV = 13%
7-d growth IC50 130 ± 49 mg/L Cu CV = 19%

TEST CONDITIONS

Temperature Range (°C) 19.0 - 20.5
pH Range 4.8 - 8.1
Dissolved Oxygen Range (mg/L) 6.0 - 7.8
Salinity (ppt) 28 - 31
Photoperiod (L:D h) 16 : 8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	< ~~50~~ 45	~~50~~ 45	< 45		
Growth		< 45	~~50~~ 45		< 45	< 45

Other

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Sancor

Sample ID BH20

EVS Project No. 04-1424-07C

Test Initiation Date/Time 20-Sep 05 / 1600h

EVS Work Order No. 0500395

Source/Date Received AGS / 20-Sep 05

Concentration % (v/v)	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW Control	19.0	19.5	20.0	19.5	20.0	19.0	20.0	19.5	20.0	20.0	20.0	19.5	20.0	20.0
Brine Control	19.0	19.5	20.0	20.0	20.0	19.0	20.0	19.5	20.0	20.0	20.0	19.5	20.0	20.0
5 (psu) 4.5	19.0	19.5	—	—	—	—	—	—	—	—	—	—	—	—
10 9	19.5	19.5	—	—	—	—	—	—	—	—	—	—	—	—
20 18	19.5	20.0	—	—	—	—	—	—	—	—	—	—	—	—
40 36	19.5	20.0	—	—	—	—	—	—	—	—	—	—	—	—
79.8 72.5	20.0	20.0	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	JXS	JXS	JXS	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXS

Concentration % (v/v)	pH													
	0	1		2		3		4		5		6		7
SW Control	7.8	7.8	7.8	7.7	7.9	7.7	7.9	7.7	7.9	7.7	7.9	7.8	8.0	7.7
Brine Control	7.8	7.6	8.0	7.8	8.0	7.8	8.0	7.7	8.0	7.8	8.0	7.9	8.1	7.8
5 (psu) 4.5	7.1	6.4	—	—	—	—	—	—	—	—	—	—	—	—
10 9	6.9	6.3	—	—	—	—	—	—	—	—	—	—	—	—
20 18	6.7	6.2	—	—	—	—	—	—	—	—	—	—	—	—
40 36	6.3	5.9	—	—	—	—	—	—	—	—	—	—	—	—
79.8 72.5	~~5.5~~ 5.1	4.8	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	POA JXS	JXS	JXS	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXS

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH IIA 030301

Comments

Test Set Up By JXS, CC Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor

EVS Project No. 04-0[illegible]1424-076

EVS Work Order No. 0500395

Sample ID BH20

Test Initiation Date/Time 20Sep05 / 1600h

Source/Date Received ABS / 20Sep05

Concentration % (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
SW Control	28	~~29~~ 30	29	29	29	29	30	30
Brine Control	29	~~29~~ 29 30	29	29	29	29	31	31
5 50 45	28	—	—	—	—	—	—	—
10 9	28	—	—	—	—	—	—	—
20 18	29	—	—	—	—	—	—	—
40 36	29	—	—	—	—	—	—	—
79.8 72.5	29	—	—	—	—	—	—	—
Tech. Initials	JM	JM	JM	—	AXF	AXF	JM	SXS

Concentration % (v/v)	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW Control	7.8	6.2	7.6	6.0	7.6	6.4	7.6	6.4	7.6	6.4	7.6	6.4	~~7.6~~ 7.6	6.6
Brine Control	7.6	6.4	7.5	6.0	7.6	6.6	7.6	6.2	7.6	6.5	7.6	6.2	~~7.6~~ 7.6	6.3
5 50 4.5	7.2	6.6	—	—	—	—	—	—	—	—	—	—	—	—
10 9	7.4	6.8	—	—	—	—	—	—	—	—	—	—	—	—
20 18	7.4	6.6	—	—	—	—	—	—	—	—	—	—	—	—
40 36	7.4	6.8	—	—	—	—	—	—	—	—	—	—	—	—
79.8 72.5	7.7	7.0	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	JM	JM	JM	JM	JM	JM	JM	AXF	AXF	AXF	AXF	JM	JM	SXS

WQ Instruments Used: Salinity II A030303 DO II A14

Comments

Test Set Up By JXS, LCC Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor

EVS Project No. 04-1424-076

EVS Work Order No. 0500395

Sample ID BH20

Test Species/Batch *Atherinops affinis* /20Sep05

Test Initiation Date/Time 20-Sep05 / 1600h

No. of Organisms/Volume 5/200mL

Concentration % (v/v)	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
Control	A	T29	5	5	5	5	5	5	5	
	B	T30	5	5	5	5	5	5	5	
	C	T31	5	5	5	5	5	5	5	
	D	T32	5	4	4	4	4	4	4	
	E	T33	5	5	5	5	5	5	5	
~~500~~ 2 Control	A	T34	~~7~~5	5	4	4	4	4	4	
	B	T35	~~m~~5	5	4	4	4	4	4	
	C	T36	~~m~~5	5	5	5	5	5	5	
	D	T37	~~m~~5	5	5	5	5	5	5	
	E	T38	~~m~~5	5	4	4	4	4	4	
45	A		0	—	—	—	—	—	—	5 fish all died an hour after seeding.
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
~~100~~ 90	A		0	—	—	—	—	—	—	(1)
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
Technician Initials		SXB	TM	TM	AXF	AXF	AXF	TM	SXB	

Sample Description clear, colorless. After salinity adjusted, sample became yellow and turbid

Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID BH20
Test Species/Batch Atherinops affinis /20Sep05
Test Initiation Date/Time 20-Sep05 / 1600h
No. of Organisms/Volume 5/200mL

Concentration % (v/v)	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
18 / 20	A		5	—	—	—	—	—	—	D
	B		5	—	—	—	—	—	—	
	C		5	—	—	—	—	—	—	
	D		5	—	—	—	—	—	—	
	E		5	—	—	—	—	—	—	
36 / 40	A		5	—	—	—	—	—	—	D
	B		5	—	—	—	—	—	—	
	C		5	—	—	—	—	—	—	
	D		5	—	—	—	—	—	—	
	E		5	—	—	—	—	—	—	
72.5 / 79.8	A		5	—	—	—	—	—	—	D
	B		5	—	—	—	—	—	—	
	C		5	—	—	—	—	—	—	
	D		5	—	—	—	—	—	—	
	E		5	—	—	—	—	—	—	
	A									
	B									
	C									
	D									
	E									
Technician Initials			VV							

Sample Description clear, colorless. sample turned to yellow and turbid after sal adj.
Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500395
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Athermops affinis*
TEST INITIATION DATE: 20-Sep-05

Pan No.	Rep	Sample ID: BH20	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
T29	A	Control	5	5	5	955.57	960.24	SXB / MFB	
T30	B		5	5	5	958.64	964.79	SXB / MFB	
T31	C		5	5	5	953.04	956.92	SXB / MFB	
T32	D		5	4	4	947.65	952.52	SXB / MFB	
T33	E		5	5	5	948.45	954.22	SXB / MFB	
T34	A	Brine-Control	5	4	4	953.92	958.05	SXB / MFB	
T35	B		5	4	4	950.07	955.72	SXB / MFB	
T36	C		5	5	5	959.4	965.01	SXB / MFB	
T37	D		5	5	5	951.89	956.2	SXB / MFB	
T38	E		5	4	4	955.95	959.02	SXB / MFB	
	A	4.5	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	9	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	18	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	36	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	72.5	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	(d)	control B					964.73	SXB	
	(d)								
	(d)								

(d) - duplicate, pan reweighed after being placed in the oven and desiccated a second time.

CAH 11/9/05

Test: LF-Larval Fish Growth and Survival Test
Test ID: 0500395b20
Species: AA-Atherinops affinis
Protocol: EPAW 95-EPA West Coast
Sample ID: BH20
Sample Type: GW-groundwater
Start Date: 9/20/2005 End Date: 9/27/2005
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5		960.24	955.57
	2	2	D-Control	5							5		964.79	958.64
	3	3	D-Control	5							5		956.92	953.04
	4	4	D-Control	5							4		952.52	947.65
	5	5	D-Control	5							5		954.22	948.45
	6	1	B-Control	5							4		958.05	953.92
	7	2	B-Control	5							4		955.72	950.07
	8	3	B-Control	5							5		965.01	959.4
	9	4	B-Control	5							5		956.2	951.89
	10	5	B-Control	5							4		959.02	955.95
	11	1	4.500	5							0			
	12	2	4.500	5							0			
	13	3	4.500	5							0			
	14	4	4.500	5							0			
	15	5	4.500	5							0			
	16	1	9.000	5							0			
	17	2	9.000	5							0			
	18	3	9.000	5							0			
	19	4	9.000	5							0			
	20	5	9.000	5							0			
	21	1	18.000	5							0			
	22	2	18.000	5							0			
	23	3	18.000	5							0			
	24	4	18.000	5							0			
	25	5	18.000	5							0			
	26	1	36.000	5							0			
	27	2	36.000	5							0			
	28	3	36.000	5							0			
	29	4	36.000	5							0			
	30	5	36.000	5							0			
	31	1	72.500	5							0			
	32	2	72.500	5							0			
	33	3	72.500	5							0			
	34	4	72.500	5							0			
	35	5	72.500	5							0			

Comments: Seacor,04-1424-076 (0500395)

Reviewed by: CAM 11/7/05

Larval Fish Growth and Survival Test-7 Day Survival

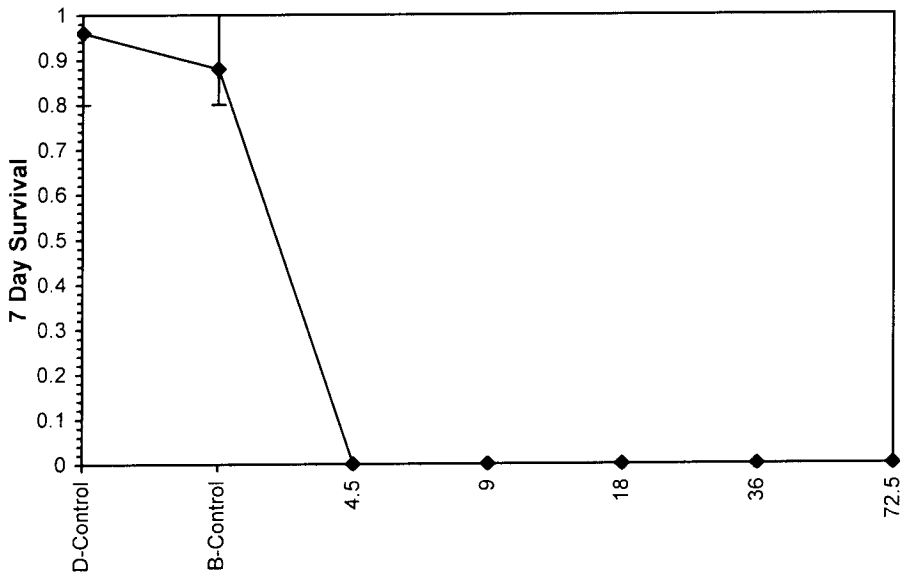
Start Date:	9/20/2005	Test ID:	0500395b20	Sample ID:	BH20
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	0.8000	1.0000
B-Control	0.8000	0.8000	1.0000	1.0000	0.8000
4.5	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.0000	0.0000	0.0000	0.0000	0.0000
72.5	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root				
Conc-%	Mean	SD	Mean	Min	Max	CV%	N
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5
B-Control	0.8800	0.1095	1.2024	1.1071	1.3453	10.848	5
4.5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5
9	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5
18	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5
36	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5
72.5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.62485	0.781	-2.5156	7.15179
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.24)	1.26491	2.306		

Dose-Response Plot



Reviewed by: Nov 7/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/20/2005	Test ID:	0500395b20	Sample ID:	BH20
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	0.9340	1.2300	0.7760	0.9740	1.1540
B-Control	0.8260	1.1300	1.1220	0.8620	0.6140
4.5	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.0000	0.0000	0.0000	0.0000	0.0000
72.5	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Untransformed					Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Mean	N-Mean
D-Control	1.0136	0.1809	1.0136	0.7760	1.2300	17.847	5	1.0136	1.0000
B-Control	0.9108	0.2181	0.9108	0.6140	1.1300	23.949	5		
4.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	0.0000	0.0000
36	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	0.0000	0.0000
72.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5	0.0000	0.0000

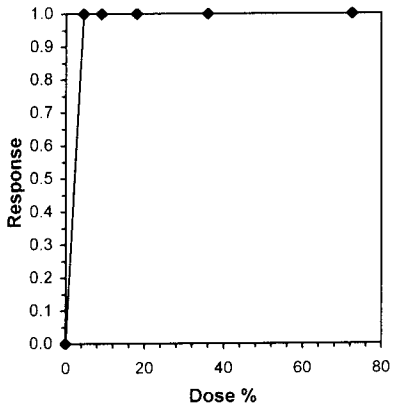
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.89057	0.781	-0.0854	1.65635
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.44)	0.81117	2.306		

Linear Interpolation (200 Resamples)

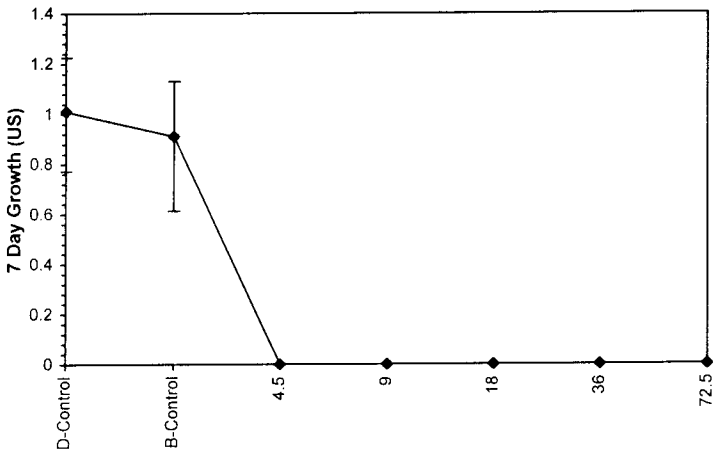
Point	%	SD	95% CL(Exp)		Skew
IC05*	0.2250	0.0000	0.2250	0.2250	-1.1008
IC10*	0.4500	0.0000	0.4500	0.4500	-1.0191
IC15*	0.6750	0.0000	0.6750	0.6750	1.0232
IC20*	0.9000	0.0000	0.9000	0.9000	-1.0109
IC25*	1.1250	0.0000	1.1250	1.1250	0.3422
IC40*	1.8000	0.0000	1.8000	1.8000	-1.0086
IC50*	2.2500	0.0000	2.2500	2.2500	#DIV/0!

% (v/v)

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: Cdm 10/4/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500395

EVS Analysts T.S. KEM. AXF. SxB
Test Initiation Date 20-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	SWG	→	→
Amount Received	1x20L	→	→
Date Collected	17-Sept-05	→	→
Date Received	19-Sept-05	→	→
Temperature (°C)	20.0 D→ 20.0	20.0 D→ 20.0	20.0 D→ 20.0
pH	6.3 D→ 6.6	6.2 D→ 6.6	6.2 D→ 6.9
DO (mg/L)	7.8 D→ 7.5	6.7 D→ 7.2	6.7 D→ 7.2
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	21 D→ 29	21 D→ 29	21 D→ 29
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

D Sal adjusted to 30 ± 2 ppt

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered UV sterilized seawater
Temperature (°C) 19.0
pH 7.8
Dissolved Oxygen (mg/L) 7.8
Salinity 28 ppt

TEST SPECIES INFORMATION

Source ABS
Date Received 20-Sept-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 20-Sept-05
7-d survival LC50 93 (~~77~~ 79-110) ~~mg/L~~ µg/L Cu
7-d growth IC50 87 (62-115) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 127 ± 33 mg/L Cu CV = 13%
7-d growth IC50 130 ± 49 mg/L Cu CV = 19%

TEST CONDITIONS

Temperature Range (°C) 19.0 - 20.0
pH Range 6.6 - 8.0
Dissolved Oxygen Range (mg/L) 6.0 - 7.8
Salinity (ppt) 28-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	<5.5	5.5	6.6 (4.6-8.2)		
Growth		<5.5	5.5		6.1 (3.8-8.9)	~~3.0 (1.9-6.0)~~ <5.5

Other

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Sucor
EVS Project No. 04-(424-07C
EVS Work Order No. 05000395

Sample ID Sw 9
Test Initiation Date/Time 20-Sep 05/1600h
Source/Date Received ABS /20-Sep 05

Concentration %(v/v)	Temperature (°C)													
	0	1		2		3		4		5		6		7
Sw Control	19.0	19.5	20.0	19.5	20.0	19.5	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0
5.5	19.0	19.5	20.0	19.5	20.0	19.5	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0
11	19.0	19.5	20.0	20.0	20.0	19.0	20.0	20.0	20.0	19.5	20.0	20.0	20.0	20.0
22	19.0	19.5	—	—	—	—	—	—	—	—	—	—	—	—
44	19.0	19.5	—	—	—	—	—	—	—	—	—	—	—	—
88.5	19.0	20.0	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	RCA SXS	JXS	SXS	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXS

Concentration %(v/v)	pH													
	0	1		2		3		4		5		6		7
Sw Control	7.8	7.6	7.8	7.7	7.9	7.7	7.9	7.8	7.9	7.7	7.9	7.8	8.0	7.6
5.5	7.3	7.5	7.5	7.6	7.7	7.5	7.5	7.5	7.5	7.6	7.7	7.7	7.8	7.5
11	7.2	7.5	7.4	7.6	7.5	7.5	7.3	7.5	7.4	7.5	7.5	7.6	7.7	7.5
22	7.0	7.3	—	—	—	—	—	—	—	—	—	—	—	—
44	6.9	7.1	—	—	—	—	—	—	—	—	—	—	—	—
88.5	6.6	6.8	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	RCA SXS	JXS	SXS	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXS

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II A 030301

Comments

Test Set Up By JXS Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Spacer
Sample ID SW 9
EVS Project No. 04-0[illegible]1424-076
Test Initiation Date/Time 20 Sep 05 / 1600h
EVS Work Order No. 0500395
Source/Date Received ABS / 20 Sep 05

Concentration % (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
SW Control	28	30	29	29	29	29	30	30
5.5	29	30	29	29	29	29	30	30
11	29	30	29	29	29	29	30	30
22	29	—	—	—	—	—	—	—
44	29	—	—	—	—	—	—	—
88.5	29	—	—	—	—	—	—	—
Tech. Initials	RLH JXS	SXB	JXS	JXS	AXF	AXF	JXS	SXB

Concentration % (v/v)	Dissolved Oxygen (mg/L)														
	0	1		2		3		4		5		6		7	
SW Control	7.8	6.2	7.6	6.0	7.6	5.4	7.6	6.5	7.6	6.3	7.6	6.2	7.6	6.6	
5.5	7.0	6.4	7.4	6.2	7.3	6.8	7.4	6.6	7.4	6.4	7.4	6.4	7.4	6.8	
11	7.2	6.6	7.3	6.4	7.2	6.8	7.2	6.7	7.3	6.3	7.2	6.4	7.3	6.7	
22	7.2	6.8	—	—	—	—	—	—	—	—	—	—	—	—	
44	7.2	6.8	—	—	—	—	—	—	—	—	—	—	—	—	
88.5	7.5	6.8	—	—	—	—	—	—	—	—	—	—	—	—	
Tech. Initials	RLH JXS	JXS	SXB	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXB	

WQ Instruments Used: Salinity II A0303C3 DO II A14
Comments

Test Set Up By JXS Data Verified By [signature] Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID SW 9
Test Species/Batch *Atherinops affinis* /20Sep05
Test Initiation Date/Time 20-Sep05 / 1600h
No. of Organisms/Volume 5/200mL

Concentration (v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW Control	A	T1	5	5	5	5	5	5	5	
	B	T2	5	5	5	5	5	5	5	
	C	T3*	5	5	5	5	5	5	5	
	D	T4	5	5	5	5	5	5	5	
	E	T5	5	5	5	5	4	4	4	
5.5	A	T6	5	5	5	4	4	3	3	
	B	T7	5	4	4	4	4	4	4	
	C	T8*	5	4	4	4	3	2	2	
	D	T9	5	5	5	5	4	3	3	
	E	~~T10~~ T10	5	4	4	3	3	2	2	
11	A	~~T11~~	2	2	2	0	—	—	—	① fed half amount of food to each beaker from Day 1.
	B	~~T12~~	1	1	0	—	—	—	—	
	C	T11	3	3	3	3	3	2	2	
	D	T12	1	4	4	4	4	3	3	
	E	T13	2	1	1	1	1	1	1	
22	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
Technician Initials			SXB	SXB	TM	AXF	AXF	AXF	TM	SXB

Sample Description [redacted] yellow, turbid, lots of deposit.
Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID SW 9
Test Species/Batch Atherinops affinis / 20Sep05
Test Initiation Date/Time 20-Sep05 / 1600h
No. of Organisms/Volume 5 / 200mL

Concentration % (v/v)	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
44	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
88.5	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials			TM							

Sample Description yellow. turbid. lots of deposit.
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500395
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Atherinops affinis*
TEST INITIATION DATE: 20-Sep-05

Pan No.	Rep	Sample ID: SW 9% (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
T1	A	Control	5	5	5	954.6	960.67	SXB / MFB	
T2	B		5	5	5	958.31	963.49	SXB / MFB	
T3	C		5	5	5	952.57	957.98	SXB / MFB	
T4	D		5	5	5	953.27	958.43	SXB / MFB	
T5	E		5	5	5	953.01	956.76	SXB / MFB	
T34	A	Brine-Control	5	4	4	953.92	958.05	SXB / MFB	
T35	B		5	4	4	950.07	955.72	SXB / MFB	
T36	C		5	5	5	959.4	965.01	SXB / MFB	
T37	D		5	5	5	951.89	956.2	SXB / MFB	
T38	E		5	4	4	955.95	959.02	SXB / MFB	
T6	A	5.5	5	3	3	954.14	956.14	SXB / MFB	
T7	B		5	4	4	956.63	961.11	SXB / MFB	
T8	C		5	2	2	953.43	955.39	SXB / MFB	
T9	D		5	3	3	956.71	960.26	SXB / MFB	
T10	E		5	2	2	951.54	953.26	SXB / MFB	
	A	11	5	0					
	B		5	0					
T11	C		5	2	2	957.92	959.57	SXB / MFB	
T12	D		5	3	3	947.17	949.79	SXB / MFB	
T13	E		5	1	1	950.71	951.74	SXB / MFB	
	A	22	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	44	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	88.5	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	(d)	Control C					957.92	JXS	
	(d)	5.5 C					955.36	JXS	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CHM Nov 9/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: SW9
Start Date: 9/20/2005 End Date: 9/27/2005

Test ID: 0500395s9
Protocol: EPAW 95-EPA West Coast
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	960.67	954.6
	2	2	D-Control	5							5	5	963.49	958.31
	3	3	D-Control	5							5	5	957.98	952.57
	4	4	D-Control	5							5	5	958.43	953.27
	5	5	D-Control	5							4	4	956.76	953.01
	6	1	B-Control	5							4	4	958.05	953.92
	7	2	B-Control	5							4	4	955.72	950.07
	8	3	B-Control	5							5	5	965.01	959.4
	9	4	B-Control	5							5	5	956.2	951.89
	10	5	B-Control	5							4	4	959.02	955.95
	11	1	5.500	5							3	3	956.14	954.14
	12	2	5.500	5							4	4	961.11	956.63
	13	3	5.500	5							2	2	955.39	953.43
	14	4	5.500	5							3	3	960.26	956.71
	15	5	5.500	5							2	2	953.26	951.54
	16	1	11.000	5							0			
	17	2	11.000	5							0			
	18	3	11.000	5							2	2	959.57	957.92
	19	4	11.000	5							3	3	949.79	947.17
	20	5	11.000	5							1	1	951.74	950.71
	21	1	22.000	5							0			
	22	2	22.000	5							0			
	23	3	22.000	5							0			
	24	4	22.000	5							0			
	25	5	22.000	5							0			
	26	1	44.000	5							0			
	27	2	44.000	5							0			
	28	3	44.000	5							0			
	29	4	44.000	5							0			
	30	5	44.000	5							0			
	31	1	88.500	5							0			
	32	2	88.500	5							0			
	33	3	88.500	5							0			
	34	4	88.500	5							0			
	35	5	88.500	5							0			

Comments: Seacor,04-1424-076 (0500395)

Reviewed by: CAM Nov 7/05

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/20/2005	Test ID:	0500395s9	Sample ID:	SW9
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	0.8000
B-Control	0.8000	0.8000	1.0000	1.0000	0.8000
5.5	0.6000	0.8000	0.4000	0.6000	0.4000
11	0.0000	0.0000	0.4000	0.6000	0.2000
22	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.0000	0.0000	0.0000	0.0000	0.0000
88.5	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5				1	25
B-Control	0.8800	0.1095	1.2024	1.1071	1.3453	10.848	5					
*5.5	0.5600	0.1673	0.8497	0.6847	1.1071	20.667	5	3.456	2.110	0.2735	11	25
*11	0.2400	0.2608	0.4971	0.2255	0.8861	58.230	5	6.177	2.110	0.2735	19	25
22	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25
44	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25
88.5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25

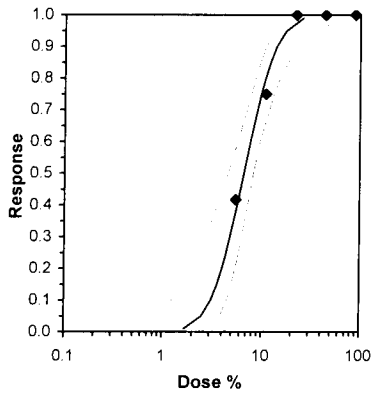
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93327	0.835	0.32641	-0.1867
Bartlett's Test indicates equal variances (p = 0.19)	3.33601	9.21034		
The control means are not significantly different (p = 0.24)	1.26491	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<5.5	5.5			0.1974	0.21289	0.8049	0.04199	1.8E-04	2, 12

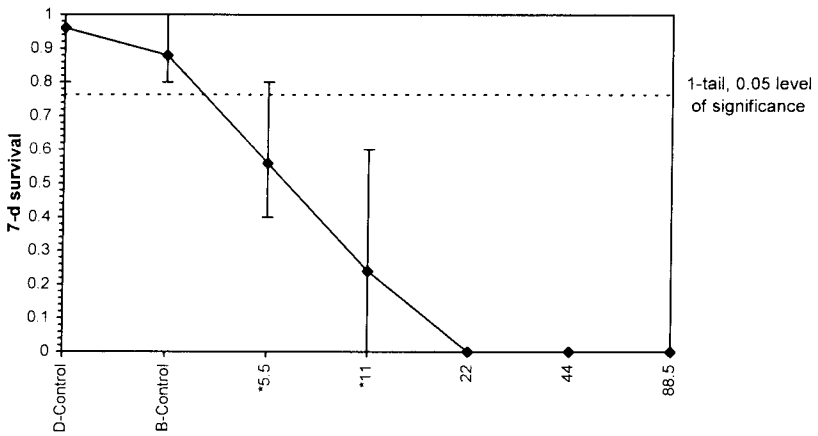
Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	3.92068	0.91177	2.13362	5.70774	0.04	1.17089	7.81473	0.76	0.81789	0.25506	5
Intercept	1.79332	0.86828	0.09149	3.49515							
TSCR	0.04136	0.0398	-0.0366	0.11937							

Point	Probits	%	95% Fiducial Limits	
EC01	2.674	1.67701	0.41339	2.88948
EC05	3.355	2.5024	0.85382	3.84255
EC10	3.718	3.09756	1.2532	4.48632
EC15	3.964	3.57716	1.62031	4.99047
EC20	4.158	4.01076	1.98398	5.44052
EC25	4.326	4.42441	2.35641	5.86869
EC40	4.747	5.66593	3.59406	7.18414
EC50	5.000	6.5749	4.5701	8.22548
EC60	5.253	7.6297	5.706	9.59141
EC75	5.674	9.77064	7.7821	13.1307
EC80	5.842	10.7783	8.6226	15.1831
EC85	6.036	12.0848	9.61111	18.1828
EC90	6.282	13.9559	10.8893	23.0815
EC95	6.645	17.2752	12.9171	33.3447
EC99	7.326	25.7776	17.4146	67.9332



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: CdM Nov 7/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/20/2005	Test ID:	0500395s9	Sample ID:	SW9
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	1.2140	1.0360	1.0820	1.0320	0.7500
B-Control	0.8260	1.1300	1.1220	0.8620	0.6140
5.5	0.4000	0.8960	0.3920	0.7100	0.3440
11	0.0000	0.0000	0.3300	0.5240	0.2060
22	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.0000	0.0000	0.0000	0.0000	0.0000
88.5	0.0000	0.0000	0.0000	0.0000	0.0000

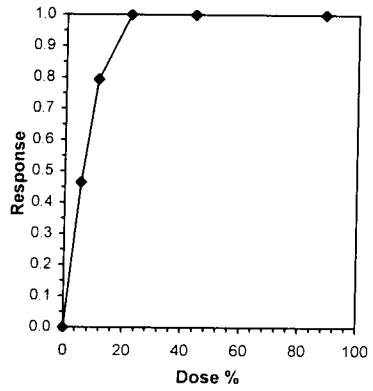
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.0228	0.1694	1.0228	0.7500	1.2140	16.559	5				1.0228	1.0000
B-Control	0.9108	0.2181	0.9108	0.6140	1.1300	23.949	5					
*5.5	0.5484	0.2425	0.5484	0.3440	0.8960	44.217	5	3.500	2.110	0.2860	0.5484	0.5362
*11	0.2120	0.2243	0.2120	0.0000	0.5240	105.789	5	5.982	2.110	0.2860	0.2120	0.2073
* 22	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000
*44	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000
* 88.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.93617		0.835		0.32122	-1.0246
Bartlett's Test indicates equal variances (p = 0.79)					0.4778		9.21034			
The control means are not significantly different (p = 0.39)					0.90686		2.306			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	<5.5	5.5			0.28599	0.27962	0.82968	0.04593	2.4E-04	2, 12

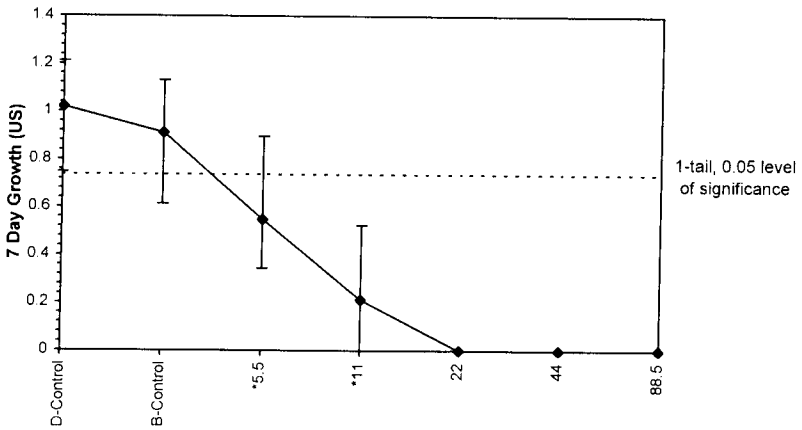
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.5929	0.1977	0.3871	1.1921	3.8372
IC10*	1.1858	0.3954	0.7741	2.3842	3.8372
IC15*	1.7787	0.5548	1.1612	3.5763	2.9665
IC20*	2.3716	0.6893	1.5482	4.7684	2.2089
IC25*	2.9645	0.8055	1.9353	5.9605	1.7039
IC40*	4.7432	1.0018	3.0964	7.5251	0.8637
IC50	6.1049	1.1638	3.8178	8.9451	0.4803

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: CAM Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seaton
EVS Project No. 04-1424-076
EVS Work Order No. 500395

EVS Analysts TJS, REM, AXF, SXB
Test Initiation Date 20-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	SW11	→	→
Amount Received	1 x 20L	→	→
Date Collected	17-Sept-05	→	→
Date Received	19-Sept-05	→	→
Temperature (°C)	20.0 → 20.0	20.0 → 20.0	20.0 → 20.0
pH	4.4 → 4.8	4.5 → 4.8	4.5 → 4.8
DO (mg/L)	6.4 → 7.2	6.3 → 7.1	6.4 → 7.1
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	26 → 29	26 → 29	26 → 29
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

① Salinity adjusted to 30 ± 2ppt.

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered UV sterilized seawater
Temperature (°C) 19.0
pH 7.8
Dissolved Oxygen (mg/L) 7.8
Salinity 28 ppt

TEST SPECIES INFORMATION

Source ABS
Date Received 20-Sept-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 20-Sept-05
7-d survival LC50 93 (~~77~~ 79-110) ~~mg/L~~ µg/L Cu
7-d growth IC50 87 (62-115) µg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 127 ± 33 µg/L Cu CV = 13%
7-d growth IC50 130 ± 49 µg/L Cu CV = 19%

TEST CONDITIONS

Temperature Range (°C) 19.0 - 20.0
pH Range 4.8 - 8.0
Dissolved Oxygen Range (mg/L) 6.0 - 7.8
Salinity (ppt) 28-30
Photoperiod (L:D h) 16 : 8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	< 6	6	7.0 (6.0-8.2)		
Growth		< 6	6		7.0 (3.7 - 9.4)	~~3.7 (1.8 - 8.4)~~ < 6 (3.7)

Other

Data Verified By C. Nelson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Secor

EVS Project No. 04-1424-07C

EVS Work Order No. 0500395

Sample ID SW 11

Test Initiation Date/Time 20-Sep-05 / 1600h

Source/Date Received ABS / 20-Sep-05

Concentration % (v/v)	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW Control	19.0	19.5	20.0	19.5	[illegible]	19.5	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0
6	19.5	19.5	20.0	20.0	20.0	19.5	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0
12	19.5	20.0	—	—	—	—	—	—	—	—	—	—	—	
24	19.5	20.0	—	—	—	—	—	—	—	—	—	—	—	—
47	19.5	19.5	—	—	—	—	—	—	—	—	—	—	—	—
93.9	20.0	20.0	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	RCH JXS	JXS	SXB	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXB

Concentration % (v/v)	pH													
	0	1		2		3		4		5		6		7
SW Control	7.8	7.5	7.8	7.7	7.9	7.7	7.9	7.8	7.9	7.7	7.9	7.7	8.0	7.6
6	7.2	7.6	7.2	7.6	7.8	7.5	7.4	7.5	7.4	7.5	7.4	7.5	7.4	7.6
12	7.1	7.4	—	—	—	—	—	—	—	—	—	—	—	—
24	6.6	7.1	—	—	—	—	—	—	—	—	—	—	—	—
47	5.9	6.2	—	—	—	—	—	—	—	—	—	—	—	—
93.9	4.8	4.8	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	RCH JXS	JXS	SXB	JXS	JXS	JXS	JXS	AXF	AXF	AXF	AXF	JXS	JXS	SXB

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH IIA 030301

Comments

Test Set Up By JXS, RCH Data Verified By C. McAdoo Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Spacer
EVS Project No. 04-6[2nd]1424-076
EVS Work Order No. 0500395

Sample ID SW11
Test Initiation Date/Time 20Sep05 / 1600h
Source/Date Received ABS / 20Sep05

Concentration % (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
SW Control	28	30	29	29	29	29	30	30
6	29	30	29	29	29	29	30	30
12	29	—	—	—	—	—	—	—
24	29	—	—	—	—	—	—	—
47	29	—	—	—	—	—	—	—
93.9	29	—	—	—	—	—	—	—
Tech. Initials	Read JXS	SXB	[illegible]	[illegible]	AXF	AXF	[illegible]	SXB

Concentration % (v/v)	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW Control	7.8	6.2	7.6	6.2	7.6	6.4	7.6	6.3	7.6	6.3	7.6	6.4	7.6	6.5
6	7.6	6.0	7.5	6.4	7.6	6.2	7.4	6.3	7.4	6.3	7.4	6.5	7.4	6.6
12	7.6	6.2	—	—	—	—	—	—	—	—	—	—	—	—
24	7.4	6.6	—	—	—	—	—	—	—	—	—	—	—	—
47	7.4	6.8	—	—	—	—	—	—	—	—	—	—	—	—
93.9	7.2	6.8	—	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	Read JXS	[illegible]	SXB	[illegible]	[illegible]	[illegible]	[illegible]	AXF	AXF	AXF	AXF	[illegible]	[illegible]	SXB

WQ Instruments Used: Salinity II A03303 DO II A14

Comments

Test Set Up By JXS, KEH Data Verified By [signature] Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID SW11
Test Species/Batch Atherinops affinis /20Sep05
Test Initiation Date/Time 20-Sep05 /1600h
No. of Organisms/Volume 5/200mL

Concentration (% v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW Control	A	T14*	5	5	5	5	5	5	5	
	B	T15	5	5	5	5	5	4	4	
	C	T16	5	5	5	5	4	4	4	
	D	T17	5	5	5	5	5	5	5	
	E	T18	5	5	5	5	5	5	5	
6	A	T19*	5	5	5	5	5	4	4	
	B	T20	4	4	4	4	4	1	1	
	C	T21	5	5	5	5	5	4	3	
	D	T22	5	5	5	5	5	4	4	
	E	T23	5	~~5~~ 4 SxB	4	3	3	3	3	
12	A		0	—						
	B		0	—						
	C		0	—						
	D		0	—						
	E		0	—						
24	A		0	—						
	B		0	—						
	C		0	—						
	D		0	—						
	E		0	—						
Technician Initials		SXB	SxB	TM	AXF	AXF	AXF	TM	SXB	

Sample Description colorless. clear.
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID SW 11
Test Species/Batch Atherinops affinis /20Sep05
Test Initiation Date/Time 20-Sep05 /1600h
No. of Organisms/Volume 5/200mL

Concentration (%)	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
47	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
93.9	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials										

Sample Description colorless. clear
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT:	Seacor	TEST TYPE:	7-d Survival and Growth
PROJECT #:	04-1424-076	TEST SPECIES:	*Atherinops affinis*
WORK ORDER #:	0500395	TEST INITIATION DATE:	20-Sep-05
BALANCE TYPE:	Sartorius BP211D		

Pan No.	Rep	Sample ID: SW11 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
T14	A	Control	5	5	5	951.81	957.8	SXB / MFB	
T15	B		5	4	4	957.64	960.78	SXB / MFB	
T16	C		5	4	4	957.75	962.78	SXB / MFB	
T17	D		5	5	5	958.72	963.5	SXB / MFB	
T18	E		5	5	5	955.29	961.19	SXB / MFB	
T34	A	Brine-Control	5	4	4	953.92	958.05	SXB / MFB	
T35	B		5	4	4	950.07	955.72	SXB / MFB	
T36	C		5	5	5	959.4	965.01	SXB / MFB	
T37	D		5	5	5	951.89	956.2	SXB / MFB	
T38	E		5	4	4	955.95	959.02	SXB / MFB	
T19	A	6	5	4	4	962.63	965.75	SXB / MFB	
T20	B		5	1	1	953.22	954.02	SXB / MFB	
T21	C		5	3	3	957.07	960.22	SXB / MFB	
T22	D		5	4	4	957.95	963.39	SXB / MFB	
T23	E		5	3	3	951.89	954.26	SXB / MFB	
	A	12	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	24	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	47	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	A	93.9	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
	(d)	6.0 A					965.7	SXB	
	(d)	control A					957.82	SXB	
	(d)								

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CAM Nov 9/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: SW11
Start Date: 9/20/2005 End Date: 9/27/2005

Test ID: 0500395s11
Protocol: EPAW 95-EPA West Coast
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	957.8	951.81
	2	2	D-Control	5							4	4	960.78	957.64
	3	3	D-Control	5							4	4	962.78	957.75
	4	4	D-Control	5							5	5	963.5	958.72
	5	5	D-Control	5							5	5	961.19	955.29
	6	1	B-Control	5							4	4	958.05	953.92
	7	2	B-Control	5							4	4	955.72	950.07
	8	3	B-Control	5							5	5	965.01	959.4
	9	4	B-Control	5							5	5	956.2	951.89
	10	5	B-Control	5							4	4	959.02	955.95
	11	1	6.000	5							4	4	965.75	962.63
	12	2	6.000	5							1	1	954.02	953.22
	13	3	6.000	5							3	3	960.22	957.07
	14	4	6.000	5							4	4	963.39	957.95
	15	5	6.000	5							3	3	954.26	951.89
	16	1	12.000	5							0	0		
	17	2	12.000	5							0	0		
	18	3	12.000	5							0	0		
	19	4	12.000	5							0	0		
	20	5	12.000	5							0	0		
	21	1	24.000	5							0	0		
	22	2	24.000	5							0	0		
	23	3	24.000	5							0	0		
	24	4	24.000	5							0	0		
	25	5	24.000	5							0	0		
	26	1	47.000	5							0	0		
	27	2	47.000	5							0	0		
	28	3	47.000	5							0	0		
	29	4	47.000	5							0	0		
	30	5	47.000	5							0	0		
	31	1	93.900	5							0	0		
	32	2	93.900	5							0	0		
	33	3	93.900	5							0	0		
	34	4	93.900	5							0	0		
	35	5	93.900	5							0	0		

Comments: Seacor,04-1424-076 (0500395)

CAH 10/19/05

Reviewed by:_____

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/20/2005	Test ID:	0500395s11	Sample ID:	SW11
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

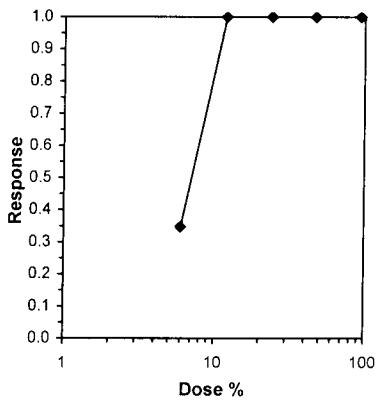
Conc-%	1	2	3	4	5
D-Control	1.0000	0.8000	0.8000	1.0000	1.0000
B-Control	0.8000	0.8000	1.0000	1.0000	0.8000
6	0.8000	0.2000	0.6000	0.8000	0.6000
12	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000
47	0.0000	0.0000	0.0000	0.0000	0.0000
93.9	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
D-Control	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5				2	25
B-Control	0.8800	0.1095	1.2024	1.1071	1.3453	10.848	5					
*6	0.6000	0.2449	0.8900	0.4636	1.1071	29.520	5	2.744	1.860	0.2439	10	25
*12	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25
*24	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25
*47	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25
*93.9	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5				25	25

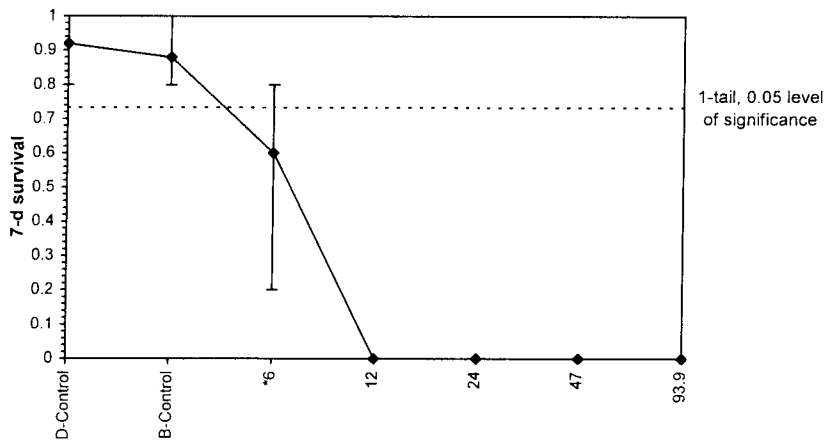
Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.89457		0.781		-1.1196	1.41801
F-Test indicates equal variances (p = 0.20)	4.05755		23.1545			
The control means are not significantly different (p = 0.58)	0.57735		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences	0.18699	0.20763	0.32402	0.04302	0.02528	1, 8

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-34.8%	7.0533	6.0391	8.2378 % (v/v)



Dose-Response Plot



statistical comparisons were against the D-control only.

CAM Nov 9/05

Reviewed by:_____

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/20/2005	Test ID:	0500395s11	Sample ID:	SW11
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment C(	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	1.1980	0.6280	1.0060	0.9560	1.1800
B-Control	0.8260	1.1300	1.1220	0.8620	0.6140
6	0.6240	0.1600	0.6300	1.0880	0.4740
12	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000
47	0.0000	0.0000	0.0000	0.0000	0.0000
93.9	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9936	0.2301	0.9936	0.6280	1.1980	23.157	5				0.9936	1.0000
B-Control	0.9108	0.2181	0.9108	0.6140	1.1300	23.949	5					
*6	0.5952	0.3350	0.5952	0.1600	1.0880	56.289	5	2.192	1.860	0.3380	0.5952	0.5990
*12	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000
*24	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000
*47	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000
*93.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000

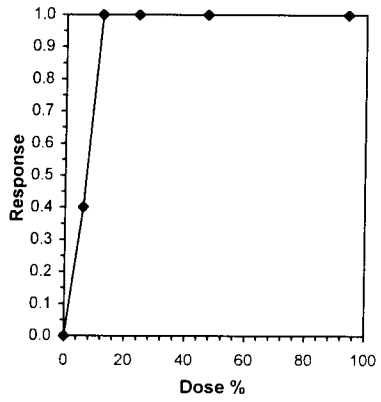
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95785	0.781	0.01141	0.35347
F-Test indicates equal variances (p = 0.48)	2.12028	23.1545		
The control means are not significantly different (p = 0.58)	0.58397	2.306		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.33799	0.34017	0.39681	0.08259	0.05974	1, 8

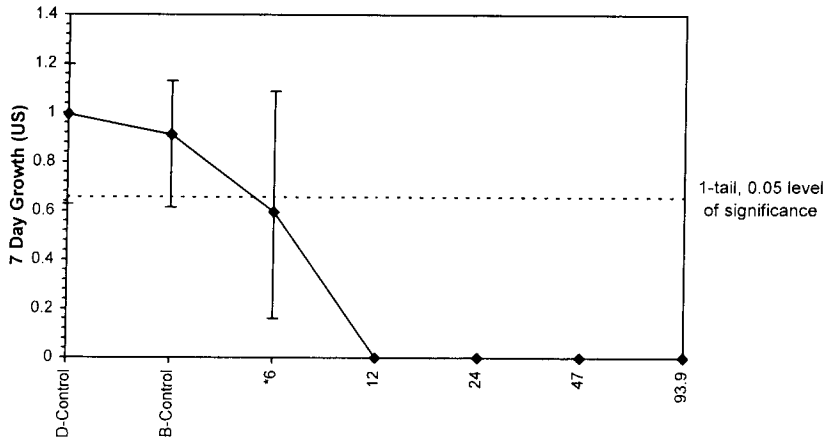
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05*	0.7482	1.0258	0.3577	7.6584	4.2711	
IC10*	1.4964	1.1473	0.7153	7.8401	2.7538	
IC15*	2.2446	1.2919	1.0730	8.0218	1.7985	
IC20*	2.9928	1.3800	1.4307	8.2035	1.2356	
IC25*	3.7410	1.4031	1.7884	8.3852	0.7916	
IC40*	5.9855	1.2800	2.8614	8.9304	-0.0004	
IC50	6.9919	1.1683	3.7237	9.4408	-0.3111	% (v/v)

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Statistical comparisons were against the D-control only.

Nov 9/05

Reviewed by:_____

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seaton
EVS Project No. 04-1424-076
EVS Work Order No. 500395

EVS Analysts TS, REM, AXF, SxB
Test Initiation Date 20-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	SW12	SW12	SW12
Amount Received	1x20L	→	
Date Collected	17-Sept-05	→	
Date Received	19-Sept-05	→	
Temperature (°C)	20.0 ② 20.0	20.0	20.0
pH	8.0 ② 8.0	8.1	8.2
DO (mg/L)	8.4 ② 7.8	7.6	7.6
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	28 ② 28	29	29
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

② aerated for 5 min.

DILUTION/CONTROL WATER (initial water quality)
Water Type Filtered UV sterilized seawater
Temperature (°C) 19.0
pH 7.8
Dissolved Oxygen (mg/L) 7.8
Salinity 28 ppt

TEST SPECIES INFORMATION
Source ABS
Date Received 20-Sept-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 20-Sept-05
7-d survival LC50 93 (~~77~~ 79-110) ~~mg~~ µg/L Cu
7-d growth IC50 87 (62-115) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 127 ± 33 mg/L Cu, CV = 13%
7-d growth IC50 130 ± 49 mg/L Cu CV = 19%

TEST CONDITIONS
Temperature Range (°C) 19.0 - 20.5
pH Range 7.6 - 8.2
Dissolved Oxygen Range (mg/L) 6.0 - 7.8
Salinity (ppt) 28-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	50	100	>100 (nc)		
Growth		~~100~~ 50	~~200~~ 750		>100 (nc)	>100 (nc)

Other nc: not calculable

Data Verified By C. McPherson
Date Verified 10/19/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Sancor
EVS Project No. 04-1424-07C
EVS Work Order No. 0500395

Sample ID Sw 12
Test Initiation Date/Time 20-Sep 05 / 1600h
Source/Date Received ABS / 20-Sep 05

Concentration %(v/v)	Temperature (°C)													
	0	1		2		3		4		5		6		7
Sw Control	20.0	20.0	20.0	19.5	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.5
6.25	19.0	20.0	20.0	19.5	20.0	19.5	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.5
12.5	19.5	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.5	20.0	20.5
25	19.5	19.5	20.0	20.0	20.0	20.0	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.5
~~49~~ 50	19.5	20.0	20.0	20.0	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.5	20.0	20.5
~~98.4~~ 100	20.0	20.0	20.0	20.0	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.5	20.0	20.5
Tech. Initials	REH JXS	JM	SXB	JM	JM	JM	JM	AKF	AKF	AKF	AKF	JM	JM	SXB

Concentration %(v/v)	pH													
	0	1		2		3		4		5		6		7
Sw Control	7.8	7.6	7.8	7.7	7.9	7.6	7.9	7.6	7.9	7.6	7.9	7.7	8.0	7.7
6.25	7.8	7.6	7.8	7.8	7.9	7.6	7.9	7.6	7.9	7.6	7.9	7.8	8.0	7.8
12.5	7.8	7.6	7.9	~~7.8~~ 7.9	7.9	7.6	7.8	7.6	7.8	7.7	7.9	7.8	8.0	7.8
25.0	7.8	7.7	7.9	7.8	7.9	7.8	8.0	7.8	7.9	7.7	8.0	7.8	8.0	7.8
~~49~~ 50	7.9	7.7	8.0	~~7.8~~ 7.8	8.0	7.8	8.2	7.8	8.1	7.8	8.1	7.8	8.0	7.8
~~98.4~~ 100	8.0	7.6	8.1	7.7	8.1	7.8	~~8.4~~ 8.2	7.8	8.1	7.8	8.2	7.9	8.1	7.9
Tech. Initials	REH JXS	JM	SXB	SXB	JM	JM	JM	AKF	AKF	AKF	AKF	JM	JM	SXB

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH IA 030301

Comments

Test Set Up By JXS, REH Data Verified By C. McPherson Date Verified NOV 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Spacer
EVS Project No. 04-0[illegible]1424-076
EVS Work Order No. 0500395

Sample ID SW12
Test Initiation Date/Time 20 Sep 05 / 1000h
Source/Date Received ABS / 20 Sep 05

Concentration % (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
SW (Control)	28	30	29	29	29	29	30	30
6.25	28	30	29	29	29	29	30	30
12.5	28	30	29	29	29	29	30	30
25.0	28	30	29	29	29	29	29	30
~~25~~ 50	28	30	29	29	29	29	29	30
~~50~~ 100	28	29	29	29	29	29	29	30
Tech. Initials	RET JXS	SXB	7-7	7-7	AXF	AXF	7-7	SXB

Concentration % (v/v)	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW (Control)	7.8	6.4	7.6	6.6	7.6	6.2	7.6	6.3	7.6	6.2	7.6	6.2	7.6	6.6
6.25	7.8	6.2	7.6 SXB	6.4	7.6	6.4	7.6	6.3	7.6	6.3	7.6	6.4	7.6	6.4
12.5	7.8	6.2	7.6	6.2	7.6	6.6	7.6	6.5	7.6	6.6	7.6	6.4	7.6	6.4
25	7.8	6.4	7.6	6.0	7.6	6.8	7.6	6.7	7.6	6.7	7.7	6.6	7.6	6.4
~~25~~ 50	7.8	6.4	7.6 SXB	6.2	7.6	6.8	7.7	6.8	7.7	6.8	7.7	6.4	7.6	6.8
~~50~~ 100	7.8	6.6	7.7	6.2	7.6	6.6	7.7	6.8	7.7	6.7	7.7	6.6	7.6	6.7
Tech. Initials	RET JXS	7-7	SXB	7-7	7-7	7-7	7-7	AXF	AXF	AXF	AXF	7-7	7-7	SXB

WQ Instruments Used: Salinity II A03303 DO II A14

Comments

Test Set Up By JXS - RET Data Verified By C. Alderson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Sencor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID SW12
Test Species/Batch *Atherinops affinis* /20Sep05
Test Initiation Date/Time 20-Sep05 / 1600h
No. of Organisms/Volume 5/200mL

Concentration %(v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW Control	A	T39	5	5	5	5	5	5	5	
	B	40	5	5	5	5	5	5	5	
	C	41	5	5	5	5	5	5	5	
	D	42	5	5	5	5	5	5	5	
	E	43	5	5	5	5	5	5	5	
6.25	A	44	5	5	5	5	5	4	4	
	B	45	5	5	5	5	5	5	5	
	C	46	5	5	5	5	5	5	5	
	D	47*	5	5	5	5	5	5	5	
	E	48	5	5	5	5	5	5	5	
12.5	A	49	5	5	5	5	5	5	5	
	B	50	5	5	5	4	4	4	4	
	C	51*	5	5	5	5	5	5	5	
	D	52	5	5	5	5	5	5	5	
	E	53	5	5	5	5	5	5	5	
25	A	54	5	5	5	5	5	5	5	
	B	55	5	5	5	5	4	4	4	
	C	56	5	5	5	5	5	5	5	
	D	57	5	5	5	5	5	5	5	
	E	58	5	5	5	5	5	5	5	
Technician Initials		SXB	SXB	AXF	AXF	AXF	AKL	JD	SXB	

Sample Description clear, colorless
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID SW12
Test Species/Batch *Atherinops affinis* /20Sep05
Test Initiation Date/Time 20-Sep05 /1600h
No. of Organisms/Volume 5/200mL

Concentration (%v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
50.0	A	T59	5	5	5	5	4	4	4	
	B	60	5	5	5	5	5	5	5	
	C	61	5	5	5	5	5	4	4	
	D	62	5	5	5	5	5	5	5	
	E	63	5	5	5	5	5	5	5	
100	A	64	5	5	5	5	4	4	4	
	B	65	5	5	5	5	5	4	4	
	C	66*	5	4	4	4	4	4	4	
	D	67	5	5	5	5	4	4	4	
	E	68	5	5	4	4	4	4	4	
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials		SKB	SKB	AXF	AXF	AXF	AXF	TZ	SKB	

Sample Description clear, colorless.
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500395
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Atherinops affinis*
TEST INITIATION DATE: 20-Sep-05

Pan No.	Rep	Sample ID: SW-12 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
T39	A	Control	5	5	5	954.18	959.35	SXB/MFB	
T40	B		5	5	5	952.56	958.12	SXB/MFB	
T41	C		5	5	5	952.19	957.9	SXB/MFB	
T42	D		5	5	5	958.76	965.7	SXB/MFB	
T43	E		5	5	5	954.42	959.44	SXB/MFB	
T44	A	6.25	5	4	4	951.43	955.41	SXB/MFB	
T45	B		5	5	5	953.23	958.17	SXB/MFB	
T46	C		5	5	5	953.02	959.27	SXB/MFB	
T47	D		5	5	5	953.07	958.43	SXB/MFB	
T48	E		5	5	5	953.35	957.78	SXB/MFB	
T49	A	12.5	5	5	5	953.92	959.78	SXB/MFB	
T50	B		5	4	4	953.83	957.45	SXB/MFB	
T51	C		5	5	5	959.08	964.72	SXB/MFB	
T52	D		5	5	5	951.6	956.04	SXB/MFB	
T53	E		5	5	5	953.57	958.31	SXB/MFB	
T54	A	25	5	5	5	951.91	957.46	SXB/MFB	
T55	B		5	4	4	951.72	955.32	SXB/MFB	
T56	C		5	5	5	955.29	959.32	SXB/MFB	
T57	D		5	5	5	955.55	960.67	SXB/MFB	
T58	E		5	5	5	960.91	965.85	SXB/MFB	
T59	A	50	5	4	4	952.91	957.94	SXB/MFB	
T60	B		5	5	5	964.08	967.89	SXB/MFB	
T61	C		5	4	4	958.79	962.4	SXB/MFB	
T62	D		5	5	5	956.05	962.39	SXB/MFB	
T63	E		5	5	5	962.58	967.08	SXB/MFB	
T64	A	100	5	4	4	959.31	963.79	SXB/MFB	
T65	B		5	4	4	958.01	962.08	SXB/MFB	
T66	C		5	4	4	950.83	955.92	SXB/MFB	
T67	D		5	4	4	955.02	959.64	SXB/MFB	
T68	E		5	4	4	957.22	962.35	SXB/MFB	
	(d)	6.25 D					958.4	SXB	
	(d)	12.5 C					964.7	SXB	
	(d)	100 C					955.86	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CdM
Nov. 9/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: SW12
Start Date: 9/20/2005 End Date: 9/27/2005

Test ID: 0500395s12
Protocol: EPAW 95-EPA West Coast
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	959.35	954.18
	2	2	D-Control	5							5	5	958.12	952.56
	3	3	D-Control	5							5	5	957.9	952.19
	4	4	D-Control	5							5	5	965.7	958.76
	5	5	D-Control	5							5	5	959.44	954.42
	11	1	6.250	5							4	4	955.41	951.43
	12	2	6.250	5							5	5	958.17	953.23
	13	3	6.250	5							5	5	959.27	953.02
	14	4	6.250	5							5	5	958.43	953.07
	15	5	6.250	5							5	5	957.78	953.35
	16	1	12.500	5							5	5	959.78	953.92
	17	2	12.500	5							4	4	957.45	953.83
	18	3	12.500	5							5	5	964.72	959.08
	19	4	12.500	5							5	5	956.04	951.6
	20	5	12.500	5							5	5	958.31	953.57
	21	1	25.000	5							5	5	957.46	951.91
	22	2	25.000	5							4	4	955.32	951.72
	23	3	25.000	5							5	5	959.32	955.29
	24	4	25.000	5							5	5	960.67	955.55
	25	5	25.000	5							5	5	965.85	960.91
	26	1	50.000	5							4	4	957.94	952.91
	27	2	50.000	5							5	5	967.89	964.08
	28	3	50.000	5							4	4	962.4	958.79
	29	4	50.000	5							5	5	962.39	956.05
	30	5	50.000	5							5	5	967.08	962.58
	31	1	100.000	5							4	4	963.79	959.31
	32	2	100.000	5							4	4	962.08	958.01
	33	3	100.000	5							4	4	955.92	950.83
	34	4	100.000	5							4	4	959.64	955.02
	35	5	100.000	5							4	4	962.35	957.22

Comments: Seacor,04-1424-076 (0500395)

10/3/05

ToxCalc 5.0

Reviewed by:_____

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/20/2005	Test ID:	0500395s12	Sample ID:	SW12
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

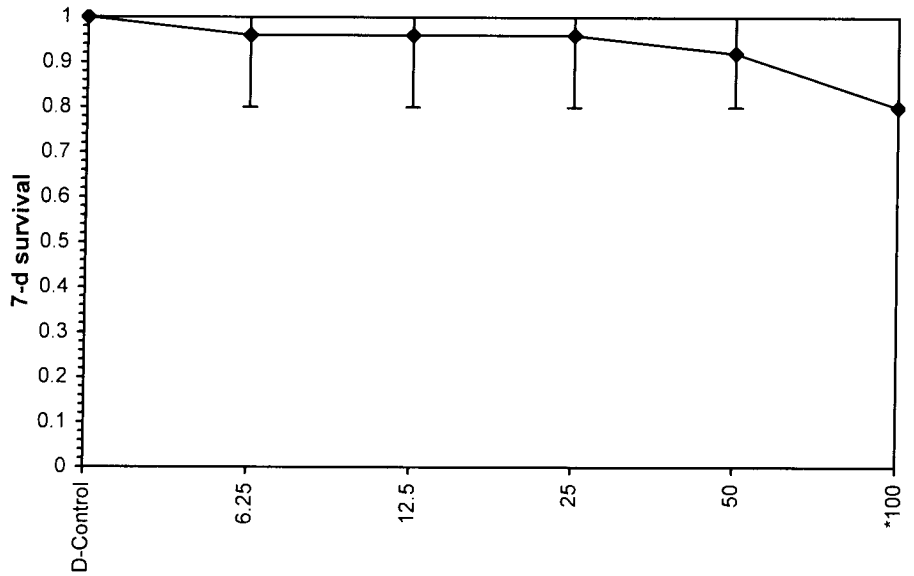
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
6.25	0.8000	1.0000	1.0000	1.0000	1.0000
12.5	1.0000	0.8000	1.0000	1.0000	1.0000
25	1.0000	0.8000	1.0000	1.0000	1.0000
50	0.8000	1.0000	0.8000	1.0000	1.0000
100	0.8000	0.8000	0.8000	0.8000	0.8000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
6.25	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5		
12.5	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00
25	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00
50	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5	22.50	17.00
*100	0.8000	0.0000	1.1071	1.1071	1.1071	0.000	5	15.00	17.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.78117	0.888	-1.3638	1.17803
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.35)	1	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	50	100	70.7107	2

Dose-Response Plot



Reviewed by: Nov 9/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/20/2005	Test ID:	0500395s12	Sample ID:	SW12
End Date:	9/27/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500395)				

Conc-%	1	2	3	4	5
D-Control	1.0340	1.1120	1.1420	1.3880	1.0040
6.25	0.7960	0.9880	1.2500	1.0720	0.8860
12.5	1.1720	0.7240	1.1280	0.8880	0.9480
25	1.1100	0.7200	0.8060	1.0240	0.9880
50	1.0060	0.7620	0.7220	1.2680	0.9000
100	0.8960	0.8140	1.0180	0.9240	1.0260

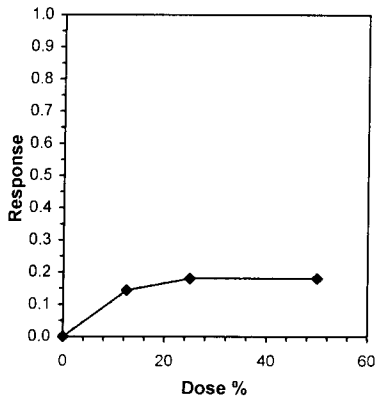
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.1360	0.1516	1.1360	1.0040	1.3880	13.346	5				1.1360	1.0000
6.25	0.9984	0.1749	0.9984	0.7960	1.2500	17.523	5					
12.5	0.9720	0.1827	0.9720	0.7240	1.1720	18.793	5	1.436	2.230	0.2547	0.9720	0.8556
25	0.9296	0.1613	0.9296	0.7200	1.1100	17.352	5	1.807	2.230	0.2547	0.9306	0.8192
50	0.9316	0.2193	0.9316	0.7220	1.2680	23.542	5	1.789	2.230	0.2547	0.9306	0.8192
100	0.9356	0.0887	0.9356	0.8140	1.0260	9.478	5					

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.96627		0.868		0.36923	-0.7262
Bartlett's Test indicates equal variances (p = 0.90)					0.59732		11.3449			
The control means are not significantly different (p = 0.22)					1.32908		2.306			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	50	>50		2	0.25472	0.22423	0.0478	0.03262	0.26148	3, 16

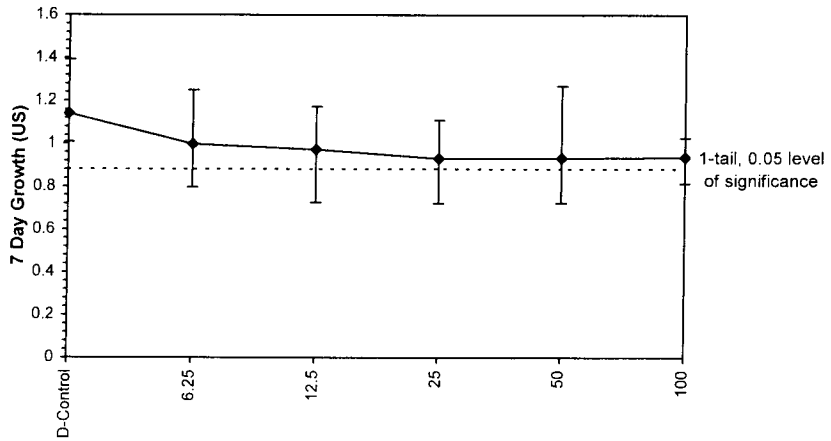
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05*	4.329			
IC10*	8.659			
IC15	14.432			
IC20	>50			
IC25	>50			
IC40	>50			
IC50	>50			

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500395

EVS Analysts TES. REM. AXF. SxB
Test Initiation Date 20-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	05-Cu-002 (100 mg/L Cu)		
Amount ~~Received~~ Prep'd	1 L		
Date ~~Collected~~ Prep'd	27-June-05		
Date ~~Received~~ Exp'd	27-Dec-05		
Temperature (°C)			
pH			
DO (mg/L)			
Conductivity (µmhos/cm)			
Salinity (ppt)			
Ammonia (mg/L N)			
Chlorine (mg/L Cl)			
Other			

DILUTION/CONTROL WATER (initial water quality)
Water Type Filtered UV sterilized seawater
Temperature (°C) 19.0
pH 7.8
Dissolved Oxygen (mg/L) 7.8
Salinity 28 ppt

TEST SPECIES INFORMATION
Source ABS
Date Received 20-Sept-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 20-Sept-05
7-d survival LC50 93 (~~77~~ 79-110) ~~mg~~/L Cu
7-d growth IC50 87 (62-115) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 127 ± 33 mg/L Cu, CV = 13%
7-d growth IC50 130 ± 49 mg/L Cu CV = 19%

TEST CONDITIONS
Temperature Range (°C) 19.0 - 20.5
pH Range 7.5 - 8.0
Dissolved Oxygen Range (mg/L) ~~6.0~~ 6.7 - 7.8
Salinity (ppt) 28 - 30
Photoperiod (L:D h) 16 : 8
Aeration Provided? No
Other —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
				93 (79-110) Cu		
Survival	~~mg/L~~	56	100	~~93.3 (79.4-109.6)~~		
Growth	Cu	56	100		~~87.1 (62.4-115.4)~~ Cu 87 (62-115)	~~58.5 (13.3-78.4)~~ Cu 58 (13-78)

Other

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Secor

Sample ID Cu Reftox

EVS Project No. 04-1424-07C

Test Initiation Date/Time 20-Sep 05 / 1600h

EVS Work Order No. 0500395

Source/Date Received ABS / 20-Sep 05

Concentration ~~ug/L~~ ug/L Cu	Temperature (°C)													
	0	1		2		3		4		5		6		7
Control	19.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.1	20.0	20.0
32	19.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
56	19.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.5	20.0	20.0
100	19.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.5
180	19.0	19.5	20.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.5
320	19.0	20.0	20.0	—										
Tech. Initials	REH SXS	TH	TH	TH	TH	TH	TH	AXF	AXF	AXF	AXF	TH	TH	SXS

~~ug/L~~ Cu Concentration	pH													
	0	1		2		3		4		5		6		7
Control	7.8	7.6	7.8	7.6	7.9	7.5	7.9	7.5	7.9	7.6	7.9	7.7	8.0	SXS 7.87 SXS
32	7.8	7.6	7.8	7.7	7.9	7.6	7.9	7.5	7.9	7.5	7.9	7.7	8.0	7.87
56	7.8	7.5	7.8	7.6	7.9	7.7	7.9	7.6	7.9	7.6	7.9	7.7	8.0	7.7
100	7.8	7.6	7.8	7.6	7.9	7.7	7.9	7.6	7.9	7.6	7.9	7.8	8.0	7.7
180	7.8	7.6	7.9	7.6	7.9	~~7.7~~ 7.5 TH	7.9	7.7	7.9	7.6	7.9	7.8	8.0	7.8
320	7.8	7.6	7.9	—										
Tech. Initials	REH SXS	TH	TH	TH	TH	AXF TH	AXF TH	AXF	AXF	AXF	AXF	TH	TH	SXS

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II A 030301

Comments

Test Set Up By JXS, REH Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Spacor
EVS Project No. 04-0[illegible]1424-076
EVS Work Order No. 0500395

Sample ID Cu Reftox
Test Initiation Date/Time 20 Sep 05 / 1600h
Source/Date Received ABS / 20 Sep 05

Concentration ug/L Cu	Salinity (ppt)							
	0	1	2	3	4	5	6 D	7
Control	28	~~28~~ 30	29	29	29	29	30	30
32	28	~~28~~ 30	29	29	29	29	30	30
56	28	~~28~~ 30	29	29	29	29	30	30 ~~30~~ 3x8
100	28	~~28~~ 30	29	29	29	29	30	30
180	28	~~28~~ 30	29	29	29	29	30	30
320	28	~~28~~ 30						
Tech. Initials	RTH JXS				AXF	AXF		SXS

Concentration ug/L Cu	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
Control	7.8	6.4	7.6	6.4	7.6	7.0	7.6	7.1	7.6	7.0	7.6	6.8	7.6	6.8
32	7.8	6.2	7.6	6.6	7.6	6.4	7.2	6.6	7.6	6.5	7.6	6.4	7.6	6.6
56	7.8	6.2	7.6	6.5	7.6	6.5	7.2	6.6	7.6	6.5	7.6	6.4	7.6	6.6
100	7.8	6.0	7.6	6.0	7.6	6.5	7.2	6.8	7.6	6.6	7.6	6.6	7.6	6.6
180	7.8	6.4	7.6	6.2	7.6	6.8	7.2	6.8	7.6	6.7	7.6	6.4	7.6	6.4
320	7.8	6.6	7.6											
Tech. Initials	RTH JXS							AXF	AXF	AXF	AXF			SXS

WQ Instruments Used: Salinity II A 0303 03 DO II A14
Comments D used I-A-0501

Test Set Up By JXS, RTH Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID Cu Reftox
Test Species/Batch Atherinops affinis /20Sep05
Test Initiation Date/Time 20-Sep05 /1600h
No. of Organisms/Volume 5/200mL

Concentration ug/L Cu	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
Control	A	T 69	5	5	5	5	5	5	5	
	B	70	5	5	5	5	5	5	5	
	C	71	5	5	5	5	5	5	5	
	D	72	5	5	5	5	5	5	5	
	E	73	5	5	5	5	5	5	5	
32	A	74	5	5	5	4	4	4	4	
	B	75	5	5	5	5	5	5	5	
	C	76	5	5	5	5	5	5	5	
	D	77	5	5	5	5	5	5	5	
	E	78*	5	5	5	5	5	5	5	
56	A	79	5	5	5	3	3	3	3	
	B	80	5	5	5	5	5	5	5	
	C	81	5	5	5	5	5	5	5	
	D	82	5	5	5	5	5	5	5	
	E	83	5	5	5	5	5	5	5	
100	A	84	5	3	2	2	2	2	2	
	B	85	3	2	2	2	2	2	1	
	C	R 86	5	4	4	3	3	3	3	
	D	R 87*	5	2	1	1	1	1	1	
	E	R 88	5	3	2	2	2	2	2	
Technician Initials		SXB	TT	SXB	TT	AXF	AXF	TT	SXB	

Sample Description Colorless, clear
Data Verified By C. McPhee Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500395

Sample ID Cu Reftox
Test Species/Batch Atherinops affinis /20Sep05
Test Initiation Date/Time 20-Sep05 /1600h
No. of Organisms/Volume 5/200mL

Concentration ug/L Cu	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
180 ~~Control~~ R89	A		4	2	1	0	—	—	—	
	B		3	1	0	—	—	—	—	
	C	R89	3	1	1	1	1	1	1	
	D	R90	2	2	2	2	2	2	2	
	E		2	0	—	—	—	—	—	
320	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		1							
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
56 R88	A									
	B									
	C									
	D									
	E									
100 R91	A									
	B									
	C									
	D									
	E									
Technician Initials		BXB	TH	SXB	AXF	AXF	AXF	TH	SXB	

Sample Description clear. colorless
Data Verified By C. McPherson Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

Scalo7

~~Golder - Morrow(Van Wharves)~~

PROJECT # 04-1421-076
WORK ORDER # 0500395
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Atherinops affinis*
TEST INITIATION DATE: 20-Sep-05

Pan No.	Rep	Sample ID: Cu ug/L	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
T69	A	Control	5	5	5	953.54	960.15	SXB / MFB	
T70	B		5	5	5	954.55	958.77	SXB / MFB	
T71	C		5	5	5	950.79	956.63	SXB / MFB	
T72	D		5	5	5	955.47	959.79	SXB / MFB	
T73	E		5	5	5	947.2	952.39	SXB / MFB	
T74	A	32	5	4	4	953.73	956.55	SXB / MFB	
T75	B		5	5	5	952.72	957.58	SXB / MFB	
T76	C		5	5	5	954.72	961.03	SXB / MFB	
T77	D		5	5	5	962.9	969.05	SXB / MFB	
T78	E		5	5	5	952.91	958.15	SXB / MFB	
T79	A	56	5	3	3	955.96	958.11	SXB / MFB	
T80	B		5	5	5	950.74	954.95	SXB / MFB	
T81	C		5	5	5	954.78	959.34	SXB / MFB	
T82	D		5	5	5	956.11	960.74	SXB / MFB	
T83	E		5	5	5	953.62	958.28	SXB / MFB	
T84	A	100	5	2	2	957.25	959.23	SXB / MFB	
T85	B		5	1	1	957.49	958.07	SXB / MFB	
R86	C		5	3	3	952.29	955.78	SXB / MFB	
R87	D		5	1	1	959.12	960.67	SXB / MFB	
R88	E		5	2	2	953.71	956.25	SXB / MFB	
	A	180	5						
	B		5						
R89	C		5	1	1	952.15	952.57	SXB / MFB	
R90	D		5	2	2	952.52	954.71	SXB / MFB	
	E		5						
	A	320	5						
	B		5						
	C		5						
	D		5						
	E		5						
	(d)	32 E					958.14	SXB	
	(d)	100 D					960.6	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CAM Nov 7/05

QA/QC review: _____

Test: LF-Larval Fish Growth and Survival Test | Test ID: rtaacu48
Species: AA-Atherinops affinis | Protocol: EPAW 95-EPA West Coast
Sample ID: REF-Ref Toxicant | Sample Type: CU-Copper
Start Date: 9/20/2005 End Date: 9/28/2005 | Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	960.15	953.54
	2	2	D-Control	5							5	5	958.77	954.55
	3	3	D-Control	5							5	5	956.63	950.79
	4	4	D-Control	5							5	5	959.79	955.47
	5	5	D-Control	5							5	5	952.39	947.2
	6	1	32.000	5							4	4	956.55	953.73
	7	2	32.000	5							5	5	957.58	952.72
	8	3	32.000	5							5	5	961.03	954.72
	9	4	32.000	5							5	5	969.05	962.9
	10	5	32.000	5							5	5	958.15	952.91
	11	1	56.000	5							3	3	958.11	955.96
	12	2	56.000	5							5	5	954.95	950.74
	13	3	56.000	5							5	5	959.34	954.78
	14	4	56.000	5							5	5	960.74	956.11
	15	5	56.000	5							5	5	958.28	953.62
	16	1	100.000	5							2	2	959.23	957.25
	17	2	100.000	5							1	1	958.07	957.49
	18	3	100.000	5							3	3	955.78	952.29
	19	4	100.000	5							1	1	960.67	959.12
	20	5	100.000	5							2	2	956.25	953.71
	21	1	180.000	5							ʊ			
	22	2	180.000	5							ɒ			
	23	3	180.000	5							1	1	952.57	952.15
	24	4	180.000	5							2	2	954.71	952.52
	25	5	180.000	5							0	0	0	0
	26	1	320.000	5							0	0	0	0
	27	2	320.000	5							0	0	0	0
	28	3	320.000	5							0	0	0	0
	29	4	320.000	5							0	0	0	0
	30	5	320.000	5							0	0	0	0

Comments: Seacor, 0500395

Reviewed by: CHM Nov 7/05

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	9/20/2005	Test ID:	rtaacu48	Sample ID:	REF-Ref Toxicant
End Date:	9/28/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor, 0500395				

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
32	0.8000	1.0000	1.0000	1.0000	1.0000
56	0.6000	1.0000	1.0000	1.0000	1.0000
100	0.4000	0.2000	0.6000	0.2000	0.4000
180	0.0000	0.0000	0.2000	0.4000	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

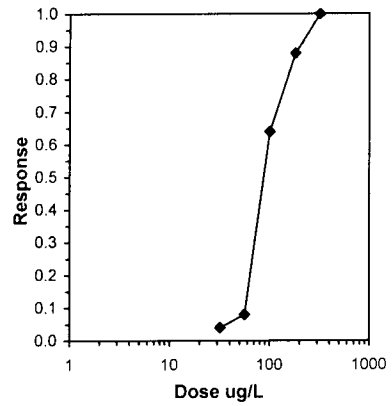
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5			0	25
32	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00	1	25
56	0.9200	0.1789	1.2534	0.8861	1.3453	16.384	5	25.00	17.00	2	25
*100	0.3600	0.1673	0.6366	0.4636	0.8861	27.958	5	15.00	17.00	16	25
*180	0.1200	0.1789	0.3650	0.2255	0.6847	56.537	5	15.00	17.00	22	25
320	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5			25	25

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92868	0.888	-0.3211	0.97478
Equality of variance cannot be confirmed				

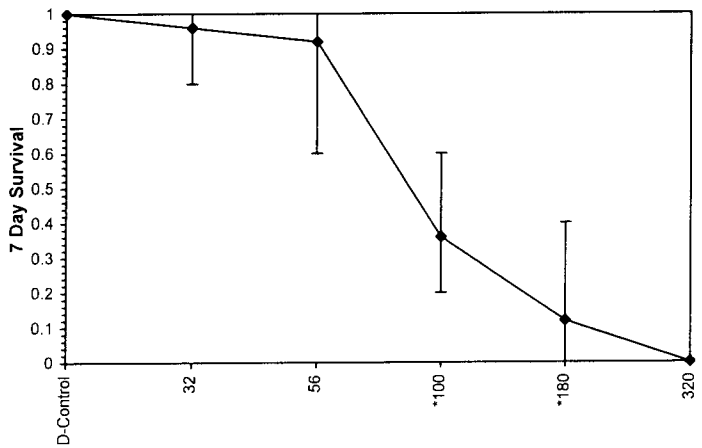
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	56	100	74.8331	

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%				
5.0%	93.279	79.382	109.610	
10.0%	91.884	78.498	107.553	
20.0%	89.155	74.047	107.345	
Auto-4.0%	93.297	79.414	109.607	ug/L Cu



Dose-Response Plot



CSM 11/07/05

Reviewed by:_____

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/20/2005	Test ID:	rtaacu48	Sample ID:	REF-Ref Toxicant
End Date:	9/28/2005	Lab ID:	BCEVS-EVS Environment C(	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor, 0500395				

Conc-ug/L	1	2	3	4	5
D-Control	1.3220	0.8440	1.1680	0.8640	1.0380
32	0.5640	0.9720	1.2620	1.2300	1.0480
56	0.4300	0.8420	0.9120	0.9260	0.9320
100	0.3960	0.1160	0.6980	0.3100	0.5080
180	0.0000	0.0000	0.0840	0.4380	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

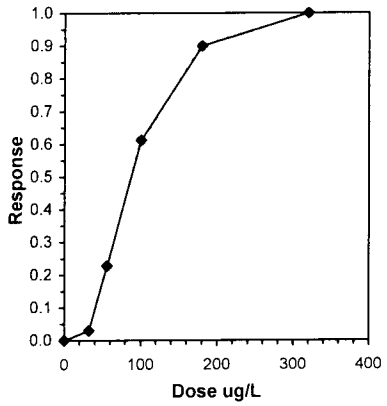
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.0472	0.2031	1.0472	0.8440	1.3220	19.397	5				1.0472	1.0000
32	1.0152	0.2800	1.0152	0.5640	1.2620	27.580	5	0.227	2.300	0.3247	1.0152	0.9694
56	0.8084	0.2146	0.8084	0.4300	0.9320	26.542	5	1.692	2.300	0.3247	0.8084	0.7720
*100	0.4056	0.2174	0.4056	0.1160	0.6980	53.604	5	4.545	2.300	0.3247	0.4056	0.3873
*180	0.1044	0.1900	0.1044	0.0000	0.4380	181.994	5	6.679	2.300	0.3247	0.1044	0.0997
320	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97053	0.888	-0.3957	-0.1734
Bartlett's Test indicates equal variances (p = 0.95)	0.68372	13.2767		

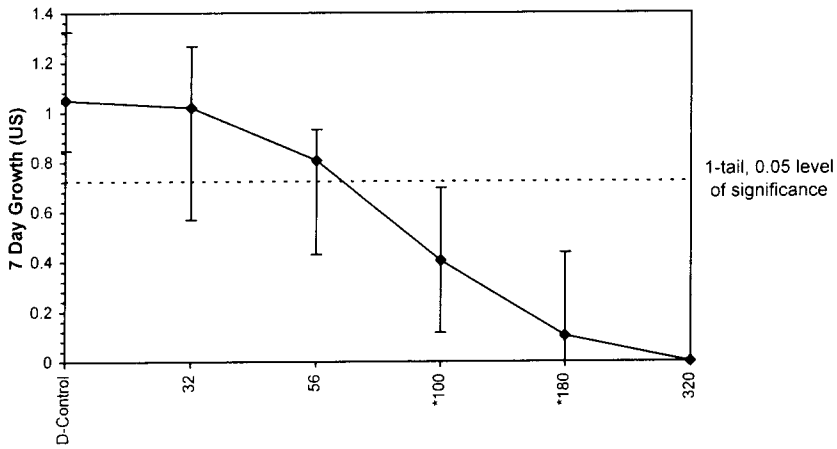
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	56	100	74.8331		0.32466	0.31003	0.83777	0.04981	3.5E-06	4, 20

Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew	
IC05	34.363	12.861	0.000	50.122	-0.3843	
IC10	40.439	11.726	0.000	66.939	-0.4603	
IC15	46.516	11.455	2.252	70.068	-0.5283	
IC20	52.593	10.791	7.717	74.427	-0.6415	
IC25	58.512	10.172	13.261	78.379	-0.7453	
IC40	75.671	8.879	43.455	97.366	-0.2284	
IC50	87.110	9.202	62.380	115.355	0.2335	ug/L Cu



Dose-Response Plot



Reviewed by: CAM Nov 7/05

Summary of Results for the 7-d Topsmelt
Survival and Growth Toxicity Test

Client	Seacor Environment Engineering	**Species**	*Atherinops affinis*
Project No.	04-1424-076	**Initiation Date**	27-Sep-05
WO No.	0500456		

Sample ID:	**BH 16**					
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**			**Growth (mg) Mean ± SD[1]**		
D-control	100.0	±	0.0	1.28	±	0.06
Brine-control[3]	100.0	±	0.0	1.38	±	0.14
0.001	100.0	±	0.0	1.13	±	0.61
0.0032	96.0	±	8.9	1.32	±	0.07
0.010	92.0	±	17.9	1.45	±	0.32
0.032	92.0	±	11.0	1.45	±	0.28
0.1	95.0	±	11.2	1.34	±	0.20
5.0	0.0	±	0.0 *	0.00	±	0.00 *
NOEC	0.1			0.1		
LOEC	5.0			5.0		
LC50 (95% CL)[2]	0.49 (0.36 - 0.67)			NA		
IC25 (95% CL)[2]	NA			1.33 (0.59 -1.33)		
IC50 (95% CL)[2]	NA			2.55 (2.06 -2.55)		

Sample ID:	**BH 20**					
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**			**Growth (mg) Mean ± SD[1]**		
D-control	96.0	±	8.9	1.29	±	0.30
0.001	100.0	±	0.0	1.44	±	0.21
0.003	100.0	±	0.0	1.45	±	0.25
0.01	92.0	±	11.0	1.28	±	0.27
0.032	100.0	±	0.0	1.23	±	0.16
0.1	100.0	±	0.0	1.60	±	0.21
4.6	0.0	±	0.0 *	0.00	±	0.00 *
NOEC	0.1			0.1		
LOEC	4.6			4.6		
LC50 (95% CL)[2]	0.64 (0.55 - 0.73)			NA		
IC25 (95% CL)[2]	NA			1.17 (0.60 - 1.24)		
IC50 (95% CL)[2]	NA			2.31 (1.93 - 2.36)		

Sample ID:	**SW 9**					
Concentration (%v/v)	**Survival (%) Mean ± SD[1]**			**Growth (mg) Mean ± SD[1]**		
D-control	96.0	±	8.9	1.10	±	0.20
0.01	96.0	±	8.9	1.11	±	0.20
0.032	92.0	±	11.0	1.22	±	0.37
0.1	100.0	±	0.0	1.17	±	0.14
0.32	96.0	±	8.9	1.07	±	0.16
1.0	96.0	±	8.9	1.32	±	0.31
5.6	100.0	±	0.0	1.31	±	0.42
NOEC	5.6			5.6		
LOEC	>5.6			>5.6		
LC50 (95% CL)[2]	>5.6			NA		
IC25 (95% CL)[2]	NA			>5.6		
IC50 (95% CL)[2]	NA			>5.6		

CAM Nov 9/05

Sample ID:	SW 11					
Concentration (%v/v)	Survival (%) Mean ± SD[1]			Growth (mg) Mean ± SD[1]		
D-control	100.0	±	0.0	1.24	±	0.15
0.01	100.0	±	0.0	1.12	±	0.24
0.032	100.0	±	0.0	1.58	±	0.93
0.1	100.0	±	0.0	1.17	±	0.22
0.32	100.0	±	0.0	1.15	±	0.28
1.0	100.0	±	0.0	1.16	±	0.12
6.2	88.0	±	26.8	0.99	±	0.32
NOEC	6.2			6.2		
LOEC	>6.2			>6.2		
LC50 (95% CL)[2]	>6.2			NA		
IC25 (95% CL)[2]	NA			>6.2		
IC50 (95% CL)[2]	NA			>6.2		

[1] n=5 replicates per treatment

[2] CL = Confidence limits

[3] Brine control applies to all samples tested

nc = not calculable

NA = Not applicable

Toxicity testing was carried out in accordance with applicable test methodologies and/or standards of practice. Our liability is limited solely to the cost of re-testing in the event of non-compliance with such test specifications or standards of practice. Golder/EVS accepts no responsibility or liability for the interpretation or use of these testing results by others, nor for any delay, loss, damage or interruptions of testing, collection, preparation, and delivery of samples or test results resulting from events or circumstances beyond our control.

Cdfl
Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500456

EVS Analysts TJS, MFB, SxB
Test Initiation Date 27-Sep-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	B1 16	–	–
Amount Received	1x20L	–	–
Date Collected	17-Sept-05	–	–
Date Received	19-Sept-05	–	–
Temperature (°C)	19.5 ② 19.5	–	–
pH	3.2 ② 4.1	–	–
DO (mg/L)	8.2 ② 7.4	–	–
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	14 ② 29	–	–
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

② Salinity adjusted 30±2ppt.

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered, UV sterilized seawater
Temperature (°C) 19.5
pH 7.9
Dissolved Oxygen (mg/L) 7.8
Salinity 29

TEST SPECIES INFORMATION

Source ABS
Date Received 27-Sep-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 27-Sep-05
7-d survival LC50 121 (111-133) mg/L Cu
7-d growth IC50 125 (112-135) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 125 ± 40 mg/L Cu, CV = 16%
7-d growth IC50 124 ± 43 mg/L Cu, CV = 17%

TEST CONDITIONS

Temperature Range (°C) 19.5 - 21.0
pH Range 7.8 - 8.0
Dissolved Oxygen Range (mg/L) ~~29-30~~ 6.2-7.9
Salinity (ppt) 29-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	0.1	5	0.49 (0.36-0.67)		
Growth		0.1	5		2.55 (2.06-2.55)	1.33 (0.59-1.33)

Other

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Sencor
EVS Project No. 04-1424-076
EVS Work Order No. 0500456

Sample ID BM16
Test Initiation Date/Time 27-Sept-05 / 1530h
Source/Date Received ABS / 27-Sept-05

% (v/v) Concentration	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW CTL	20.0	21.0	20.0	20.5	20.0	19.5	20.0	20.5	20.0	19.5	20.0	20.0	20.0	20.5
Brine CTL	20.0	20.0	20.0	20.5	20.0	20.5	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.5
0.001	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.5
0.0032	19.5	20.5	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
0.01	19.5	20.0	20.0	20.5	20.0	19.5	20.0	20.5	20.5	20.0	20.0	19.5	20.0	20.0
0.032	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	19.5	20.0	19.5	20.0	20.0
0.1	19.5	20.5	20.0	20.5	20.0	20.0	20.0	21.0	20.0	20.0	20.0	20.0	20.0	20.0
Tech. Initials	MFB	MFB		MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB			

% (v/v) Concentration	pH													
	0	1		2		3		4		5		6		7
SW CTL	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.8
Brine CTL	8.0	7.8	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.8
0.001	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.8	7.9	7.8
0.0032	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.7
0.01	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.8
0.032	7.9	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8
0.1	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.8	7.8
Tech. Initials	MFB	MFB		MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB			

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-03030 1
Comments

Test Set Up By TM, MFB, SxB Data Verified By C. Mathison Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor | Sample ID BH16

EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05 / 1530 h

EVS Work Order No. 500456 | Source/Date Received ABS / 27-Sept-05

% (v/v) Concentration	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Seawater CTL	29	29	29	29	29	29	29	30
Brine-CTL	29	29	29	29	29	29	29	30
0.001	29	29	29	29	29	29	29	30
0.0032	29	29	29	29	29	29	29	30
0.01	29	29	29	29	29	29	29	30
0.032	29	29	29	29	29	29	29	30
0.1	29	29	29	29	29	29	29	30
Tech. Initials	MFB	〃	MFB	MFB	MFB	MFB	〃	〃

% (v/v) Concentration	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW CTL	7.8	6.9	7.8	6.9	7.7	6.8	7.8	6.6	7.6	6.2	7.6	7.0	7.6	7.0
Brine-CTL	7.8	6.8	7.8	6.7	7.7	6.8	7.8	6.7	7.5	6.4	7.6	6.8	7.6	7.0
0.001	7.8	7.0	7.8	6.8	7.7	7.0	7.8	6.6	7.6	6.4	7.6	6.6	7.6	6.8
0.0032	7.7	7.1	7.8	6.7	7.7	6.8	7.8	6.6	7.6	6.4	7.6	6.6	7.6	6.8
0.01	7.6	6.8	7.8	6.8	7.7	7.0	7.8	6.7	7.6	6.5	7.6	6.5	7.6	6.8
0.032	7.7	7.0	7.8	7.0	7.7	6.9	7.9	6.6	7.6	6.4	7.6	6.4	7.6	6.6
0.1	7.8	6.9	7.8	6.9	7.7	6.9	7.8	6.5	7.5	6.5	7.6	6.2	7.6	6.8
Tech. Initials	MFB	MFB	〃	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	〃	〃	〃

WQ Instruments Used: Salinity T-A-030303 | DO T-A-14

Comments

Test Set Up By TR, MFB SKB | Data Verified By C. McAllister | Date Verified 10/9/05

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor

EVS Project No. 04-1424-076

EVS Work Order No. 508456

Sample ID BH16

Test Initiation Date/Time 27-Sept-05 / 1530 ~~1500~~ h

Source/Date Received ABS/27-Sept-05

% (v/v) Concentration	Temperature (°C)													
	0	1		2		3		4		5		6		7
~~6.0~~ 5.0	20.0	20.0	20.0											
Tech. Initials	TM	TM	TM											

% (v/v) Concentration	pH													
	0	1		2		3		4		5		6		7
~~6.0~~ 5.0	6.9	7.1	7.0	~~X~~	6.9									
Tech. Initials	TM	MFB	TM											

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-050301

Comments

Test Set Up By TM, MFB, SNB Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500456

Sample ID BH16
Test Initiation Date/Time 27-Sept-05 / 1530 ~~1700~~
Source/Date Received ABS / 27-Sept-05

% (v/v) Concentration	Salinity (ppt)							
	0	1	2	3	4	5	6	7
5.0	29	29						
Tech. Initials	TM	TM						

% (v/v) Concentration	Dissolved Oxygen (mg/L)													
	0		1		2		3		4		5		6	7
5.0	7.7	7.0	7.7											
Tech. Initials	TM	TM	TM											

WQ Instruments Used: Salinity II-A-030303 DO II-A-14

Comments

Test Set Up By SRB. MFBKS Data Verified By C. McEwen Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Seacor
EVS Project No.: 04-1424-076
EVS Work Order No.: 0500456

Sample ID: BH16
Test Species/Batch: A. affinis / 27-Sept-05
Test Initiation Date/Time: 27-~~Sept~~ Sept-05 / 1530h
No. of Organisms/Volume: 5 / 200 mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW CTL	A	5121	5	5	5	5	5	5	5	
	B	122	5	5	5	5	5	5	5	
	C	123	5	5	5	5	5	5	5	
	D	124	5	5	5	5	5	5	5	
	E	125	5	5	5	5	5	5	5	
Brine-CTL	A	126	5	5	5	5	5	5	5	
	B	127	5	5	5	5	5	5	5	
	C	128	5	5	5	5	5	5	5	
	D	129	5	5	5	5	5	5	5	
	E	130	5	5	5	5	5	5	5	
0.001	A	131	5	5	5	5	5	5	5	
	B	132	5	5	5	5	5	5	5	
	C	133	5	5	5	5	5	5	5	
	D	134	5	5	5	5	5	5	5	
	E	135	5	5	5	5	5	5	5	
0.0032	A	136	5	5	5	5	5	5	5	
	B	137	5	5	5	5	5	4	4	
	C	138	5	5	5	5	5	5	5	
	D	139	5	5	5	5	5	5	5	
	E	140	5	5	5	5	5	5	5	
Technician Initials		MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	

Sample Description: clear, colorless
Data Verified By: C. McPherson
Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Spectra
EVS Project No.: 04-1424-076
EVS Work Order No.: 0500456

Sample ID: BH16
Test Species/Batch: A. affinis / 27-Sept-05
Test Initiation Date/Time: 27-~~Sept~~ Sept-05 / 1530h
No. of Organisms/Volume: 5 / 200 mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
0.01	A	5141	5	5	5	5	5	5	5	
	B	142	3	3	3	3	3	3	3	
	C	143	5	5	5	5	5	5	5	
	D	144	5	5	5	5	5	5	5	
	E	145	5	5	5	5	5	5	5	
0.032	A	146	5	5	5	5	5	5	5	
	B	147	5	5	4	4	4	4	4	
	C	148	5	5	5	5	5	5	4 MB	
	D	149	5	5	5	5	5	5	5	
	E	150	5	5	5	5	5	5	5	
0.1	A	151	5	5	5	5	5	5	5	(1) Fish found stuck to side of beaker 8 mm above water level
	B	152	5	5	5	5	5	5	5	
	C	153	5	5	5	5	5	5	5	
	D	154	5	5	5	5	5	5	5	
	E	155	5	5	5	4(1)	4	3	3	
5	A		0	—	—	—	—	—	—	
	B		0	—	—	—	—	—	—	
	C		0	—	—	—	—	—	—	
	D		0	—	—	—	—	—	—	
	E		0	—	—	—	—	—	—	
Technician Initials		MFB	SXB	MFB	MFB	MFB	MFB	TM	MFB TM	

Sample Description: clear. colorless
Data Verified By: C. McPherson
Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500456
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES *Atherinops affinis*
TEST INITIATION DATE: 27-Sep-05

Pan No.	Rep	Sample ID: BH16 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
S 121	A	D-Control	5	5	5	1100.47	1107.37	SXB	
122	B		5	5	5	1077.68	1083.94	SXB	
123	C		5	5	5	1081.76	1088.03	SXB	
124	D		5	5	5	1076.62	1082.67	SXB	
125	E		5	5	5	1079.33	1085.75	SXB	
126	A	Brine-Control	5	5	5	1077.83	1085.44	SXB	
127	B		5	5	5	1082.55	1090.32	SXB	
128	C		5	5	5	1081.26	1087.66	SXB	
129	D		5	5	5	1081.52	1087.70	SXB	
130	E		5	5	5	1090.63	1097.28	SXB	
131	A	0.001	5	5	5	1091.14	1099.48	SXB	
132	B		5	5	5	1088.69	1096.00	SXB	
133	C		5	5	5	1082.84	1083.30	SXB	
134	D		5	5	5	1090.11	1096.41	SXB	
135	E		5	5	5	1092.66	1098.44	SXB	
136	A	0.0032	5	5	5	1082.42	1089.12	SXB	
137	B		5	4	4	1087.44	1093.44	SXB	
138	C		5	5	5	1092.49	1099.43	SXB	
139	D		5	5	5	1088.89	1095.71	SXB	
140	E		5	5	5	1093.65	1100.24	SXB	
141	A	0.01	5	5	5	1089.03	1097.04	SXB	
142	B		5	3	3	1096.00	1100.59	SXB	
143	C		5	5	5	1102.29	1111.03	SXB	
144	D		5	5	5	1097.53	1104.57	SXB	
145	E		5	5	5	1108.61	1116.49	SXB	
146	A	0.032	5	5	5	1104.35	1113.80	SXB	
147	B		5	4	4	1106.88	1113.62	SXB	
148	C		5	4	4	1099.33	1104.91	SXB	
149	D		5	5	5	1085.39	1092.88	SXB	
150	E		5	5	5	1092.90	1100.01	SXB	
151	A	0.1	5	5	5	1098.26	1105.03	SXB	
152	B		5	5	5	1097.41	1104.68	SXB	
153	C		5	5	5	1097.88	1104.92	SXB	
154	D		5	5	5	1099.27	1106.68	SXB	
155	E		4	3	3	1068.22	1072.19	SXB	one fish was killed while feeding
	A	5	5	0					
	B		5	0					
	C		5	0					
	D		5	0					
	E		5	0					
S123	(d)		5	5	5	1081.76	1087.65	SXB	
S132	(d)		5	5	5	1088.69	1095.63	SXB	
S143	(d)		5	5	5	1102.29	1110.23	SXB	
S149	(d)		5	5	5	1085.39	1092.43	SXB	
S151	(d)		5	5	5	1098.26	1104.72	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CAM Nov 9/05

Test: LF-Larval Fish Growth and Survival Test | Test ID: 0500456b16
Species: AA-Atherinops affinis | Protocol: EPAW 95-EPA West Coast
Sample ID: BH16 | Sample Type: GW-groundwater
Start Date: 9/27/2005 End Date: 10/4/2005 | Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	1107.37	1100.47
	2	2	D-Control	5							5	5	1083.94	1077.68
	3	3	D-Control	5							5	5	1088.03	1081.76
	4	4	D-Control	5							5	5	1082.67	1076.62
	5	5	D-Control	5							5	5	1085.75	1079.33
	6	1	B-Control	5							5	5	1085.44	1077.83
	7	2	B-Control	5							5	5	1090.32	1082.55
	8	3	B-Control	5							5	5	1087.66	1081.26
	9	4	B-Control	5							5	5	1087.70	1081.52
	10	5	B-Control	5							5	5	1097.28	1090.63
	11	1	0.001	5							5	5	1099.48	1091.14
	12	2	0.001	5							5	5	1096.00	1088.69
	13	3	0.001	5							5	5	1083.30	1082.84
	14	4	0.001	5							5	5	1096.41	1090.11
	15	5	0.001	5							5	5	1098.44	1092.66
	16	1	0.003	5							5	5	1089.12	1082.42
	17	2	0.003	5							4	4	1093.44	1087.44
	18	3	0.003	5							5	5	1099.43	1092.49
	19	4	0.003	5							5	5	1095.71	1088.89
	20	5	0.003	5							5	5	1100.24	1093.65
	21	1	0.010	5							5	5	1097.04	1089.03
	22	2	0.010	5							3	3	1100.59	1096.00
	23	3	0.010	5							5	5	1111.03	1102.29
	24	4	0.010	5							5	5	1104.57	1097.53
	25	5	0.010	5							5	5	1116.49	1108.61
	26	1	0.032	5							5	5	1113.80	1104.35
	27	2	0.032	5							4	4	1113.62	1106.88
	28	3	0.032	5							4	4	1104.91	1099.33
	29	4	0.032	5							5	5	1092.88	1085.39
	30	5	0.032	5							5	5	1100.01	1092.90
	31	1	0.100	5							5	5	1105.03	1098.26
	32	2	0.100	5							5	5	1104.68	1097.41
	33	3	0.100	5							5	5	1104.92	1097.88
	34	4	0.100	5							5	5	1106.68	1099.27
	35	5	0.100	4							3	3	1072.19	1068.22
	36	1	5.000	5							0	0		
	37	2	5.000	5							0	0		
	38	3	5.000	5							0	0		
	39	4	5.000	5							0	0		
	40	5	5.000	5							0	0		

Comments: Seacor,04-1424-076 (0500456)

Reviewed by: 11/9/05

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/27/2005	Test ID:	0500456b16	Sample ID:	BH16
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
B-Control	1.0000	1.0000	1.0000	1.0000	1.0000
0.001	1.0000	1.0000	1.0000	1.0000	1.0000
0.0032	1.0000	0.8000	1.0000	1.0000	1.0000
0.01	1.0000	0.6000	1.0000	1.0000	1.0000
0.032	1.0000	0.8000	0.8000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000	0.7500
5	0.0000	0.0000	0.0000	0.0000	0.0000

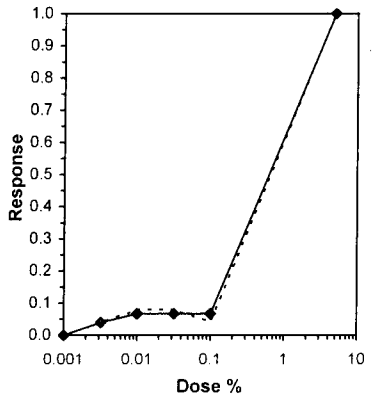
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5			0	25
B-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5				
0.001	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00	0	25
0.0032	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	16.00	1	25
0.01	0.9200	0.1789	1.2534	0.8861	1.3453	16.384	5	25.00	16.00	2	25
0.032	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5	22.50	16.00	2	25
0.1	0.9500	0.1118	1.2857	1.0472	1.3453	10.369	5	25.00	16.00	1	24
5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5			25	25

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.75661	0.9	-1.8943	3.58347
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.306		

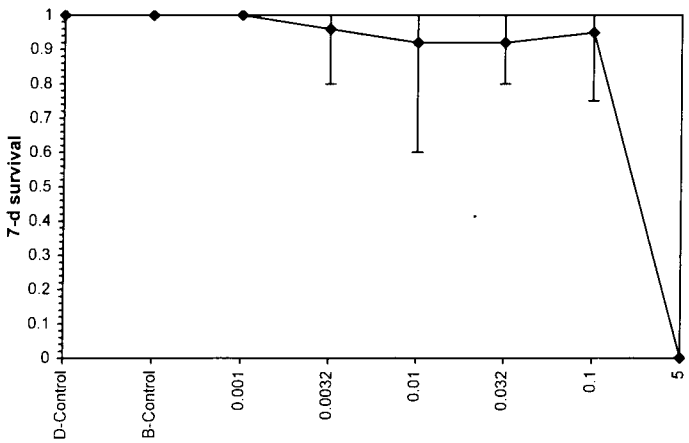
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.1	5	0.70711	1000

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%	0.4881	0.3550	0.6712	
5.0%	0.5840	0.4173	0.8174	
10.0%	0.6141	0.4880	0.7728	
20.0%	0.6141	0.4880	0.7728	
Auto-0.0%	0.4881	0.3550	0.6712	%(v/v)



Dose-Response Plot



statistical comparisons were against the D-control only.

CdM 10v9/05

Reviewed by:

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/27/2005	Test ID:	0500456b16	Sample ID:	BH16
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

Conc-%	1	2	3	4	5
D-Control	1.3800	1.2520	1.2540	1.2100	1.2840
B-Control	1.5220	1.5540	1.2800	1.2360	1.3300
0.001	1.6680	1.4620	0.0920	1.2600	1.1560
0.0032	1.3400	1.2000	1.3880	1.3640	1.3180
0.01	1.6020	0.9180	1.7480	1.4080	1.5760
0.032	1.8900	1.3480	1.1160	1.4980	1.4220
0.1	1.3540	1.4540	1.4080	1.4820	0.9925
5	0.0000	0.0000	0.0000	0.0000	0.0000

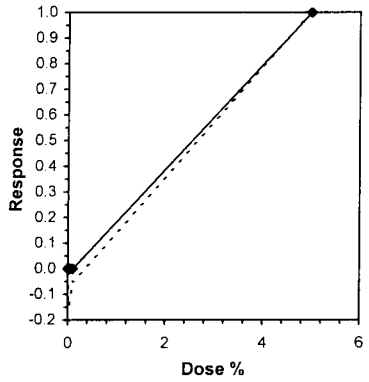
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
D-Control	1.2760	0.0638	1.2760	1.2100	1.3800	5.002	5			1.3282	1.0000
B-Control	1.3844	0.1446	1.3844	1.2360	1.5540	10.441	5				
0.001	1.1276	0.6113	1.1276	0.0920	1.6680	54.211	5	28.00	16.00	1.3282	1.0000
0.0032	1.3220	0.0730	1.3220	1.2000	1.3880	5.526	5	32.00	16.00	1.3282	1.0000
0.01	1.4504	0.3212	1.4504	0.9180	1.7480	22.143	5	35.00	16.00	1.3282	1.0000
0.032	1.4548	0.2822	1.4548	1.1160	1.8900	19.397	5	34.00	16.00	1.3282	1.0000
0.1	1.3381	0.1992	1.3381	0.9925	1.4820	14.887	5	34.00	16.00	1.3282	1.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5			0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.85647	0.9	-1.5718	5.18635
Bartlett's Test indicates unequal variances (p = 5.63E-04)	21.8342	15.0863		
The control means are not significantly different (p = 0.16)	1.53396	2.306		

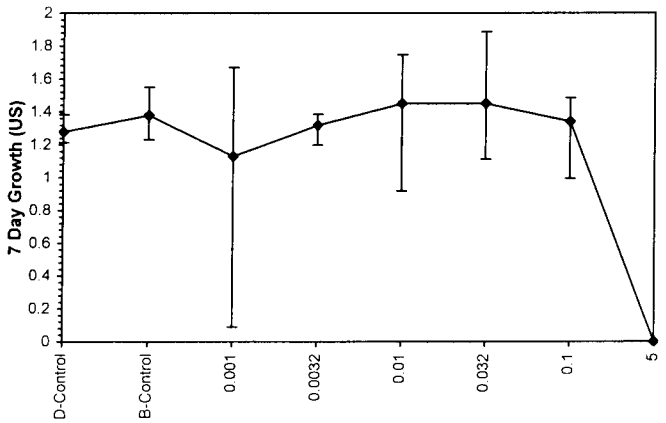
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.1	5	0.70711	1000

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	0.3450	0.1234	0.0000	0.3450	-0.4510
IC10	0.5900	0.1733	0.0000	0.5900	-1.0258
IC15	0.8350	0.1919	0.0000	0.8350	-1.4455
IC20	1.0800	0.1942	0.2912	1.0800	-1.8488
IC25	1.3250	0.1847	0.5855	1.3250	-1.9624
IC40	2.0600	0.1478	1.4684	2.0600	-1.9624
IC50	2.5500	0.1232	2.0570	2.5500	-1.9624



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: GHM Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500456

EVS Analysts JLS, MFB, SxB
Test Initiation Date 27-Sep-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	BH20	→	→
Amount Received	1x20L	–	–
Date Collected	17-Sept-05	–	–
Date Received	19-Sept-05	–	–
Temperature (°C)	19.5 → 19.5	–	–
pH	4.3 ① → 5.1	–	–
DO (mg/L)	10.2 ① → 7.8	–	–
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	5.3 ① → 29	–	–
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

① salinity adjusted to 30 ± 2 ppt

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered, UV sterilized seawater
Temperature (°C) 19.5
pH 7.9
Dissolved Oxygen (mg/L) 7.8
Salinity 29

TEST SPECIES INFORMATION

Source ABS
Date Received 27-Sep-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 27-Sep-05
7-d survival LC50 121 (111-133) mg/L Cu
7-d growth IC50 125 (112-135) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 125 ± 40 mg/L Cu, CV = 16%
7-d growth IC50 124 ± 43 mg/L Cu, CV = 17%

TEST CONDITIONS

Temperature Range (°C) 19.5-21.0
pH Range 6.9-8.0
Dissolved Oxygen Range (mg/L) 6.2-7.8
Salinity (ppt) 28-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	0.1	4.6	0.64 (0.6-0.7)		
Growth		0.1	4.6		2.3 (1.9-2.4)	1.2 (0.6-1.2)

Other

Data Verified By C. Tillerson
Date Verified Nov 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor | Sample ID BH 20

EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05 / 1530h

EVS Work Order No. 0500456 | Source/Date Received ABS / 27-Sept

% (v/v) Concentration	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW CTL	20.0	21.0	20.0	20.0	20.0	19.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
0.001	20.0	20.5	20.0	20.0	20.0	19.5	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.0
0.0032	20.0	20	20.0	20.5	20.0	19.5	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.5
0.01	20.0	20.5	20.0	20.5	20.0	20.0	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.5
0.032	20.0	20.0	20.0	20.0	20.0	19.5	20.0	20.5	20.0	20.0	20.5	20.5	20.0	20.5
0.1	20.0	20.0	20.0	20.0	20.0	19.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
4.6	20.0	20.0	20.0	—	20	—								
Tech. Initials	TH	MFB	TH	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TH	TH	TH

% (v/v) Concentration	pH													
	0	1		2		3		4		5		6		7
SW CTL	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.8	7.9	7.8
0.001	7.9	7.8	7.8	7.8	7.9	7.8	8.0	7.9	7.9	7.9	7.9	7.8	7.9	7.8
0.0032	7.9	7.8	7.8	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.8	7.9	7.8
0.01	7.9	7.8	7.8	7.9	7.9	7.8	8.0	7.9	7.8	7.9	7.9	7.8	7.9	7.8
0.032	7.9	7.8	7.8	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9	8.0
0.1	7.9	7.8	7.8	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0
4.6	6.9	7.5	7.3	—	7.9	—								
Tech. Initials	MFB/TH	MFB/TH	TH	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TH	TH	TH

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-030301

Comments

Test Set Up By TH, MFB | Data Verified By [signature] | Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor | Sample ID BH 20

EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05 / 1530h

EVS Work Order No. 500456 | Source/Date Received ABS / 27-Sept-05

% (v/v) Concentration	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Sea water CTL	29	29	28	29	29	29	29	30
0.001	29	29	28	29	29	29	29	30
0.0032	29	29	29	29	29	29	29	30
0.01	29	29	29	29	29	29	29	30
0.032	29	29	29	29	29	29	29	30
0.1	29	29	29	29	29	29	29	30
4.6	29	29	29	—	—	—	—	—
Tech. Initials	MFB	TM	MFB	MFB	MFB	MFB	TM	TM

% (v/v) Concentration	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW CTL	7.8	6.4	7.8	6.8	7.7	6.8	7.8	6.4	7.6	6.5	7.6	6.4	7.6	6.2
0.001	7.6	6.3	7.8	6.8	7.7	7.0	7.8	6.6	7.6	6.6	7.6	6.4	7.6	6.4
0.0032	7.7	6.6	7.8	6.7	7.7	6.8	7.8	6.5	7.6	6.4	7.6	6.2	7.6	6.4
0.01	7.6	6.8	7.8	6.8	7.7	6.8	7.8	6.6	7.6	6.4	7.6	6.2	7.6	6.5
0.032	7.7	6.8	7.8	6.9	7.7	6.8	7.8	6.8	7.6	6.4	7.6	6.2	7.6	6.6
0.1	7.7	6.6	7.8	7.0	7.7	6.6	7.8	6.6	7.6	6.3	7.6	6.4	7.6	6.6
4.6	7.7	6.2	7.8	—	—	—	—	—	—	—	—	—	—	—
Tech. Initials	TM	TM	TM	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TM	TM	TM

WQ Instruments Used: Salinity II-A-030303 | DO II-A-14

Comments

Test Set Up By TM, MFB | Data Verified By C. McPherson | Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0502456

Sample ID BH20
Test Species/Batch A. affinis / 27-Sept-05
Test Initiation Date/Time 27-Sept-05 /
No. of Organisms/Volume 5/200 ml

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW-CTL	A	S 21	5	5	5	4	4	4	4	
	B	22	5	5	5	5	5	5	5	
	C	23	5	5	5	5	5	5	5	
	D	24	5	5	5	5	5	5	5	
	E	25	5	5	5	5	5	5	5	
0.001	A	26	5	5	5	5	5	5	5	
	B	27	5	5	5	5	5	5	5	
	C	28	5	5	5	5	5	5	5	
	D	29	5	5	5	5	5	5	5	
	E	30	5	5	5	5	5	5	5	
0.0032	A	31	5	5	5	5	5	5	5	
	B	32	5	5	5	5	5	5	5	
	C	33	5	5	5	5	5	5	5	
	D	34	5	5	5	5	5	5	5	
	E	35	5	5	5	5	5	5	5	
0.01	A	36	5	5	5	5	5	4	4	
	B	37	5	5	5	5	5	5	5	
	C	38	4	4	4	#4	4	4	4	
	D	39	5	5	5	5	5	5	5	
	E	V40	5	5	5	5	5	5	5	
Technician Initials		MFB	SXR	SXR	MFB	MFB	MFB/AK	JM	MFB	

Sample Description clear. slightly yellowish in 4.6% (v/v)
Data Verified By C. McPherson Date Verified NOV 7/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0509

Sample ID BH 20
Test Species/Batch A. affinis / 27-Sept-05
Test Initiation Date/Time 27-Sept-05 1
No. of Organisms/Volume 5/200 ml

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
0.032	A	41	5	5	5	5	5	5	5	
	B	42	5	5	5	5	5	5	5	
	C	43	5	5	5	5	5	5	5	
	D	44	5	5	5	5	5	5	5	
	E	45	5	5	5	5	5	5	5	
0.1	A	46	5	5	5	5	5	5	5	
	B	47	5	5	5	5	5	5	5	
	C	48	5	5	5	5	~~5~~ 4①	4	4	
	D	49	5	5	5	5	5	5	5	
	E	50	5	5	5	5	5	5	5	
4.6	A		0	0	—	—	—	—	—	
	B		0	0	—	—	—	—	—	
	C		0	0	—	—	—	—	—	
	D		0	0	—	—	—	—	—	
	E		0	0	—	—	—	—	—	
	A									
	B									
	C									
	D									
	E									
Technician Initials			SXS	SXS	MFB	MFB	MFB / AXF	TZ	MFB	

Sample Description clear. slightly yellowish in 4.6% (v/v)
Data Verified By C. McPherson Date Verified Nov 9/05

① Dead fish found on side of beaker.

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT	Seacor	TEST TYPE:	7-d Survival and Growth
PROJECT #	04-1424-076	TEST SPECIES:	*Atherinops affinis*
WORK ORDER #	0500456	TEST INITIATION DATE:	27-Sep-05
BALANCE TYPE	Sartorius BP211D		

Pan No.	Rep	Sample ID: BH20 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
S 21	A	D-Control	5	4	4	954.38	958.54	SXB	
22	B		5	5	5	964.23	971.16	SXB	
23	C		5	5	5	962.76	971.15	SXB	
24	D		5	5	5	962.61	968.99	SXB	
25	E		5	5	5	961.48	967.85	SXB	
126	A	Brine-Control	5	5	5	1077.83	1085.44	SXB	
127	B		5	5	5	1082.55	1090.32	SXB	
128	C		5	5	5	1081.26	1087.66	SXB	
129	D		5	5	5	1081.52	1087.70	SXB	
130	E		5	5	5	1090.63	1097.28	SXB	
26	A	0.001	5	5	5	955.21	963.62	SXB	
27	B		5	5	5	964.42	971.56	SXB	
28	C		5	5	5	961.88	969.94	SXB	
29	D		5	5	5	962.43	968.25	SXB	
30	E		5	5	5	958.03	964.61	SXB	
31	A	0.0032	5	5	5	959.17	964.5	SXB	
32	B		5	5	5	963.56	971.79	SXB	
33	C		5	5	5	963.89	970.55	SXB	
34	D		5	5	5	958.73	966.96	SXB	
35	E		5	5	5	962.24	970.13	SXB	
36	A	0.01	5	4	4	960.86	966.53	SXB	
37	B		5	5	5	959.89	967.26	SXB	
38	C		5	4	4	964.08	968.7	SXB	
39	D		5	5	5	962.99	969.47	SXB	
40	E		5	5	5	959.61	967.57	SXB	
41	A	0.032	5	5	5	966.61	972.79	SXB	
42	B		5	5	5	966.46	973.68	SXB	
43	C		5	5	5	962.31	968.16	SXB	
44	D		5	5	5	957.88	962.89	SXB	
45	E		5	5	5	957.81	964.25	SXB	
46	A	0.1	5	5	5	954.32	960.86	SXB	
47	B		5	5	5	959.29	968.29	SXB	
48	C		4	4	4	956.89	962.72	SXB	one fish was killed while feeding
49	D		5	5	5	966.3	975.14	SXB	
50	E		5	5	5	966.33	974.77	SXB	
	A	4.6	5	0	0				
	B		5	0	0				
	C		5	0	0				
	D		5	0	0				
	E		5	0	0				
S22	(d)	Control B					970.68	SXB	
S43	(d)	0.032 C					968.01	SXB	
S50	(d)	0.1 E					974.67	SXB	

(d) - duplicate, pan reweighed after being placed in the oven and desiccated a second time.

CdM Nov 9/05

Test: LF-Larval Fish Growth and Survival Test | Test ID: 0500456b20
Species: AA-Atherinops affinis | Protocol: EPAW 95-EPA West Coast
Sample ID: BH20 | Sample Type: GW-groundwater
Start Date: 9/27/2005 End Date: 10/4/2005 | Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							4	4	958.54	954.38
	2	2	D-Control	5							5	5	971.16	964.23
	3	3	D-Control	5							5	5	971.15	962.76
	4	4	D-Control	5							5	5	968.99	962.61
	5	5	D-Control	5							5	5	967.85	961.48
	6	1	B-Control	5							5	5	1085.44	1077.83
	7	2	B-Control	5							5	5	1090.32	1082.55
	8	3	B-Control	5							5	5	1087.66	1081.26
	9	4	B-Control	5							5	5	1087.7	1081.52
	10	5	B-Control	5							5	5	1097.28	1090.63
	11	1	0.001	5							5	5	963.62	955.21
	12	2	0.001	5							5	5	971.56	964.42
	13	3	0.001	5							5	5	969.94	961.88
	14	4	0.001	5							5	5	968.25	962.43
	15	5	0.001	5							5	5	964.61	958.03
	16	1	0.003	5							5	5	964.5	959.17
	17	2	0.003	5							5	5	971.79	963.56
	18	3	0.003	5							5	5	970.55	963.89
	19	4	0.003	5							5	5	966.96	958.73
	20	5	0.003	5							5	5	970.13	962.24
	21	1	0.010	5							4	4	966.53	960.86
	22	2	0.010	5							5	5	967.26	959.89
	23	3	0.010	5							4	4	968.7	964.08
	24	4	0.010	5							5	5	969.47	962.99
	25	5	0.010	5							5	5	967.57	959.61
	26	1	0.032	5							5	5	972.79	966.61
	27	2	0.032	5							5	5	973.68	966.46
	28	3	0.032	5							5	5	968.16	962.31
	29	4	0.032	5							5	5	962.89	957.88
	30	5	0.032	5							5	5	964.25	957.81
	31	1	0.100	5							5	5	960.86	954.32
	32	2	0.100	5							5	5	968.29	959.29
	33	3	0.100	4							4	4	962.72	956.89
	34	4	0.100	5							5	5	975.14	966.3
	35	5	0.100	5							5	5	974.77	966.33
	36	1	4.600	5							0	0		
	37	2	4.600	5							0	0		
	38	3	4.600	5							0	0		
	39	4	4.600	5							0	0		
	40	5	4.600	5							0	0		

Comments: Seacor,04-1424-076 (0500456)

Reviewed by: CAM Nov 7/05

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/27/2005	Test ID:	0500456b20	Sample ID:	BH20
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

Conc-%	1	2	3	4	5
D-Control	0.8000	1.0000	1.0000	1.0000	1.0000
B-Control	1.0000	1.0000	1.0000	1.0000	1.0000
0.001	1.0000	1.0000	1.0000	1.0000	1.0000
0.0032	1.0000	1.0000	1.0000	1.0000	1.0000
0.01	0.8000	1.0000	0.8000	1.0000	1.0000
0.032	1.0000	1.0000	1.0000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000	1.0000
4.6	0.0000	0.0000	0.0000	0.0000	0.0000

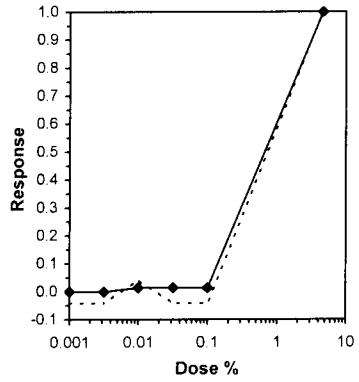
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5			1	25
B-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5				
0.001	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0	25
0.0032	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0	25
0.01	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5	25.00	16.00	2	25
0.032	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0	25
0.1	1.0000	0.0000	1.3398	1.3181	1.3453	0.907	5	28.00	16.00	0	24
*4.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5			25	25

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.74417	0.9	-1.4588	3.30086
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.35)	1	2.306		

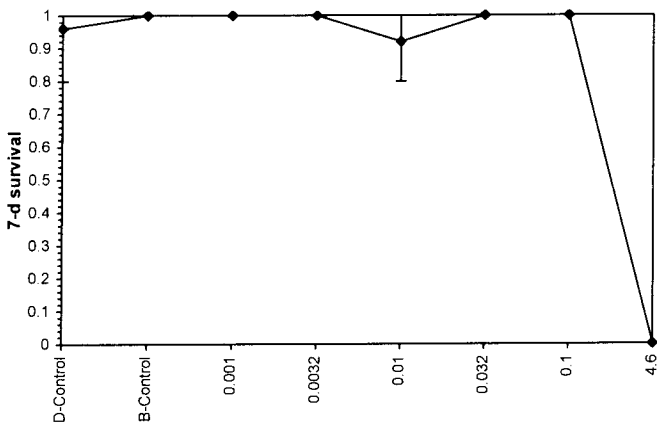
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.1	4.6	0.67823	1000

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%	0.6358	0.5532	0.7307	
5.0%	0.6607	0.6022	0.7249	
10.0%	0.6607	0.6022	0.7249	
20.0%	0.6607	0.6022	0.7249	
Auto-0.0%	0.6358	0.5532	0.7307	%(v/v)



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: AM Nov 9/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/27/2005	Test ID:	0500456b20	Sample ID:	BH20
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

Conc-%	1	2	3	4	5
D-Control	0.8320	1.3860	1.6780	1.2760	1.2740
B-Control	1.5220	1.5540	1.2800	1.2360	1.3300
0.001	1.6820	1.4280	1.6120	1.1640	1.3160
0.0032	1.0660	1.6460	1.3320	1.6460	1.5780
0.01	1.1340	1.4740	0.9240	1.2960	1.5920
0.032	1.2360	1.4440	1.1700	1.0020	1.2880
0.1	1.3080	1.8000	1.4575	1.7680	1.6880
4.6	0.0000	0.0000	0.0000	0.0000	0.0000

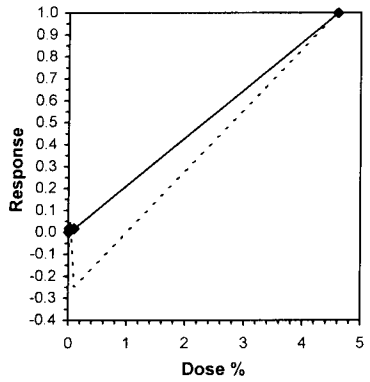
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.2892	0.3041	1.2892	0.8320	1.6780	23.590	5				1.3944	1.0000
B-Control	1.3844	0.1446	1.3844	1.2360	1.5540	10.441	5					
0.001	1.4404	0.2120	1.4404	1.1640	1.6820	14.721	5	-0.999	2.360	0.3571	1.3944	1.0000
0.0032	1.4536	0.2523	1.4536	1.0660	1.6460	17.354	5	-1.086	2.360	0.3571	1.3944	1.0000
0.01	1.2840	0.2661	1.2840	0.9240	1.5920	20.723	5	0.034	2.360	0.3571	1.3721	0.9840
0.032	1.2280	0.1618	1.2280	1.0020	1.4440	13.179	5	0.404	2.360	0.3571	1.3721	0.9840
0.1	1.6043	0.2130	1.6043	1.3080	1.8000	13.276	5	-2.082	2.360	0.3571	1.3721	0.9840
*4.6	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96214	0.9	-0.4148	-0.5855
Bartlett's Test indicates equal variances (p = 0.89)	1.66799	15.0863		
The control means are not significantly different (p = 0.54)	0.63218	2.306		

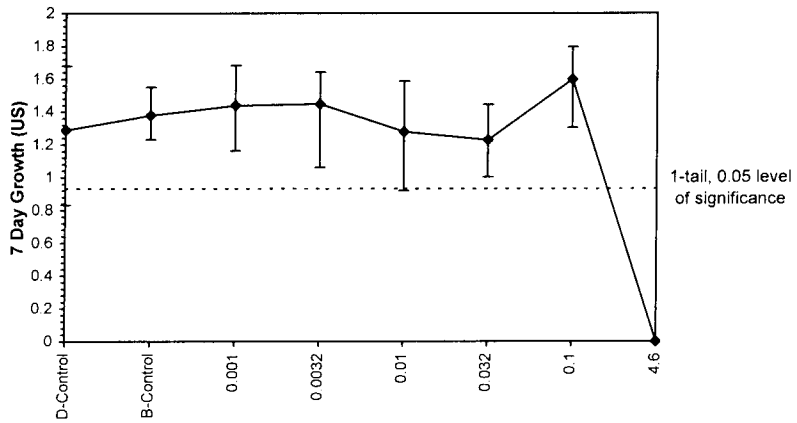
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.1	4.6	0.67823	1000	0.3571	0.27699	0.09988	0.05724	0.16274	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	0.2555	0.1413	0.0000	0.3458	-0.2285
IC10	0.4842	0.1754	0.0000	0.5697	-0.8755
IC15	0.7128	0.1758	0.0639	0.7936	-1.2074
IC20	0.9415	0.1672	0.3308	1.0176	-1.3118
IC25	1.1701	0.1568	0.5976	1.2415	-1.3118
IC40	1.8561	0.1254	1.3981	1.9132	-1.3118
IC50	2.3134	0.1045	1.9317	2.3610	-1.3118



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: CAM Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Seavor
EVS Project No. 04-1424-076
EVS Work Order No. 500456

EVS Analysts JxS, MFB, SxB
Test Initiation Date 27-Sept-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	SW9	–	–
Amount Received	1x20L	–	–
Date Collected	17-Sep-05	–	–
Date Received	19-Sep-05	–	–
Temperature (°C)	19.5 ⇒ 19.5	–	–
pH	5.8 ⇒ 6.3	–	–
DO (mg/L)	9.2 ⇒ 7.8	–	–
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	21 ⇒ 29	–	–
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

DILUTION/CONTROL WATER (initial water quality)
Salinity adjusted to 30.12 ppt
Water Type Filtered, UV sterilized seawater
Temperature (°C) 19.5
pH 7.9
Dissolved Oxygen (mg/L) 7.8
Salinity 29

TEST SPECIES INFORMATION
Source ABS
Date Received 27-Sep-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 27-Sep-05
7-d survival LC50 121 (111-133) mg/L Cu
7-d growth IC50 125 (112-135) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 125 ± 40 mg/L Cu, CV=16%
7-d growth IC50 124 ± 43 mg/L Cu, CV=17%

TEST CONDITIONS
Temperature Range (°C) 19.5-21.0
pH Range 7.4-8.0
Dissolved Oxygen Range (mg/L) 6.2-7.8
Salinity (ppt) 29-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	5.6	>5.6	>5.6		
Growth		5.6	>5.6		>5.6 (nc)	>5.6 (nc)

Other

Data Verified By C. McPherson
Date Verified 10/3/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor | Sample ID SWQ

EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05 / 1530h

EVS Work Order No. 0500456 | Source/Date Received ABS / 27-Sept-05

% (v/v) Concentration	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW CTL	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
0.01	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
0.032	19.5	21.0	20.0	20.5	20.0	20.5	20.0	21	20.0	20.0	20.0	20.0	20.0	20.0
0.1	19.5	21.0	20.0	21.0	20.0	21.0	20.0	20.5	20.5	20.0	20.5	20.0	20.0	20.5
0.32	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.0	20.5	20.5	20.0	20.0
1.0	19.5	21.0	20.0	21.0	20.0	20.5	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0
5.6	19.5	21.0	20.0	21.0	20.0	21.0	20.0	20.5	20.5	19.5	20.0	20.5	20.0	20.5
Tech. Initials	SXB	MFB		MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB			

% (v/v) Concentration	pH													
	0	1		2		3		4		5		6		7
SW CTL	7.9	7.8	~~7.9~~ 7.9	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9
0.01	7.8	7.8	7.8	7.8	7.9	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8
0.032	7.9	7.8	7.8	7.9	7.9	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8
0.1	7.9	7.8	7.8	7.9	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8
0.32	7.9	7.9	7.8	7.9	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8
1.0	7.9	7.8	7.8	7.8	7.9	7.8	7.9	7.8	7.8	7.9	7.9	7.9	7.9	7.8
5.6	7.6	7.8	7.6	7.8	7.7	7.8	7.6	7.9	7.5	7.8	7.6	7.8	7.8	7.8
Tech. Initials	MFB	MFB		MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB			

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-030301

Comments

Test Set Up By JKS, MFB, SXB Data Verified By [illegible] Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 500456

Sample ID SW9
Test Initiation Date/Time 27-Sept-05 / 1530h
Source/Date Received ABS / 27-Sept-05

% (v/v) Concentration	Salinity (ppt)							
	0	1	2	3	4	5	6	7
SeawaterCTL	29	29	29	29	29	29	29	30
0.01	29	29	29	29	29	29	29	30
0.032	29	29	29	29	29	29	29	30
0.1	29	29	29	29	29	29	29	30
0.32	29	29	29	29	29	29	29	30
1.0	29	29	29	29	29	29	29	30
5.6	29	29	29	29	29	29	29	30
Tech. Initials	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB

% (v/v) Concentration	Dissolved Oxygen (mg/L)													
	0		1		2		3		4		5		6	7
SW CTL	7.8	6.8	7.8	6.7	7.7	6.8	7.8	6.5	7.6	6.5	7.6	6.2	7.6	6.2
0.01	7.7	7.0	7.7	6.6	7.7	7.0	7.9	6.5	7.6	6.5	7.6	6.4	7.6	6.4
0.032	7.7	6.8	7.7	6.7	7.7	7.0	7.9	6.3	7.6	6.4	7.6	6.4	7.6	6.6
0.1	7.8	6.7	7.7	6.7	7.8	6.8	7.8	6.8	7.6	6.4	7.6	6.4	7.6	6.8
0.32	7.7	6.7	7.7	6.6	7.8	6.8	7.8	6.5	7.5	6.5	7.6	6.2	7.6	6.2
1.0	7.7	6.6	7.7	6.9	7.8	6.6	7.9	6.5	7.6	6.4	7.6	6.5	7.6	6.6
5.6	7.7	6.8	7.7	6.8	7.8	6.6	7.8	6.5	7.5	6.4	7.6	6.5	7.6	6.4
Tech. Initials	SXB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB

WQ Instruments Used: Salinity II-A-030303 DO II-A-14

Comments

Test Set Up By JR, MFB, SXB Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0502456

Sample ID SW9
Test Species/Batch A. affinis / 27-Sept-05
Test Initiation Date/Time 27-~~Sept~~ Sept-05 / 1530h
No. of Organisms/Volume 5 / 200 mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW-CTL	A	51	5	5	5	5	5	-	5	1 sick fish lying on bottom - moves when disturbed - Dead after water change.
	B	52	5	5	~~4~~ 4	4	4	4	4	
	C	53	5	5	5	5	5	-	5	
	D	54	5	5	5	5	5	5	5	
	E	55	5	5	5	5	5	5	5	
0.01	A	56	5	5	5	5	5	5	5	
	B	57	5	5	5	5	5	5	5	
	C	58	5	4	4	4	4	4	~~4~~ 4	
	D	59	5	5	5	5	5	5	5	
	E	60	5	5	5	5	5	5	5	
0.032	A	61	5	5	5	5	5	5	5	
	B	62	5	5	5	5	5	5	5	
	C	63	5	5	5	5	5	5	5	
	D	64	5	5	4	4	4	4	~~4~~ 4	
	E	65	5	5	4	4	4	4	4	
0.1	A	66	5	5	5	5	5	5	5	
	B	67	5	5	5	5	5	5	5	
	C	68	5	5	5	5	5	5	5	
	D	69	5	5	5	5	5	5	5	
	E	70	5	5	5	5	5	5	5	
Technician Initials		TH	MFB	MFB	MFB	MFB	MFB	TH	TH	

Sample Description Clear, colorless
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Seacor
EVS Project No.: 04-1424-076
EVS Work Order No.: 0509456

Sample ID: SW9
Test Species/Batch: A. affinis / 27-Sept-05
Test Initiation Date/Time: 27-~~AP~~ Sept-05 / 1530h
No. of Organisms/Volume: 5 / 200 ml

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
0.32	A	71	5	5	4	4	4	4	4	
	B	72	5	5	5	5	5	5	5	
	C	73	5	5	5	5	5	5	5	
	D	74	5	5	5	5	5	5	5	
	E	75	5	5	5	5	5	5	5	
1.0	A	76	5	~~4~~ 4	4	4	4	4	4	
	B	77	5	5	5	5	5	5	5	
	C	78	5	5	5	5	5	5	5	
	D	79	5	5	5	5	5	5	5	
	E	80	5	5	5	5	5	5	5	
5.6	A	81	5	5	5	5	5	5	5	
	B	82	5	5	5	5	5	5	5	
	C	83	5	5	5	5	5	5	5	
	D	84	5	5	5	5	5	5	5	
	E	85	5	5	5	5	5	5	5	
	A									
	B									
	C									
	D									
	E									
Technician Initials		JM	MFB	MFB	MFB	MFB	MFB	JM	JM	

Sample Description: clear, colorless
Data Verified By: C. McPherson
Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500456
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Atherinops affinis*
TEST INITIATION DATE: 27-Sep-05

Pan No.	Rep	Sample ID: SW9 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
S 51	A	Control	5	5	5	964.93	970.53	SXB	
52	B		5	4	4	958.98	962.87	SXB	
53	C		5	5	5	956.88	962.25	SXB	
54	D		5	5	5	1081.73	1088.22	SXB	
55	E		5	5	5	1077.57	1083.62	SXB	
126	A	Brine-Control	5	5	5	1077.83	1085.44	SXB	
127	B		5	5	5	1082.55	1090.32	SXB	
128	C		5	5	5	1081.26	1087.66	SXB	
129	D		5	5	5	1081.52	1087.70	SXB	
130	E		5	5	5	1090.63	1097.28	SXB	
56	A	0.01	5	5	5	1080.15	1085.06	SXB	
57	B		5	5	5	1079.76	1085.32	SXB	
58	C		5	4	4	1081.16	1085.57	SXB	
59	D		5	5	5	1083.77	1089.81	SXB	
60	E		5	5	5	1068.76	1075.69	SXB	
61	A	0.032	5	5	5	1069.06	1076.88	SXB	
62	B		5	5	5	1070.29	1078.59	SXB	
63	C		5	5	5	1067.44	1072.96	SXB	
64	D		5	4	4	1069.71	1074.31	SXB	
65	E		5	4	4	1073.01	1077.27	SXB	
66	A	0.1	5	5	5	1071.41	1076.78	SXB	
67	B		5	5	5	1070.32	1076.07	SXB	
68	C		5	5	5	1073.23	1078.89	SXB	
69	D		5	5	5	1071.58	1077.02	SXB	
70	E		5	5	5	1074.18	1081.31	SXB	
71	A	0.32	5	4	4	1075.04	1080.22	SXB	
72	B		5	5	5	1076.63	1081.59	SXB	
73	C		5	5	5	1069.31	1073.66	SXB	
74	D		5	5	5	1076.62	1083.08	SXB	
75	E		5	5	5	1078.91	1084.78	SXB	
76	A	1	5	4	4	1078.89	1082.88	SXB	
77	B		5	5	5	1077.11	1083.59	SXB	
78	C		5	5	5	1079.12	1086.95	SXB	
79	D		5	5	5	1079.03	1086.11	SXB	
80	E		5	5	5	958.45	966.01	SXB	
81	A	5.6	5	5	5	1117.22	1126.3	SXB	
82	B		5	5	5	1101.41	1109.33	SXB	
83	C		5	5	5	1106.39	1113.28	SXB	
84	D		5	5	5	1099.26	1103.67	SXB	
85	E		5	5	5	1101.9	1106.3	SXB	
S53	(d)						962.07	SXB	
S55	(d)						1083.4	SXB	
S78	(d)						1086.69	SXB	
S85	(d)						1106.11	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CAM 10/9/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: SW9
Start Date: 9/27/2005 End Date: 10/4/2005

Test ID: 0500456s9
Protocol: EPAW 95-EPA West Coast
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	970.53	964.93
	2	2	D-Control	5							4	4	962.87	958.98
	3	3	D-Control	5							5	5	962.25	956.88
	4	4	D-Control	5							5	5	1088.22	1081.73
	5	5	D-Control	5							5	5	1083.62	1077.57
	6	1	B-Control	5							5	5	1085.44	1077.83
	7	2	B-Control	5							5	5	1090.32	1082.55
	8	3	B-Control	5							5	5	1087.66	1081.26
	9	4	B-Control	5							5	5	1087.70	1081.52
	10	5	B-Control	5							5	5	1097.28	1090.63
	11	1	0.010	5							5	5	1085.06	1080.15
	12	2	0.010	5							5	5	1085.32	1079.76
	13	3	0.010	5							4	4	1085.57	1081.16
	14	4	0.010	5							5	5	1089.81	1083.77
	15	5	0.010	5							5	5	1075.69	1068.76
	16	1	0.032	5							5	5	1076.88	1069.06
	17	2	0.032	5							5	5	1078.59	1070.29
	18	3	0.032	5							5	5	1072.96	1067.44
	19	4	0.032	5							4	4	1074.31	1069.71
	20	5	0.032	5							4	4	1077.27	1073.01
	21	1	0.100	5							5	5	1076.78	1071.41
	22	2	0.100	5							5	5	1076.07	1070.32
	23	3	0.100	5							5	5	1078.89	1073.23
	24	4	0.100	5							5	5	1077.02	1071.58
	25	5	0.100	5							5	5	1081.31	1074.18
	26	1	0.320	5							4	4	1080.22	1075.04
	27	2	0.320	5							5	5	1081.59	1076.63
	28	3	0.320	5							5	5	1073.66	1069.31
	29	4	0.320	5							5	5	1083.08	1076.62
	30	5	0.320	5							5	5	1084.78	1078.91
	31	1	1.000	5							4	4	1082.88	1078.89
	32	2	1.000	5							5	5	1083.59	1077.11
	33	3	1.000	5							5	5	1086.95	1079.12
	34	4	1.000	5							5	5	1086.11	1079.03
	35	5	1.000	5							5	5	966.01	958.45
	36	1	5.600	5							5	5	1126.30	1117.22
	37	2	5.600	5							5	5	1109.33	1101.41
	38	3	5.600	5							5	5	1113.28	1106.39
	39	4	5.600	5							5	5	1103.67	1099.26
	40	5	5.600	5							5	5	1106.30	1101.90

Comments: Seacor,04-1424-076 (0500456)

Reviewed by: CAM Nov 9/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/27/2005	Test ID:	0500456s9	Sample ID:	SW9
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

Conc-%	1	2	3	4	5
D-Control	1.1200	0.7780	1.0740	1.2980	1.2100
B-Control	1.5220	1.5540	1.2800	1.2360	1.3300
0.01	0.9820	1.1120	0.8820	1.2080	1.3860
0.032	1.5640	1.6600	1.1040	0.9200	0.8520
0.1	1.0740	1.1500	1.1320	1.0880	1.4260
0.32	1.0360	0.9920	0.8700	1.2920	1.1740
1	0.7980	1.2960	1.5660	1.4160	1.5120
5.6	1.8160	1.5840	1.3780	0.8820	0.8800

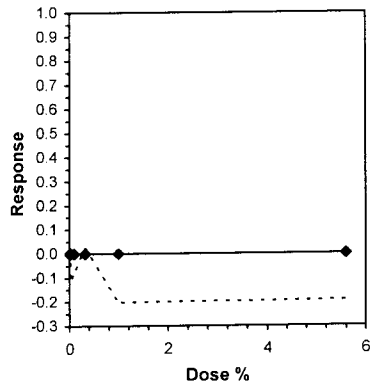
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.0960	0.1975	1.0960	0.7780	1.2980	18.018	5				1.1861	1.0000
B-Control	1.3844	0.1446	1.3844	1.2360	1.5540	10.441	5					
0.01	1.1140	0.1963	1.1140	0.8820	1.3860	17.618	5	-0.103	2.409	0.4206	1.1861	1.0000
0.032	1.2200	0.3711	1.2200	0.8520	1.6600	30.417	5	-0.710	2.409	0.4206	1.1861	1.0000
0.1	1.1740	0.1443	1.1740	1.0740	1.4260	12.288	5	-0.447	2.409	0.4206	1.1861	1.0000
0.32	1.0728	0.1638	1.0728	0.8700	1.2920	15.267	5	0.133	2.409	0.4206	1.1861	1.0000
1	1.3176	0.3081	1.3176	0.7980	1.5660	23.381	5	-1.269	2.409	0.4206	1.1861	1.0000
5.6	1.3080	0.4195	1.3080	0.8800	1.8160	32.069	5	-1.214	2.409	0.4206	1.1861	1.0000

Auxiliary Tests				Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)				0.98034		0.91		-0.1423	-0.3966
Bartlett's Test indicates equal variances (p = 0.28)				7.48709		16.8119			
The control means are significantly different (p = 0.03)				2.63512		2.306			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	5.6	>5.6		17.8571	0.42062	0.38378	0.04967	0.07624	0.68866	6, 28

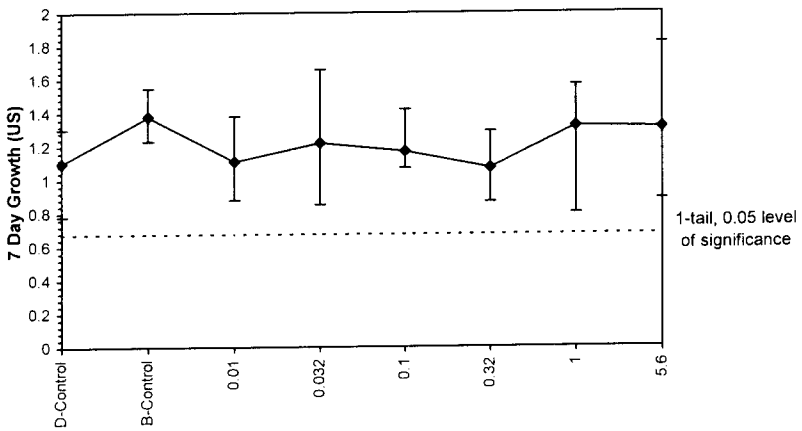
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	>5.6			
IC10	>5.6			
IC15	>5.6			
IC20	>5.6			
IC25	>5.6			
IC40	>5.6			
IC50	>5.6			

% (v)



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: CAM 10/9/05

Larval Fish Growth and Survival Test-7-d survival

Start Date:	9/27/2005	Test ID:	0500456s9	Sample ID:	SW9
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

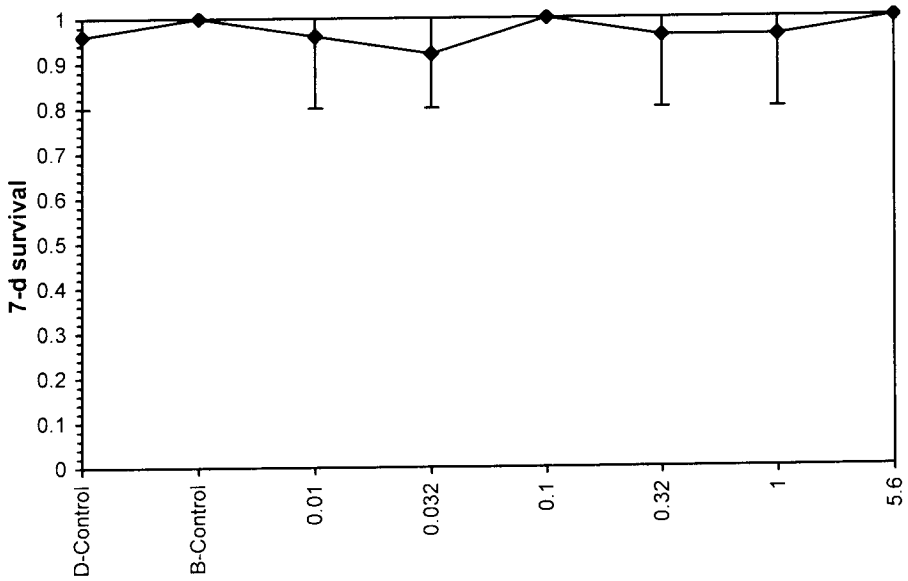
Conc-%	1	2	3	4	5
D-Control	1.0000	0.8000	1.0000	1.0000	1.0000
B-Control	1.0000	1.0000	1.0000	1.0000	1.0000
0.01	1.0000	1.0000	0.8000	1.0000	1.0000
0.032	1.0000	1.0000	1.0000	0.8000	0.8000
0.1	1.0000	1.0000	1.0000	1.0000	1.0000
0.32	0.8000	1.0000	1.0000	1.0000	1.0000
1	0.8000	1.0000	1.0000	1.0000	1.0000
5.6	1.0000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5		
B-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
0.01	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	27.50	16.00
0.032	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5	25.00	16.00
0.1	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00
0.32	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	27.50	16.00
1	0.9600	0.0894	1.2922	1.1071	1.3453	8.058	5	25.50	16.00
5.6	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.73809	0.91	-1.4343	0.88183
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.35)	1	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	5.6	>5.6		17.8571

Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: CAM Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Sealer
EVS Project No. 04-1424-076
EVS Work Order No. 500456

EVS Analysts TCS, MFB, SxB
Test Initiation Date 27-Sep-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	SW 11	→	
Amount Received	~~17~~ 23 1×20L	–	–
Date Collected	17-Sept-05	–	–
Date Received	19-Sept-05	–	–
Temperature (°C)	19.5 D → 19.5	–	–
pH	4.2 D → 4.7	–	–
DO (mg/L)	9.0 D → 7.8	–	–
Conductivity (µmhos/cm)	–	–	–
Salinity (ppt)	26 D → 29	–	–
Ammonia (mg/L N)	–	–	–
Chlorine (mg/L Cl)	–	–	–
Other	–	–	–

Salinity adjusted to 30 ± 2 ppt.

DILUTION/CONTROL WATER (initial water quality)

Water Type Filtered, UV sterilized seawater
Temperature (°C) 19.5
pH 7.9
Dissolved Oxygen (mg/L) 7.8
Salinity 29

TEST SPECIES INFORMATION

Source ABS
Date Received 27-Sep-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 27-Sep-05
7-d survival LC50 121 (111-133) mg/L Cu
7-d growth IC50 125 (112-135) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 125 ± 40 mg/L Cu, CV = 16%
7-d growth IC50 124 ± 43 mg/L Cu, CV = 17%

TEST CONDITIONS

Temperature Range (°C) 19.5-21.0
pH Range 7.3-7.9
Dissolved Oxygen Range (mg/L) 6.2-7.8
Salinity (ppt) 29-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other –

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	~~25~~ 6.2	> ~~25~~ 6.2	> ~~25~~ 6.2		
Growth		~~25~~ 6.2	> ~~25~~ 6.2		> ~~25~~ 6.2 (nc)	> ~~25~~ 6.2 (nc)

Other –

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client: Seacor
Sample ID: SW 1
EVS Project No.: 04-1424-076
Test Initiation Date/Time: 27-Sept-05 / 1530h
EVS Work Order No.: 0500456
Source/Date Received: ABS / 27-Sept-05

% (v/v) Concentration	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW CTL	19.5	20.5	20.0	20.0	20.0	20.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
0.01	19.5	20.5	20.0	20.5	20.0	20.5	20.0	21.0	21.0	20.0	20.0	20.5	20.0	20.5
0.032	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.5	19.5	20.0	20.5	20.0	20.5
0.1	19.5	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.5
0.32	19.5	20.5	20.0	21.0	20.0	20.5	20.0	21.0	20.0	20.0	20.0	20.0	20.0	20.5
1.0	19.5	20.5	20.0	21.0	20.0	20.5	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.5
6.2	19.5	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	20.0	20.5	20.0	20.0	20.5
Tech. Initials	SxB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	JW	JW	JW

% (v/v) Concentration	pH													
	0	1		2		3		4		5		6		7
SW CTL	7.9	7.9	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.8
0.01	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.8
0.032	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.8
0.1	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8
0.32	7.9	7.9	7.9	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.9
1.0	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.8
6.2	7.6	7.7	7.8	7.8	7.4	7.7	7.5	7.8	7.4	7.8	7.3	7.8	7.5	7.8
Tech. Initials	SxB	MFB/JW	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	JW	JW	JW

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-030301

Comments

Test Set Up By: Jes, MFB, SxB Data Verified By: C. Henderson Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor | Sample ID SW11

EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05/1530h

EVS Work Order No. 500456 | Source/Date Received ABS/27-Sept-05

% SW1 Concentration	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Seawater CTL	29	29	29	29	29	29	29	30
0.01	29	29	29	29	29	29	29	30
0.032	29	29	29	29	29	29	29	30
0.1	29	29	29	29	29	29	29	30
0.32	29	29	29	29	29	29	29	30
1.0	29	29	29	29	29	29	29	30
6.2	29	29	29	29	29	29	29	30
Tech. Initials	SXB	MFB	MFB	MFB	MFB	MFB	TH	TH

% SW1 Concentration	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW CTL	7.8	7.0	7.6	7.0	7.7	6.8	7.8	6.6	7.6	6.3	7.6	6.2	7.6	6.2
0.01	7.8	7.0	7.5	7.0	7.7	6.7	7.8	6.5	7.6	6.3	7.6	6.2	7.6	6.4
0.032	7.7	6.9	7.6	6.9	7.7	6.8	7.8	6.6	7.6	6.4	7.6	6.4	7.6	6.2
0.1	7.7	7.0	7.6	6.9	7.7	7.0	7.8	6.5	7.6	6.6	7.6	6.4	7.6	6.2
0.32	7.6	6.8	7.8	6.8	7.7	6.8	7.9	6.6	7.6	6.4	7.6	6.2	7.6	6.4
1.0	7.8	6.8	7.8	6.8	7.7	6.8	7.8	6.7	7.6	6.3	7.6	6.2	7.6	6.4
6.2	7.8	6.8	7.8	7.0	7.7	6.9	7.8	6.8	7.5	6.5	7.6	6.4	7.6	6.6
Tech. Initials	SXB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TH	TH	TH

WQ Instruments Used: Salinity II-A-030303 | DO II-A-14

Comments

Test Set Up By TR, SXB, MFB | Data Verified By C. McPherson | Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Spectra
EVS Project No. 04-1424-076
EVS Work Order No. 0502456

Sample ID ~~B~~ SW11
Test Species/Batch A. affinis / 27-Sept-05
Test Initiation Date/Time 27-~~B~~ Sept-05 / 1530h
No. of Organisms/Volume 5 / 200 mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW-CTL	A	586	5	5	5	5	5	5	5	
	B	87	5	5	5	5	5	5	5	
	C	88	5	5	5	5	5	5	5	
	D	89	5	5	5	5	5	5	5	
	E	90	5	5	5	5	5	5	5	
0.01	A	91	5	5	5	5	5	5	5	
	B	92	5	5	5	5	5	5	5	
	C	93	5	5	5	5	5	5	5	
	D	94	5	5	5	5	5	5	5	
	E	95	5	5	5	5	5	5	5	
0.032	A	96	5	5	5	5	5	5	5	
	B	97	5	5	5	5	5	5	5	
	C	98	5	5	5	5	5	5	5	
	D	99	5	5	5	5	5	5	5	
	E	100	5	5	5	5	5	5	5	
0.1	A	101	5	5	5	5	5	5	5	
	B	102	5	5	5	5	5	5	5	
	C	103	5	5	5	5	5	5	5	
	D	104	5	5	5	5	5	5	5	
	E	105	5	5	5	5	5	5	5	
Technician Initials		TM	MFB	MFB	MFB	MFB	MFB	TM	TM	

Sample Description colorless. clear
Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Seacor
EVS Project No.: 04-1424-076
EVS Work Order No.: 0502456

Sample ID: SW11
Test Species/Batch: A. affinis / 27-Sept-05
Test Initiation Date/Time: 27-Sept-05 / 1530h
No. of Organisms/Volume: 5 / 200 mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
0.32	A	106	5	5	5	5	5	5	5	
	B	107	5	5	5	5	5	5	5	
	C	108	5	5	5	5	5	5	5	
	D	109	5	5	5	5	5	5	5	
	E	110	5	5	5	5	5	5	5	
1.0	A	111	5	5	5	5	4(1)	4	4	(1) Fish on side of beaker 3mm above water.
	B	112	5	5	5	5	5	5	5	
	C	113	5	5	5	5	5	5	5	
	D	114	5	5	5	5	5	5	5	
	E	115	5	5	5	5	5	5	5	
6.2	A	116	2	2	2	2	2	2	2	
	B	117	5	5	5	5	5	5	5	
	C	118	5	5	5	5	5	5	5	
	D	119	5	5	5	5	5	5	5	
	E	120	5	5	5	5	5	5	5	
	A									
	B									
	C									
	D									
	E									
Technician Initials		TM	MFB	MFB	MFB	MFB	MFB	TM	TM	

Sample Description: clear, colorless
Data Verified By: C. Matthews
Date Verified: Nov 9/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500456
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Atherinops affinis*
TEST INITIATION DATE: 27-Sep-05

Pan No.	Rep	Sample ID: SW11 % (v/v)	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
86	A	D-Control	5	5	5	1095.43	1102.78	SXB	
87	B		5	5	5	1109.93	1115.32	SXB	
88	C		5	5	5	1111.72	1117.61	SXB	
89	D		5	5	5	1109.02	1115.06	SXB	
90	E		5	5	5	1107.06	1113.39	SXB	
126	A	Brine-Control	5	5	5	1077.83	1085.44	SXB	
127	B		5	5	5	1082.55	1090.32	SXB	
128	C		5	5	5	1081.26	1087.66	SXB	
129	D		5	5	5	1081.52	1087.70	SXB	
130	E		5	5	5	1090.63	1097.28	SXB	
91	A	0.010	5	5	5	1109.35	1117.02	SXB	
92	B		5	5	5	1107.93	1113.50	SXB	
93	C		5	5	5	1108.47	1113.20	SXB	
94	D		5	5	5	1105.07	1110.01	SXB	
95	E		5	5	5	1106.53	1111.65	SXB	
96	A	0.032	5	5	5	1111.44	1119.28	SXB	
97	B		5	5	5	1073.63	1079.78	SXB	
98	C		5	5	5	1071.23	1087.09	SXB	
99	D		5	5	5	1062.74	1067.83	SXB	
100	E		5	5	5	1067.51	1072.04	SXB	
101	A	0.100	5	5	5	1100.59	1107.73	SXB	
102	B		5	5	5	1095.78	1101.67	SXB	
103	C		5	5	5	1098.14	1104.32	SXB	
104	D		5	5	5	1090.75	1096.66	SXB	
105	E		5	5	5	1111.12	1115.26	SXB	
106	A	0.320	5	5	5	1089.81	1095.94	SXB	
107	B		5	5	5	1090.52	1093.89	SXB	
108	C		5	5	5	1090.78	1097.08	SXB	
109	D		5	5	5	1093.87	1099.69	SXB	
110	E		5	5	5	1076.42	1083.52	SXB	
111	A	1.000	4	4	4	1100.59	1106.08	SXB	one fish was killed while feeding
112	B		5	5	5	1089.11	1094.85	SXB	
113	C		5	5	5	1091.44	1096.62	SXB	
114	D		5	5	5	1089.90	1095.58	SXB	
115	E		5	5	5	1094.99	1100.62	SXB	
116	A	6.200	5	2	2	1089.35	1091.84	SXB	
117	B		5	5	5	1091.61	1097.69	SXB	
118	C		5	5	5	1088.58	1094.00	SXB	
119	D		5	5	5	1082.41	1088.90	SXB	
120	E		5	5	5	1082.90	1087.13	SXB	
86	(d)						1102.73	SXB	
100	(d)						1071.95	SXB	
106	(d)						1095.66	SXB	
115	(d)						1100.57	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time.

CAM 10/19/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: SW11
Start Date: 9/27/2005 End Date: 10/4/2005

Test ID: 0500456s11
Protocol: EPAW 95-EPA West Coast
Sample Type: GW-groundwater
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	1102.78	1095.43
	2	2	D-Control	5							5	5	1115.32	1109.93
	3	3	D-Control	5							5	5	1117.61	1111.72
	4	4	D-Control	5							5	5	1115.06	1109.02
	5	5	D-Control	5							5	5	1113.39	1107.06
	6	1	B-Control	5							5	5	1085.44	1077.83
	7	2	B-Control	5							5	5	1090.32	1082.55
	8	3	B-Control	5							5	5	1087.66	1081.26
	9	4	B-Control	5							5	5	1087.7	1081.52
	10	5	B-Control	5							5	5	1097.28	1090.63
	11	1	0.010	5							5	5	1117.02	1109.35
	12	2	0.010	5							5	5	1113.5	1107.93
	13	3	0.010	5							5	5	1113.2	1108.47
	14	4	0.010	5							5	5	1110.01	1105.07
	15	5	0.010	5							5	5	1111.65	1106.53
	16	1	0.032	5							5	5	1119.28	1111.44
	17	2	0.032	5							5	5	1079.78	1073.63
	18	3	0.032	5							5	5	1087.09	1071.23
	19	4	0.032	5							5	5	1067.83	1062.74
	20	5	0.032	5							5	5	1072.04	1067.51
	21	1	0.100	5							5	5	1107.73	1100.59
	22	2	0.100	5							5	5	1101.67	1095.78
	23	3	0.100	5							5	5	1104.32	1098.14
	24	4	0.100	5							5	5	1096.66	1090.75
	25	5	0.100	5							5	5	1115.26	1111.12
	26	1	0.320	5							5	5	1095.94	1089.81
	27	2	0.320	5							5	5	1093.89	1090.52
	28	3	0.320	5							5	5	1097.08	1090.78
	29	4	0.320	5							5	5	1099.69	1093.87
	30	5	0.320	5							5	5	1083.52	1076.42
	31	1	1.000	4							4	4	1106.08	1100.59
	32	2	1.000	5							5	5	1094.85	1089.11
	33	3	1.000	5							5	5	1096.62	1091.44
	34	4	1.000	5							5	5	1095.58	1089.9
	35	5	1.000	5							5	5	1100.62	1094.99
	36	1	6.200	5							2	2	1091.84	1089.35
	37	2	6.200	5							5	5	1097.69	1091.61
	38	3	6.200	5							5	5	1094	1088.58
	39	4	6.200	5							5	5	1088.9	1082.41
	40	5	6.200	5							5	5	1087.13	1082.9

Comments: Seacor,04-1424-076 (0500456)

CAM Nov 9/05

Reviewed by:_____

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	9/27/2005	Test ID:	0500456s11	Sample ID:	SW11
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

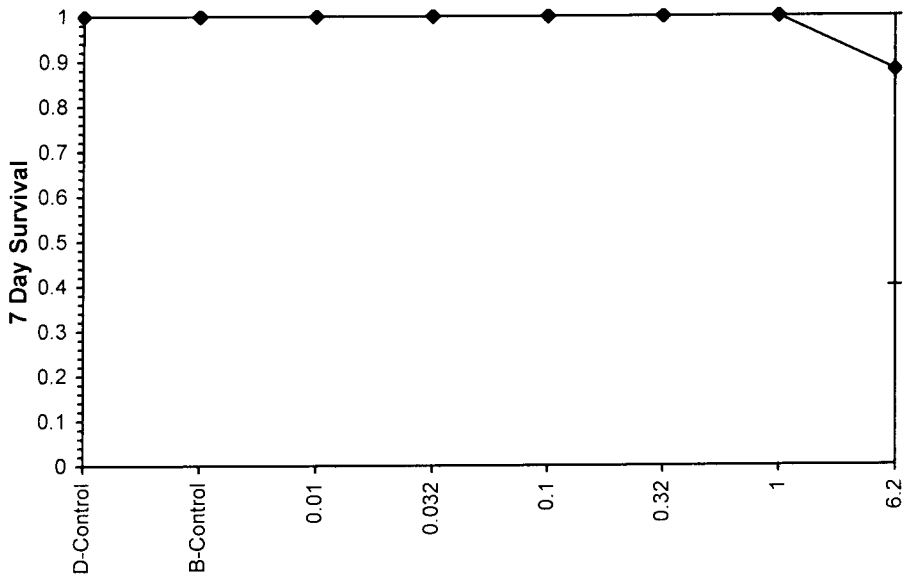
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
B-Control	1.0000	1.0000	1.0000	1.0000	1.0000
0.01	1.0000	1.0000	1.0000	1.0000	1.0000
0.032	1.0000	1.0000	1.0000	1.0000	1.0000
0.1	1.0000	1.0000	1.0000	1.0000	1.0000
0.32	1.0000	1.0000	1.0000	1.0000	1.0000
1	1.0000	1.0000	1.0000	1.0000	1.0000
6.2	0.4000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
B-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
0.01	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
0.032	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
0.1	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
0.32	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
1	1.0000	0.0000	1.3398	1.3181	1.3453	0.907	5	25.00	16.00
6.2	0.8800	0.2683	1.2132	0.6847	1.3453	24.351	5	25.00	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.40817	0.91	-4.1384	22.9963
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.2	>6.2		16.129

Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: 10/19/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/27/2005	Test ID:	0500456s11	Sample ID:	SW11
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	GW-groundwater
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor,04-1424-076 (0500456)				

Conc-%	1	2	3	4	5
D-Control	1.4700	1.0780	1.1780	1.2080	1.2660
B-Control	1.5220	1.5540	1.2800	1.2360	1.3300
0.01	1.5340	1.1140	0.9460	0.9880	1.0240
0.032	1.5680	1.2300	3.1720	1.0180	0.9060
0.1	1.4280	1.1780	1.2360	1.1820	0.8280
0.32	1.2260	0.6740	1.2600	1.1640	1.4200
1	1.3725	1.1480	1.0360	1.1360	1.1260
6.2	0.4980	1.2160	1.0840	1.2980	0.8460

			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
D-Control	1.2400	0.1455	1.2400	1.0780	1.4700	11.734	5			1.3133	1.0000
B-Control	1.3844	0.1446	1.3844	1.2360	1.5540	10.441	5				
0.01	1.1212	0.2389	1.1212	0.9460	1.5340	21.310	5	21.00	16.00	1.3133	1.0000
0.032	1.5788	0.9256	1.5788	0.9060	3.1720	58.629	5	28.00	16.00	1.3133	1.0000
0.1	1.1704	0.2168	1.1704	0.8280	1.4280	18.528	5	26.00	16.00	1.1704	0.8912
0.32	1.1488	0.2818	1.1488	0.6740	1.4200	24.526	5	26.00	16.00	1.1563	0.8804
1	1.1637	0.1248	1.1637	1.0360	1.3725	10.728	5	22.00	16.00	1.1563	0.8804
6.2	0.9884	0.3231	0.9884	0.4980	1.2980	32.689	5	23.00	16.00	0.9884	0.7526

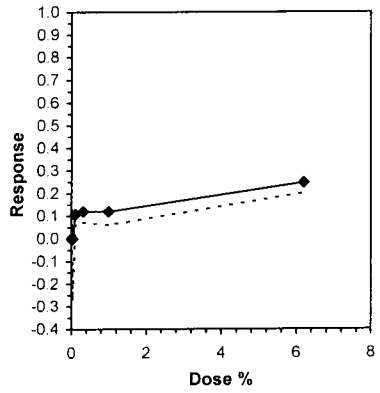
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.82001	0.91	2.05301	9.32676
Bartlett's Test indicates unequal variances (p = 6.49E-04)	23.4844	16.8119		
The control means are not significantly different (p = 0.15)	1.57428	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.2	>6.2		16.129

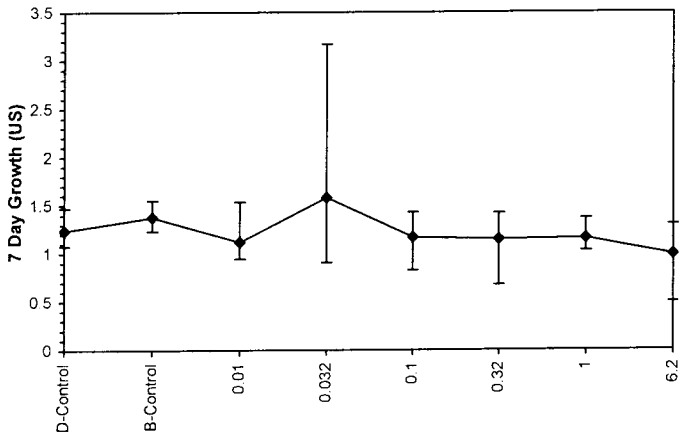
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	0.0632			
IC10	0.0945			
IC15	2.2366			
IC20	4.2710			
IC25	>6.2			
IC40	>6.2			
IC50	>6.2			

% (v/v)



Dose-Response Plot



Statistical comparisons were against the D-control only.

Reviewed by: CdM Nov9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Sealer
EVS Project No. 04-1424-076
EVS Work Order No. 500456

EVS Analysts JLS, MFB, SxB
Test Initiation Date 27-Sep-05

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	Cu - reftox 05-Cu-a2 100 mg/L		
Amount ~~Received~~ Prep'd	1 L		
Date ~~Collected~~ Prep'd	27-June-05		
Date ~~Received~~ Exp'd	27-Dec-05		
Temperature (°C)			
pH			
DO (mg/L)			
Conductivity (µmhos/cm)			
Salinity (ppt)			
Ammonia (mg/L N)			
Chlorine (mg/L Cl)			
Other			

DILUTION/CONTROL WATER (initial water quality)
Water Type Filtered, UV sterilized seawater
Temperature (°C) 19.5
pH 7.9
Dissolved Oxygen (mg/L) 7.8
Salinity 29

TEST SPECIES INFORMATION
Source ABS
Date Received 27-Sep-05
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 27-Sep-05
7-d survival LC50 121 (111-133) mg/L Cu
7-d growth IC50 125 (112-135) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 125 ± 40 mg/L Cu, CV = 16%
7-d growth IC50 124 ± 43 mg/L Cu, CV = 17%

TEST CONDITIONS
Temperature Range (°C) 19.5-21.0
pH Range 7.8-8.0
Dissolved Oxygen Range (mg/L) 6.2-7.8
Salinity (ppt) 29-30
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	mg/L Cu	100	180	121 (111-133) CETIS ~~121.2 (110.7-132.7)~~		
Growth		100	180		~~124.7 (112.5-135.0)~~ CETIS 125 (112-135)	~~95.8 (68.3-113.2)~~ CETIS 76 (68-113)

Other

Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Sencor | Sample ID Cu - reflux

EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05 / 1530h

EVS Work Order No. 0500456 | Source/Date Received ABS / 27-Sept

µg/L Cu Concentration	Temperature (°C)													
	0	1		2		3		4		5		6		7
SW CTL	19.5	21.0	20.0	20.5	20.0	19.5	20.0	20.5	20.0	20.0	20.0	20.0	20.0	20.0
32	19.5	20.5	20.0	20.5	20.0	20.0	20.0	20.5	20.5	20.0	20.0	20.0	20.0	20.0
56	19.5	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.5	20.0	20.5	20.0	20.0	20.5
100	19.5	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	19.5	20.0	20.0	20.0	20.5
180	19.5	21.0	20.0	21.0	20.0	21.0	20.0	20.0	20.0	~~20.0~~				
320	19.5	20.5	20.0	21.0	20.0	20.5	~~20.0~~							
Tech. Initials	TH	MFB/TH	TH	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TH	TH	TH

µg/L Cu Concentration	pH													
	0	1		2		3		4		5		6		7
SW CTL	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.7	7.9	7.9	8.0	7.9
32	7.9	7.8	7.9	7.9	7.9	~~7.8~~	7.9	7.8	7.9	7.8	7.9	7.8	8.0	7.9
56	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.8	8.0	7.9
100	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.9	8.0	7.9
180	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9					
320	7.9	7.9	7.9	7.9	7.9	7.9								
Tech. Initials	MFB	MFB	TH	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TH	TH	TH

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-030301

Comments

Test Set Up By TH, MFB. Data Verified By C. McPherson Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client Seacor | Sample ID Cu Ryton K
EVS Project No. 04-1424-076 | Test Initiation Date/Time 27-Sept-05 / 1530h
EVS Work Order No. 500456 | Source/Date Received ABS / 27-Sept-05

mg/L Cu Concentration	Salinity (ppt)							
	0	1	2	3	4	5	6	7
SeawaterCTL	29	29	29	29	29	29	29	30
32	29	29	29	29	29	29	29	30
56	29	29	29	29	29	29	29	30
100	29	29	29	29	29	29	29	30
180	29	29	29	29	29	—	—	—
320	29	29	29	—	—	—	—	—
Tech. Initials	MFB	TJ	MFB	MFB	MFB	MFB	TJ	TJ

mg/L Cu Concentration	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
SW CTL	7.8	6.7	7.8	7.0	7.7	6.8	7.6	6.6	7.6	6.4	7.6	6.4	7.6	6.2
32	7.8	6.4	7.8	6.6	7.7	6.8	7.8	6.5	7.6	6.5	7.6	6.2	7.6	6.4
56	7.8	6.5	7.8	6.8	7.7	6.8	7.8	6.8	7.6	6.6	7.6	6.4	7.6	6.4
100	7.8	6.5	7.8	6.8	7.7	6.8	7.8	6.7	7.6	6.6	7.6	6.4	7.6	6.4
180	7.8	6.6	7.8	6.8	7.7	6.6	7.8	6.8	7.6	—	—	—	—	—
320	7.8	6.7	7.8	6.7	7.7	7.2	—	—	—	—	—	—	—	—
Tech. Initials	MFB	MFB/TJ	TJ	MFB	MFB	MFB	MFB	MFB	MFB	MFB	MFB	TJ	TJ	TJ

WQ Instruments Used: Salinity II-A-030303 | DO II-A-14

Comments

Test Set Up By TJ, MFB | Data Verified By C. McPherson | Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client Seacor
EVS Project No. 04-1424-076
EVS Work Order No. 0500456

Sample ID Cu - reflux
Test Species/Batch A. affinis / 27-Sept-05
Test Initiation Date/Time 27-~~Sept~~ Sept-05 / 1530h
No. of Organisms/Volume 5/200 ml

mg/L Cu Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
SW CTL	A	S1	5	5	5	5	5			(1) Fish killed while feeding
	B	2	5	5	5 (3)	4	4		4	(3) Dne fish sick
	C	3	5	5	5	5	5	5	5	
	D	4	5	5	5	5	5	5	5	
	E	5	4	3 (1)	3	3	3	3	3	
32	A	6	5	4 (2)	4	4	4	4	4	(2) Fish killed while moving beaker (Presumed) Found stuck to glass 10mm above water.
	B	7	5	5	5	5	5	5	5	
	C	8	5	5	5	5	5	5	5	
	D	9	5	5	5	5	4 (2)	4	4	
	E	10	5	5	5	5	5	5	5	
56	A	11	5	5	5	5	4	4	4	
	B	12	5	5	5	5	5	5	5	
	C	13	5	5	5	5	5	5	5	
	D	14	5	5	5	5	5	5	5	
	E	15	5	5	5	5	5	5	5	
100	A	16	5	5	4	4	4	4	4	
	B	17	5	5	5	5	5	5	4	
	C	18	5	4	4	4	4	4	4	
	D	19	5	5	4	4	4	4	4	
	E	✓ 20	5	4	4	3 (2)	3	3	3	
Technician Initials		TH	TH	MFB	MFB	MFB	MFB	TH	TH	

Sample Description clear. colorless
Data Verified By C. McPherson
Date Verified Nov 9/05

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Seacor
EVS Project No.: 04-1424-076
EVS Work Order No.: 0500456

Sample ID: Cu - reftox
Test Species/Batch: A. affinis / 27-Sept-05
Test Initiation Date/Time: 27-Sept-05 / 1530h
No. of Organisms/Volume: 5 / 200 mL

mg/L Cu Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
180	A		1	1	0					
	B		0							
	C		1	0						
	D		2	2	1	1	0			
	E		2	1	0					
320	A		0	0						
	B		0	0						
	C		0	0						
	D		0	0						
	E		1	1	0					
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials		TM	TM	MFB	MFB	MFB	MFB			

Sample Description: clear colorless
Data Verified By: C. McPherson
Date Verified: Nov 3/05

EVS ENVIRONMENT CONSULTANTS

Larval Fish Toxicity Tests - Dry Weight Data

CLIENT: Seacor
PROJECT #: 04-1424-076
WORK ORDER #: 0500456
BALANCE TYPE: Sartorius BP211D

TEST TYPE: 7-d Survival and Growth
TEST SPECIES: *Atherinops affinis*
TEST INITIATION DATE: 27-Sep-05

Pan No.	Rep	Sample ID: Cu ug/L	Survival At Start	Number of Survivors	Number Weighed	Pan weight (mg)	Final Weight (mg) Pan + Biomass	Tech'n Initials	Comments
S 1	A	Control	5	5	5	957.22	962.64	SXB	
2	B		5	4	4	960.87	966.66	SXB	
3	C		5	5	5	957.04	963.84	SXB	
4	D		5	5	5	953.76	959.65	SXB	
5	E		4	3	3	959.12	963.77	SXB	one fish was killed while feeding
6	A	32	4	4	4	958.91	965.95	SXB	one fish was killed while feeding
7	B		5	5	5	959.79	966.05	SXB	
8	C		5	5	5	955.19	961.31	SXB	
9	D		4	4	4	954.57	961.53	SXB	one fish was killed while feeding
10	E		5	5	5	956.74	961.62	SXB	
11	A	56	5	4	4	956.68	963.82	SXB	
12	B		5	5	5	961.75	970.09	SXB	
13	C		5	5	5	958.92	965.44	SXB	
14	D		5	5	5	962.21	966.42	SXB	
15	E		5	5	5	962.74	968.77	SXB	
16	A	100	5	4	4	958.87	963.23	SXB	
17	B		5	4	4	958.44	963.99	SXB	
18	C		5	4	4	958.28	962.87	SXB	
19	D		5	4	4	963.14	967.52	SXB	
20	E		4	3	3	963.7	967.26	SXB	one fish was killed while feeding
	A	180							
	B								
	C								
	D								
	E								
	A	320							
	B								
	C								
	D								
	E								
S 5	(d)	Control E		3	3	959.12	963.45	SXB	
S 16	(d)	100 A		4	4	958.87	963.19	SXB	

(d) - duplicate; pan reweighed after being placed in the oven and desiccated a second time

QA/QC review: CdM 11/9/05

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: REF-Ref Toxicant
Start Date: 9/27/2005 End Date: 10/4/2005

Test ID: rtaacu49
Protocol: EPAW 95-EPA West Coast
Sample Type: CU-Copper
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	962.64	957.22
	2	2	D-Control	5							4	4	966.66	960.87
	3	3	D-Control	5							5	5	963.84	957.04
	4	4	D-Control	5							5	5	959.65	953.76
	5	5	D-Control	4							3	3	963.77	959.12
	6	1	32.000	4							4	4	965.95	958.91
	7	2	32.000	5							5	5	966.05	959.79
	8	3	32.000	5							5	5	961.31	955.19
	9	4	32.000	4							4	4	961.53	954.57
	10	5	32.000	5							5	5	961.62	956.74
	11	1	56.000	5							4	4	963.82	956.68
	12	2	56.000	5							5	5	970.09	961.75
	13	3	56.000	5							5	5	965.44	958.92
	14	4	56.000	5							5	5	966.42	962.21
	15	5	56.000	5							5	5	968.77	962.74
	16	1	100.000	5							4	4	963.23	958.87
	17	2	100.000	5							4	4	963.99	958.44
	18	3	100.000	5							4	4	962.87	958.28
	19	4	100.000	5							4	4	967.52	963.14
	20	5	100.000	4							3	3	967.26	963.7
	21	1	180.000	5							0	0	0	0
	22	2	180.000	5							0	0	0	0
	23	3	180.000	5							0	0	0	0
	24	4	180.000	5							0	0	0	0
	25	5	180.000	5							0	0	0	0
	26	1	320.000	5							0	0	0	0
	27	2	320.000	5							0	0	0	0
	28	3	320.000	5							0	0	0	0
	29	4	320.000	5							0	0	0	0
	30	5	320.000	5							0	0	0	0

Comments: Seacor, second round testing

Reviewed by CdM Nov 9/05

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	9/27/2005	Test ID:	rtaacu49	Sample ID:	REF-Ref Toxicant
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor, second round testing 400456				

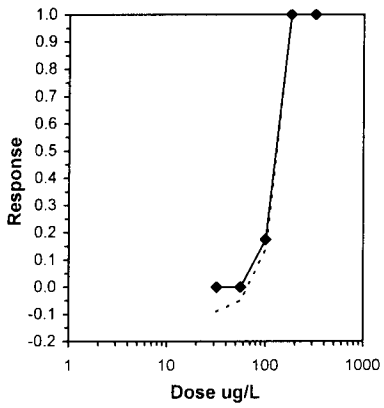
Conc-ug/L	1	2	3	4	5
D-Control	1.0000	0.8000	1.0000	1.0000	0.7500
32	1.0000	1.0000	1.0000	1.0000	1.0000
56	0.8000	1.0000	1.0000	1.0000	1.0000
100	0.8000	0.8000	0.8000	0.8000	0.7500
180	0.0000	0.0000	0.0000	0.0000	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9100	0.1245	1.2380	1.0472	1.3453	11.984	5			2	24
32	1.0000	0.0000	1.3344	1.3181	1.3453	1.115	5	29.50	17.00	0	23
56	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	30.50	17.00	1	25
100	0.7900	0.0224	1.0952	1.0472	1.1071	2.448	5	21.50	17.00	5	24
*180	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5			25	25
*320	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5			25	25

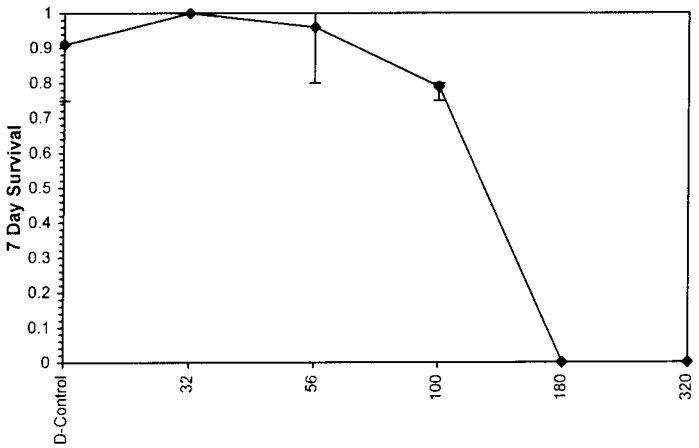
Auxiliary Tests				Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)				0.84708	0.868	-1.1517	1.11698
Bartlett's Test indicates unequal variances (p = 4.84E-04)				17.7967	11.3449		
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**			
Steel's Many-One Rank Test	100	180	134.164				

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%	121.18	110.70	132.65
5.0%	123.29	111.07	136.86
10.0%	124.95	109.65	142.40
20.0%	126.09	117.94	134.80
Auto-0.0%	121.18	110.70	132.65 ug/L Cu



Dose-Response Plot



Reviewed by: CAM Nov 9/05

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	9/27/2005	Test ID:	rtaacu49	Sample ID:	REF-Ref Toxicant
End Date:	10/4/2005	Lab ID:	BCEVS-EVS Environment C	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Seacor, second round testing				

Conc-ug/L	1	2	3	4	5
D-Control	1.0840	1.1580	1.3600	1.1780	1.1625
32	1.7600	1.2520	1.2240	1.7400	0.9760
56	1.4280	1.6680	1.3040	0.8420	1.2060
100	0.8720	1.1100	0.9180	0.8760	0.8900
180	0.0000	0.0000	0.0000	0.0000	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

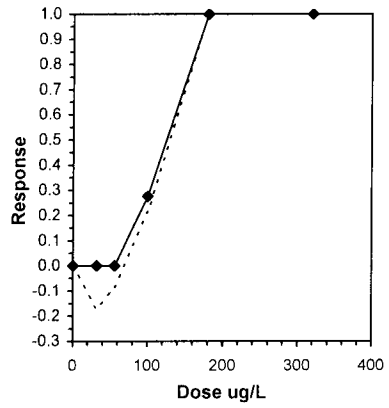
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.1885	0.1025	1.1885	1.0840	1.3600	8.627	5				1.2895	1.0000
32	1.3904	0.3455	1.3904	0.9760	1.7600	24.847	5	-1.324	2.230	0.3400	1.2895	1.0000
56	1.2896	0.3041	1.2896	0.8420	1.6680	23.580	5	-0.663	2.230	0.3400	1.2895	1.0000
100	0.9332	0.1005	0.9332	0.8720	1.1100	10.766	5	1.675	2.230	0.3400	0.9332	0.7237
*180	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000
*320	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92873	0.868	-0.0527	0.3007
Bartlett's Test indicates equal variances (p = 0.04)	8.24422	11.3449		

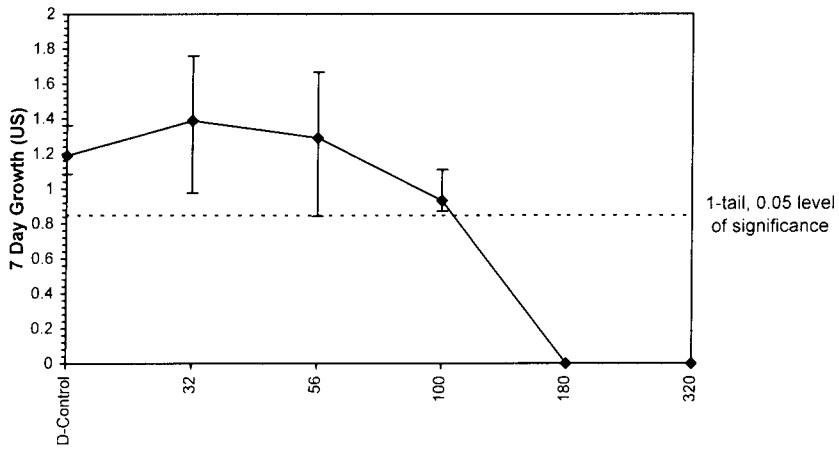
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	180	134.164		0.33997	0.28605	0.19266	0.05811	0.04682	3, 16

Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew	
IC05	63.96	8.96	25.88	70.78	-1.0414	
IC10	71.92	8.96	31.75	85.56	-1.1086	
IC15	79.89	9.48	37.63	100.34	-0.8852	
IC20	87.85	9.28	48.79	109.90	-0.8270	
IC25	95.81	8.32	68.30	113.18	-1.2500	
IC40	113.67	4.36	98.94	126.03	0.1088	
IC50	124.73	3.63	112.45	135.03	0.1096	ug/L Cu



Dose-Response Plot



Reviewed by: CdM 11/6/9/05

APPENDIX III

Chain-of-Custody Forms

1 of 2

CHAIN-OF-CUSTODY / TEST REQUEST FORM

№ 1536

Client Name SEACOR
Address #6-40 Cadillac Ave
Victoria, BC
V8Z 1T2

Client Contact Michael McLeay
Phone (250) 475-9595
Fax (250) 475-9596
Sampled by M. McLeay

Ship to EVS/Golder
N. Vancouver

Attn. Julianna

Shipping Date Sept 15, 05

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested: Topsmelt Surv. & Growth	Test(s) Requested: Sand Dollar Fertilization	Test(s) Requested: Oyster Larvae Surv. & Devel.	Test(s) Requested: Neanthes (28-day)	4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)
17/Sept/05	12:55	SW9	SW		C	1X20L	CC	✓	✓	✓		~~~20 ‰~~~ 21 ‰
17/Sept/05		SW11	SW		C	1X20L	CC	✓	✓	✓		~27 ‰
17/Sept/05	11:25	SW12	SW		C	1X20L	CC	✓	✓	✓		~29 ‰
17/Sept/05	13:40	B1120	GW		C	1X20L	CC	✓	✓	✓		~5 ‰ 4.5 sal
17/Sept/05	14:41	B1416	GW		C	1X20L	CC	✓	✓	✓		~15 ‰
16/Sept/05	10:35	S27	SED		G	1X3L	P				✓	
16/Sept/05	11:00	S28	SED		G	1X3L	P				✓	
16/Sept/05	11:15	S29	SED		G	1X3L	P				✓	
16/Sept/05	12:30	S30	SED		G	1X3L	P				✓	
16/Sept/05	12:50	S31	SED		G	1X3L	P				✓	

PO/Reference No. 201.01022.01 Task 0019
Project Title Union Bay
Results Needed By

Comments/Instructions

1) Released by: Michael McLeay Date: 18/Sept/05
Company: SEACOR Time: ~12:00
Courier Name: Air Canada/Lorna

1) Received by: JAP Date: 19 Sept 05
Company: Golder Time: 12:59

2) Released by: Date:
Company: Time:
Courier Name:

1) Received by: Date:
Company: Time:

Shaded area to be completed by Golder Laboratory upon sample receipt.

Golder Project No. 04-1424-076
Golder Work Order No. 0500395/396/397/~~398~~
Condition Upon Receipt cool
Receipt Sample Temp. (°C) 4.7°C

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); ~~Stormwater (SW);~~ Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

GW = groundwater
SW = seep water

Please see instructions for completion on back of form

Distribution of copies:
White, Yellow — accompany the shipment
Pink — kept by consignor (e.g. shipper)
Yellow — kept by consignee (e.g. receiver)
White — returned to consignor by consignee

Revision Date: November 22, 2004

CHAIN-OF-CUSTODY / TEST REQUEST FORM

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

Client Name: SEACOR
Client Contact: M. McLeay
Ship to:
Address:
Phone:
Fax:
Sampled by:
Attn.:
Shipping Date:

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested					4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)
											Nitrate-N (25-day)	Hold	
17/Sept/05	1205	S32	SED		G	1X3L	P				✓	✓	
17/Sept/05	1216	S33	SED		G	1X3L	P				✓		

PO/Reference No.: 20/.0/022.01 Task 0019
Project Title:
Results Needed By:

Comments/Instructions:

1) Released by:	Date:	2) Released by:	Date:	*Shaded area to be completed by Golder Laboratory upon sample receipt.*
Company:	Time:	Company:	Time:	Golder Project No.
Courier Name:		Courier Name:		Golder Work Order No.
1) Received by:	Date:	1) Received by:	Date:	Condition Upon Receipt
Company:	Time:	Company:	Time:	Receipt Sample Temp. (°C)

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Distribution of copies: White, Yellow — accompany the shipment
Pink — kept by consignor (e.g. shipper)
Yellow — kept by consignee (e.g. receiver)
White — returned to consignor by consignee

Please see instructions for completion on back of form

Revision Date: November 22, 2004

March 2006

Laboratory Report

Seacor Environmental Inc.

Ground Water Toxicity Testing Program

February 2006 Samples

PREPARED FOR:

Seacor Environmental Inc
Victoria, BC

PREPARED BY:

Golder Associates
North Vancouver Laboratory

Seacore Environmental

Groundwater Toxicity Testing Program

February 2006 Samples

LABORATORY REPORT

Prepared for

Seacor Environmental Inc.
#6-40 Cadillac Avenue
Victoria, BC
V8Z 1T2
CANADA

Prepared by

Golder Associates Ltd North Vancouver Laboratory
195 Pemberton Avenue
North Vancouver, BC
V7P 2R4
CANADA

Golder Project No.

04-1424-076

March 2006

TABLE OF CONTENTS

TABLE OF CONTENTS i
LIST OF TABLES ii
ACKNOWLEDGEMENTS iii

1.0 INTRODUCTION ---------- 1

2.0 METHODS ---------- 2

2.1 Echinoderm (*Strongylocentrotus purpuratus*) Fertilization Toxicity Test 2
2.2 48-h Bivalve (*Mytilus galloprovincialis*) Larval Development Toxicity Test 2
2.3 Statistical Analysis 3
2.4 Quality Assurance/Quality Control (QA/QC) 3

3.0 RESULTS ---------- 6

3.1 Echinoderm (*Strongylocentrotus purpuratus*) Fertilization Toxicity Test 6
3.2 48-h Bivalve (*Mytilus galloprovincialis*) Larval Development Toxicity Test 7
3.3 Quality Assurance/Quality Control (QA/QC) 8

4.0 REFERENCES ---------- 9

APPENDIX I Raw Data and Statistical Analyses: Echinoderm (*Strongylocentrotus purpuratus*) Fertilization Toxicity Test

APPENDIX II Raw Data and Statistical Analyses: 48-h Bivalve (*Mytilus galloprovincialis*) Larval Development Toxicity Test

APPENDIX III Chain-of-Custody Forms

LIST OF TABLES

Table 1: Echinoderm (*Strongylocentrotus purpuratus*) fertilization toxicity test methods. **4**

Table 2: 48-h bivalve (*Mytilus galloprovincialis*) larval development toxicity test methods. **5**

Table 3: Summary of results for the *S. purpuratus* toxicity test for samples SW 9 and SW 11. ..... **9**

Table 4: Summary of results for the *S. purpuratus* toxicity test for samples SW 33 and SW 37. ..... **9**

Table 5: Summary of results for the *S. purpuratus* toxicity test for samples SW 38B and SW 40. ..... **9**

Table 6: Summary of results for the *S. purpuratus* toxicity test for the Iron reference toxicant. **9**

Table 7: Summary of results for the 48-h *M. galloprovincialis* toxicity test for samples SW 9 and SW 11. ..... **9**

Table 8: Summary of results for the 48-h *M. galloprovincialis* toxicity test for samples SW 37 and the iron reference toxicant. **9**

Table 9: Summary of ammonia and sulphide values for the *M. galloprovincialis* toxicity test. **9**

ACKNOWLEDGEMENTS

Toxicity testing was conducted by Jenny Shao, Lee Card, Meg Lauder, Rachael Eedy and Shawn Seguin. Statistical analyses were performed by Shawn Seguin. The report was written by Shawn Seguin and reviewed by Edmund Canaria. Quality Assurance/Quality Control (QA/QC) review was conducted by Julianna Galfi Kalocai.

1.0 INTRODUCTION

Two batches of six ground water samples, identified as SW9, SW11, SW33, SW37, SW38B and SW40, were collected for toxicity testing by Seacor Environmental Inc., Victoria, BC. Each batch was received at the North Vancouver laboratory on January 28, 2006 and February 13, 2006, respectively and were stored in the dark at 4°C until test initiation.

A selected number of samples as well as an iron reference toxicant (reftox) solution were tested for toxicity using the echinoderm (*Strongylocentrotus purpuratus*) fertilization and the 48h bivalve (*Mytilus galloprovincialis*) larval development toxicity tests. Only samples SW9, SW11, SW37 from the January 26, 2006 collection and the iron reference toxicant were tested with the 48h bivalve larval development toxicity test; while all the samples from the February 10, 2006 collection and the iron reftox were tested with the echinoderm fertilization test.

This report describes the methods and results of these toxicity tests. The raw data and statistical analyses are provided in Appendices I and II. The chain-of-custody forms are provided in Appendix III.

2.0 METHODS

2.1 ECHINODERM (*STRONGYLOCENTROTUS PURPURATUS*) FERTILIZATION TOXICITY TEST

The echinoderm (*Strongylocentrotus purpuratus*) fertilization toxicity test was conducted in accordance with Environment Canada (1992 with 1997 amendments). Test conditions and methods are summarized in Table 1.

This fertilization test involves exposing echinoderm sperm to a series of test concentrations for ten minutes followed by the addition of echinoderm eggs. Fertilization occurs for ten minutes, after the addition of eggs. Following the ten minutes exposure time, the eggs are preserved and the numbers of fertilized and unfertilized eggs in each replicate are counted. These observations are assessed in comparison to the negative control.

A Fe reference toxicant was tested concurrently with the samples. A series of 8 concentrations (See Table.1) were prepared from a stock solution of 100 mg/L Fe. The source was Ferric chloride Hexahydrate ($FeCl_3 \bullet 6H_20$) from BDH.

2.2 48-H BIVALVE (*MYTILUS GALLOPROVINCIALIS*) LARVAL DEVELOPMENT TOXICITY TEST

The 48-h *M. galloprovincialis* larval development toxicity test was conducted in accordance with procedures described by the United States Environmental Protection Agency (1995). A concurrent reference toxicant test was conducted using copper. Test conditions and methods are summarized in Table 2.

This toxicity test involves exposing developing *M. galloprovincialis* larvae to a series of test concentrations for 48 h. The test is monitored daily for water quality parameters (temperature, pH, dissolved oxygen, and salinity). Tests are conducted in test tubes, using 10-mL volumes and four replicates per treatment; each replicate is inoculated with approximately 300 developing embryos. After 48 h, samples of larvae are preserved for later counting. Toxicity is based on the percentage of normal and abnormal larvae in each treatment as compared to the control. The samples were analyzed for ammonia and sulphides at test initiation and termination, and the analyses were conducted by ALS Environmental, Vancouver, BC. The Fe reference toxicant test treatments were prepared similarly as in Section 2.1.

2.3 STATISTICAL ANALYSIS

Statistical analyses for both tests was conducted using the computer software program TOXCALC (version 5.0.23; Tidepool Scientific Software, 1994). Statistical endpoints measured include the No Observed Effect Concentration (NOEC), Lowest Observed Effect Concentration (LOEC), and Effective and Inhibiting Concentrations (i.e., EC50, EC20, IC50, and IC20).

2.4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This study followed a comprehensive QA/QC Program to ensure full documentation and minimize possible errors in computation and reporting of results. The following general QA/QC guidelines were applied in this test: use of negative controls, use of positive controls, replication, instrument calibration, water quality maintenance and record-keeping, and use of standard operating procedures (SOPs). To ensure that the generated data and reporting met quality standards, all data and statistical analyses were reviewed by a member of our QA/QC Committee prior to reporting the results.

Toxicity testing was carried out in accordance with applicable test methodologies and/or standards of practice. Our liability is limited solely to the cost of re-testing in the event of non-compliance with such test specifications or standards of practice. Golder accepts no responsibility or liability for the interpretation or use of these testing results by others, nor for any delay, loss, damage or interruptions of testing, collection, preparation, and delivery of samples or test results resulting from events or circumstances beyond our control.

Table 1: Echinoderm (*Strongylocentrotus purpuratus*) fertilization toxicity test methods.

TEST PARAMETER	TEST CONDITION
Test type	Static
Test duration	10:10 min
Test chamber	16 X 125 mm test tubes
Test solution volume	10 mL
Number of replicate chambers per treatment	4
Number of eggs per test chamber	2000
Age of test organisms	< 3 hours after spawning
Sample manipulations (e.g. pre-aeration, pH adjustment, filtration)	Salinity-adjusted to 30 ± 2 ppt with hyper saline brine [HSB].
Control/dilution water	UV-sterilized and 0.5µm-filtered natural sea water from Vancouver Aquarium, BC
Dilutions	Sample: 0.003, 0.010, 0.20, 1.0, 3.0, 10.0, 33.0, Max %(v/v) Fe: 0.003, 0.010, 0.20, 1.0, 3.0, 10.0, 33.0, 100.0 mg/L Fe SDS Reftox: 1.0, 1.8, 3.2, 5.0, and 10mg/L SDS
Renewal of dilutions	None
Aeration	None during testing
Water quality parameters and frequency	Temperature, pH, dissolved oxygen, and salinity
Temperature	15 ± 1°C
Salinity	30 ± 2
Lighting	Ambient laboratory illumination (moderate intensity)
Reference toxicant	Initiated concurrently with test; same test methods as above using SDS to generate an EC50 value; results compared to lab mean ± 2 SD
Endpoint	Fertilization of eggs
Test validity	≥ 50% and ≤ 100% mean control fertilization
Reference protocols	Environment Canada (1992), (EPS/1/RM/27 with 1997 amendments)

Table 2: 48-h bivalve (*Mytilus galloprovincialis)* larval development toxicity test methods.

TEST PARAMETER	TEST CONDITION
Test type	Static.
Test duration	48h
Test vessel	16 X 125 mm test tubes
Spawning	Thermal stimulation initiated by raising seawater temperature in spawning tray from 15 to 27°C.
Number of replicate chambers per treatment	4
Number of organisms per test chamber	~295
Age of test organisms at test initiation	Test initiated ~2 h after spawning.
Sample manipulations (e.g. pre-aeration, pH adjustment, filtration)	Salinity-adjusted to 30 ± 2 ppt with hyper saline brine [HSB].
Control/dilution water	UV-sterilized and 0.45µm-filtered natural seawater obtained from Vancouver Aquarium, BC.
Dilutions	Sample: 0.003, 0.01, 0.2, 1.0, 3.0, 10, 33, Max% (v/v) Fe: 0.003, 0.010, 0.20, 1.0, 3.0, 10.0, 33.0, 100.0 mg/L Fe Reftox: 2.5, 5.0, 10.0, 20.0, 40.0 µg/L Cu.
Aeration	None required.
Water quality parameters	Temperature, pH, dissolved oxygen, and salinity. Ammonia in the salinity-adjusted sample.
Temperature	16 ± 1°C
Salinity	30 ± 2 ppt
Illumination	Overhead full-spectrum fluorescent lights; 50 – 100 ft-c; 16:8 light:dark photoperiod.
Reference toxicant	Initiated concurrently with sample using copper (Cu) to generate LC50 values; results compared to lab mean ± 2 SD.
Endpoints	Survival; normal; normal survival.
Test validity	≥ 90% mean control normal larvae and ≥50% mean control survival.
Reference protocol	US EPA (1995), EPA/600/R-95/136).

3.0 RESULTS

Summaries of results for the *Strongylocentrotus purpuratus* and *Mytilus galloprovincialis* toxicity tests are provided in Tables 3-7. Total ammonia and sulphide values are provided in Table 8. The daily test monitoring data, results of the statistical and chemical analyses are provided in Appendices I and II.

3.1 ECHINODERM (*STRONGYLOCENTROTUS PURPURATUS*) FERTILIZATION TOXICITY TEST

Test results for the echinoderm fertilization test are summarized in Tables 3-6 and the raw statistical analyses are provided in Appendix I. The test showed a mean negative control fertilization rate of 86.0%. The brine control showed a mean fertilization rate of 93.0%.

Samples SW11 and SW33 showed the most severe toxic response based on statistically significant effects observed in all the concentrations tested relative to the negative control ($p \leq 0.05$). The IC20 values for SW11 and SW33 were 0.004 %(v/v) and 0.001 %(v/v), respectively.

Sample SW40 showed a statistically significant difference as compared to the negative control ($p \leq 0.05$) in all concentrations tested, except the lowest (0.003 %(v/v), having an IC20 value of 0.05 %(v/v). Samples SW37 and SW38B showed statistically significant toxic responses from the 1.0 %(v/v) to the highest concentration tested with respect to the negative control ($p \leq 0.05$). The IC20 values for each sample were 0.72 %(v/v) and 0.29 %(v/v) respectively.

For sample SW9, the first statistically significant concentration compared to the negative control ($p \leq 0.05$) was 3.0 %(v/v). There was a considerable decrease in fertilization between 1.0 %(v/v) to 3.0 %(v/v) (from 82.2% to 7.8%). The estimated IC20 value for the sample was 1.26 %(v/v).

The iron reftox solution showed a significant decrease in fertilization at the 1.0 ppm concentration as compared to the negative control ($p \leq 0.05$), with an IC20 value of 0.43 mg/L. Caution should be taken in the interpretation of the iron reftox values since the first significant concentration of 1.0 ppm also corresponds to the presence of iron precipitate (most likely ferric oxide). These results may not necessarily indicate toxicity to iron, but may have resulted from some physical toxicity due to the precipitation or formation of particulate matter.

3.2 48-H BIVALVE (*MYTILUS GALLOPROVINCIALIS*) LARVAL DEVELOPMENT TOXICITY TEST

The 48-h *M. galloprovincialis* toxicity test showed mean negative control survival, normal, and normal surviving larvae of 96.9, 96.8, 95.6%, respectively. The corresponding brine control values for the same endpoints were 96.8, 98.0, and 96.4%, respectively. These negative and brine control test endpoint values were not significantly different when compared statistically.

Sample SW37 did not show any statistically significant response for all the endpoints in the highest concentrations. The only statistically significant results in test endpoint responses for sample SW37 was found in the percent normal endpoint for 0.2-10.0 %(v/v) concentrations relative to the negative control ($p \leq 0.05$). This however appears to be an artefactual response since no significance was found in the two highest concentration. The IC20 values for percent survival, normal, and normal survival were all >88.2 %(v/v).

Sample SW 9 showed statistically significant responses for the percent normal endpoint from concentrations 1.0 - 89.3 %(v/v) relative to the negative control ($p \leq 0.05$). The percent survival and normal survival endpoints both showed statistically significant responses at concentrations of 3.0 - 89.3 %(v/v) relative to the negative control ($p \leq 0.05$). The IC20 values for percent survival, normal, and normal survival were 2.2, 10.9, and 1.9 %(v/v) respectively.

Sample SW 11 showed the most statistically significant toxicity responses in the concentrations tested for all test endpoints. The percent normal endpoint showed statistically significant responses from concentrations 0.01 – 78.8 %(v/v) relative to the negative control ($p \leq 0.05$). The percent survival and normal survival endpoints both showed statistically significant responses at concentrations of 0.2 – 78.8 %(v/v) relative to the negative control ($p \leq 0.05$). The IC20 values for percent survival, normal, and normal survival were 0.2, 0.2, and 0.1 %(v/v) respectively.

The iron reftox showed statistically significant responses for the percent normal endpoint from concentrations 0.2 – 100 ppm relative to the negative control ($p \leq 0.05$). The percent survival and normal survival endpoints both showed statistically significant responses at concentrations of 1.0 - 100 ppm relative to the negative control ($p \leq 0.05$). The IC20 values for percent survival, normal, and normal survival were 0.5, 0.3, and 0.3 ppm respectively. Caution should be taken in the interpretation of the iron reftox toxicity since large amounts of precipitates, which were observed in this study, may have caused

entrainment toxicity. This could potentially be a factor in the concentrations greater then 1 ppm where large amounts of ferric oxide were present.

3.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The *S. purpuratus* and *M galloprovincialis* toxicity tests met all the negative control criteria for test validity as outlined in the respective Environment Canada (1992 and 1998) and US EPA (1995) protocols.

The point estimate for the fertilization endpoint of the *S. purpuratus* SDS reference toxicant test was within two standard deviations of the historical laboratory mean values. The point estimate for the bivalve proportion of normal surviving larval endpoint of the Cu reference toxicant was within three standard deviations of the laboratory mean, and the proportion normal endpoint was slightly outside three standard deviations. The departure of the later from the control limits was not very significant indicating the results were within reasonable limits of variability.

Higher confidence in the test results is also justified on the basis of the low laboratory coefficient of variations which were 13 and 16% for the bivalve normal and normal surviving larval endpoints, respectively.

Table 3: Summary of results for the *S. purpuratus* toxicity test for samples SW 9 and SW 11.

SW 9				
Treatment (%(v/v))	**Proportion Fertilized (%) Mean ± SD[0]**			
D-Control[1]	86.00	±	2.94	
B-Control[2]	93.00	±	1.83	
0.003	86.25	±	2.22	
0.010	82.50	±	7.23	
0.200	86.00	±	2.94	
1.000	82.25	±	5.12	
3.000	7.75	±	4.79	*
10.000	0.25	±	0.50	*
33.000	0.00	±	0.00	*
85.500	0.00	±	0.00	*
LOEC	3			
NOEC	1			
IC50 (95% CL)[4]	1.88 (1.75-2.00)			
IC20 (95% CL)[4]	1.26 (1.14-1.37)			
SW 11				
Treatment (%(v/v))	**Proportion Fertilized (%) Mean ± SD[0]**			
D-Control[1]	86.00	±	2.94	
B-Control[2]	93.00	±	1.83	
0.003	69.50	±	5.80	*
0.010	60.00	±	7.44	*
0.200	20.13	±	7.33	*
1.000	8.50	±	2.65	*
3.000	3.25	±	1.71	*
10.000	1.25	±	1.26	*
33.000	0.25	±	0.50	*
76.500	0.25	±	0.50	*
LOEC	0.003			
NOEC	<0.003			
IC50 (95% CL)[4]	0.09 (0.05-0.12)			
IC20 (95% CL)[4]	0.004 (0.002-0.01)			

[0] n = 4 replicates per treatment; ~2000 eggs per 10 mL (CDN)

[1] D-Control = Dilution Control

[2] B-Control = Brine Control

[4] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 4: Summary of results for the *S. purpuratus* toxicity test for samples SW 33 and SW 37.

SW 33				
Treatment (%(v/v))	**Proportion Fertilized (%) Mean ± SD[0]**			
D-Control[1]	86.00	±	2.94	
B-Control[2]	93.00	±	1.83	
0.003	31.25	±	16.21	*
0.010	32.75	±	12.42	*
0.200	32.00	±	7.79	*
1.000	21.50	±	7.23	*
3.000	7.25	±	3.95	*
10.000	1.50	±	1.29	*
33.000	0.25	±	0.50	*
83.300	0.25	±	0.50	*
LOEC	0.003			
NOEC	<0.003			
IC50 (95% CL)[4]	0.002 (0.002-0.003)			
IC20 (95% CL)[4]	0.001 (0.001-0.001)			
SW 37				
Treatment (%(v/v))	**Proportion Fertilized (%) Mean ± SD[0]**			
D-Control[1]	86.00	±	2.94	
B-Control[2]	93.00	±	1.83	
0.003	80.75	±	8.42	
0.010	82.75	±	8.81	
0.200	74.75	±	5.50	
1.000	66.25	±	11.95	*
3.000	62.25	±	12.55	*
10.000	65.00	±	5.60	*
33.000	46.25	±	14.93	*
91.600	62.50	±	8.23	*
LOEC	1			
NOEC	0.2			
IC50 (95% CL)[4]	>91.6			
IC20 (95% CL)[4]	0.72 (0.10-7.30)			

[0] n = 4 replicates per treatment; ~2000 eggs per 10 mL (CDN)

[1] D-Control = Dilution Control

[2] B-Control = Brine Control

[4] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 5: Summary of results for the *S. purpuratus* toxicity test for samples SW 38B and SW 40.

SW 38B				
Treatment (%(v/v))	**Proportion Fertilized (%) Mean ± SD[0]**			
D-Control[1]	86.00	±	2.94	
B-Control[2]	93.00	±	1.83	
0.003	79.00	±	13.44	
0.010	76.00	±	13.29	
0.200	71.25	±	14.82	
1.000	54.25	±	16.88	*
3.000	38.25	±	14.71	*
10.000	12.25	±	3.59	*
33.000	1.50	±	1.29	*
84.400	1.25	±	1.26	*
LOEC	1			
NOEC	0.2			
IC50 (95% CL)[4]	2.26 (0.14-5.18)			
IC20 (95% CL)[4]	0.29 (0.00-1.32)			
SW 40				
Treatment (%(v/v))	**Proportion Fertilized (%) Mean ± SD[0]**			
D-Control[1]	86.00	±	2.94	
B-Control[2]	93.00	±	1.83	
0.003	80.00	±	2.45	
0.010	71.00	±	16.85	*
0.200	53.50	±	10.50	*
1.000	69.50	±	5.26	*
3.000	60.50	±	4.65	*
10.000	3.75	±	1.71	*
33.000	0.00	±	0.00	*
87.800	0.00	±	0.00	*
LOEC	0.01			
NOEC	0.003			
IC50 (95% CL)[4]	4.46 (3.93-4.81)			
IC20 (95% CL)[4]	0.05 (0.00-0.22)			

[0] n = 4 replicates per treatment; ~2000 eggs per 10 mL (CDN)

[1] D-Control = Dilution Control

[2] B-Control = Brine Control

[4] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 6: Summary of results for the *S. purpuratus* toxicity test for the Iron reference toxicant.

Fe Reftox		
Treatment (ppm)	**Proportion Fertilized (%) Mean ± SD[0]**	
D-Control[1]	86.00 ± 2.94	
0.003	86.50 ± 1.29	
0.010	85.00 ± 3.56	
0.200	82.50 ± 4.51	
1.000	42.50 ± 9.54	*
3.000	1.25 ± 0.96	*
10.000	1.50 ± 1.29	*
33.000	0.00 ± 0.00	*
100.000	0.00 ± 0.00	*
LOEC	1	
NOEC	0.2	
IC50 (95% CL)[4]	0.98 (0.72-1.38)	
IC20 (95% CL)[4]	0.43 (0.31-0.54)	

[0] n = 4 replicates per treatment; ~2000 eggs per 10 mL (CDN)

[1] D-Control = Dilution Control

[4] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 7: Summary of results for the 48-h *M. galloprovincialis* toxicity test for samples SW 9 and SW 11.

SW 9												
Treatment (%(v/v))	**Normal (%) Mean ± SD[1]**				**Survival (%) Mean ± SD[1]**				**Normal Survival (%) Mean ± SD[1]**			
D-Control[2]	96.8	±	1.2		96.9	±	4.0		95.6	±	5.2	
B-Control[2]	98.0	±	0.2		96.8	±	6.4		96.4	±	7.3	
0.003	94.9	±	1.8		95.0	±	7.2		92.1	±	9.8	
0.01	96.2	±	1.2		97.2	±	5.4		95.6	±	6.6	
0.2	95.0	±	1.8		99.4	±	1.2		96.7	±	3.5	
1	90.3	±	2.6	*	96.3	±	7.5		92.1	±	9.6	
3	79.6	±	2.5	*	65.2	±	8.8	*	52.0	±	7.1	*
10	82.8	±	3.2	*	67.2	±	10.3	*	55.4	±	6.6	*
33	19.4	±	4.7	*	53.0	±	1.3	*	10.2	±	2.5	*
89.3	0.0	±	0.0	*	54.3	±	5.9	*	0.0	±	0.0	*
NOEC	0.2				1.0				1.0			
LOEC	1.0				3.0				3.0			
IC20 (95% CL)3	10.9 (10.6-12.8)				2.2 (1.8-2.8)				1.9 (1.2-2.1)			
IC50 (95% CL)3	21.9 (21.1-23.8)				>89.3				13.7 (7.2-15.6)			
SW 11												
Treatment (%(v/v))	**Normal (%) Mean ± SD[1]**				**Survival (%) Mean ± SD[1]**				**Normal Survival (%) Mean ± SD[1]**			
D-Control[2]	96.8	±	1.2		96.9	±	4.0		95.6	±	5.2	
B-Control[2]	98.0	±	0.2		96.8	±	6.4		96.4	±	7.3	
0.003	95.0	±	0.9		97.6	±	3.9		94.4	±	4.9	
0.01	92.0	±	2.2	*	96.3	±	4.4		91.3	±	7.2	
0.2	76.9	±	4.6	*	76.4	±	8.8	*	58.5	±	4.9	*
1	78.4	±	4.2	*	55.7	±	5.4	*	43.5	±	2.4	*
3	72.9	±	5.3	*	62.9	±	9.3	*	45.8	±	6.7	*
10	1.3	±	0.5	*	89.8	±	2.6	*	1.2	±	0.4	*
33	0.0	±	0.0	*	39.7	±	1.9	*	0.0	±	0.0	*
78.8	0.0	±	0.0	*	33.1	±	5.2	*	0.0	±	0.0	*
NOEC	0.003				0.01				0.01			
LOEC	0.01				0.2				0.2			
IC20 (95% CL)3	0.2 (0.2-3.1)				0.2 (0.1-0.7)				0.1 (0.0-0.1)			
IC50 (95% CL)3	5.3 (5.0-5.8)				23.2 (20.3-25.3)				0.9 (0.5-4.3)			

[1] n=4 replicates per treatment; ~295 embryos per replicate.

[2] D-Control = Dilution (Negative) Control; B-Control = Brine Control.

[3] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 8: Summary of results for the 48-h *M. galloprovincialis* toxicity test for samples SW 37 and the iron reference toxicant.

SW 37												
Treatment (%(v/v))	**Normal (%) Mean ± SD[1]**				**Survival (%) Mean ± SD[1]**				**Normal Survival (%) Mean ± SD[1]**			
D-Control[2]	96.8	±	1.2		96.9	±	4.0		95.6	±	5.2	
B-Control[2]	98.0	±	0.2		96.8	±	6.4		96.4	±	7.3	
0.003	94.2	±	1.5		98.9	±	1.6		95.4	±	5.4	
0.01	92.4	±	1.6		99.2	±	1.1		94.8	±	4.2	
0.2	92.1	±	1.4	*	99.6	±	0.8		95.5	±	5.6	
1	87.3	±	2.7	*	93.8	±	7.8		84.3	±	10.0	
3	84.7	±	12.2	*	98.7	±	2.5		89.6	±	17.8	
10	90.4	±	2.4	*	99.6	±	0.8		93.6	±	4.6	
33	94.0	±	1.6		96.7	±	4.8		94.3	±	7.3	
88.2	95.3	±	0.5		100.0	±	0.0		100.0	±	0.0	
NOEC	88.2				88.2				88.2			
LOEC	>88.2				>88.2				>88.2			
IC20 (95% CL)3	>88.2				>88.2				>88.2			
IC50 (95% CL)3	>88.2				>88.2				>88.2			
Fe Reftox												
Treatment (ppm)	**Normal (%) Mean ± SD[1]**				**Survival (%) Mean ± SD[1]**				**Normal Survival (%) Mean ± SD[1]**			
D-Control[2]	97.4	±	1.2		99.2	±	1.7		98.6	±	2.1	
0.003	96.5	±	0.9		96.5	±	7.0		95.8	±	8.5	
0.01	95.8	±	0.8		99.4	±	1.2		98.1	±	2.9	
0.2	90.4	±	1.6	*	97.3	±	2.5		90.2	±	7.2	
1	26.3	±	2.9	*	39.1	±	3.8	*	10.3	±	2.1	*
3	21.0	±	2.4	*	37.4	±	5.6	*	7.9	±	1.7	*
10	80.9	±	8.2	*	69.4	±	5.8	*	56.3	±	8.5	*
33	1.3	±	0.5	*	59.1	±	5.3	*	0.8	±	0.3	*
100	0.2	±	0.2	*	76.7	±	3.6	*	0.2	±	0.2	*
NOEC	0.01				0.2				0.2			
LOEC	0.2				1.0				1.0			
IC20 (95% CL)3	0.3 (0.4-0.4)				0.5 (0.4-0.5)				0.3 (0.2-0.4)			
IC50 (95% CL)3	0.8 (0.8-1.0)				>100				0.6 (0.6-0.7)			

[1] n=4 replicates per treatment; ~295 embryos per replicate.

[2] D-Control = Dilution (Negative) Control; B-Control = Brine Control.

[3] CL = Confidence Limits

* Indicates significant difference ($p \leq 0.05$) relative to the negative control (D-Control).

Table 9: Summary of ammonia and sulphide values for the *M. galloprovincialis* toxicity test.

Sample ID	Overlying Water Ammonia (mg/L N) Day 0	Overlying Water Ammonia (mg/L N) Day 2	Overlying Water Sulphides (mg/L S) Day 0	Overlying Water Sulphides (mg/L S) Day 2
Control	0.03	<0.02	<0.02	<0.02
SW 9	0.20	0.22	<0.02	<0.02
SW 11	0.18	0.25	<0.02	<0.02
SW 37	0.02	<0.02	<0.02	<0.02

4.0 REFERENCES

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USEPA (United States Environmental Protection Agency). 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to West Coast marine and estuarine organisms. 1st edition. US Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, OH. EPA/600/R-95/136. 661 pp.

APPENDIX I

Raw Data and Statistical Analyses: Echinoderm (*Strongylocentrotus purpuratus*) Fertilization Toxicity Test

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacore Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species S. strongylocentrotus purpuratus
Source/Date Received Westwind Sealab / 13 Feb 06
Test Duration 10:10

Sample ID	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
Control	14.0	7.8	28	8.3	
Brine Control	14.5	7.8	28	8.1	
Technician Initials	TH	TH	TH	TH	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-02050 Salinity II-A-030506 DO II-A-20

Sample Description

Data Verified By Ralph K Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor & Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Westland Sealab / 13 Feb 06
Test Duration 10:10

Sample ID	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SW9 - 0.003% (v/v)	15.0	7.7	28	8.4	
-0.01%	15.0	7.7	28	8.4	
-0.2%	15.0	7.7	28	8.4	
-1.0%	15.0	7.7	28	8.4	
-3.0%	15.0	7.6	28	8.4	
-10.0%	15.0	7.4	28	8.4	
-33.0%	15.0	7.2	28	8.2	
Max (85.5% v/v)	15.0	6.9	28	8.1	
SW11 -0.003% (v/v)	15.0	7.7	28	8.4	
-0.01%	15.0	7.7	28	8.4	
-0.2%	15.0	7.7	28	8.5	
-1.0%	15.0	7.7	28	8.5	
-3.0%	15.0	7.5	28	8.5	
-10.0%	15.0	7.3	28	8.5	
-33.0%	15.0	7.0	28	8.5	
Max (76.5% v/v)	15.0	6.8	28	7.7	
Technician Initials	RIE	RIE	RIE	RIE	

WQ Instruments Used: Temp. calibrated Hg Thermometer pH II-A-020501 Salinity II-A-030306DO II-A-20

Sample Description SW9 & SW11 - clear with orange precipitate

Data Verified By [signature] Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacorp Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Westcoast Sealab / 13 Feb 06
Test Duration 10:10

Sample ID	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SW33 - 0.003 % (v/v)	14.0	7.7	28	8.4	
- 0.01 %	14.0	7.8	28	8.4	
- 0.2 %	14.0	7.8	28	8.4	
- 1.0 %	14.0	7.8	28	8.4	
- 3.0 %	14.0	7.7	28	8.4	
- 10.0 %	14.0	7.5	28	8.5	
- 33.0 %	14.0	7.3	28	8.4	
Max (83.3 % v/v)	14.0	6.9	28	8.0	
SW37 - 0.003 % (v/v)	14.0	7.7	28	8.4	
- 0.01 %	14.0	7.9	28	8.4	
- 0.2 %	14.0	7.7	28	8.4	
- 1.0 %	14.0	7.8	28	8.4	
- 3.0 %	14.0	7.8	28	8.4	
- 10.0 %	14.0	7.8	28	8.5	
- 33.0 %	14.0	7.8	28	8.5	
Max (91.6 % v/v)	14.0	7.9	28	8.5	
Technician Initials	RIE	RIE	RIE	RIE	

WQ Instruments Used: Temp. Calib-tal Hg Thermometer pH II-A-020501 Salinity II-A-030306 DO II-A-20

Sample Description SW33 - Clear with orange precipitate / SW37 - Clear with small organics (very few)

Data Verified By Ralph K Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacorp Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06000049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Westwind Seaclub / 13 Feb 06
Test Duration 10:10

Sample ID	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SW388 - 0.003 %.v/v	15.0	7.7	28	8.5	
- 0.01 %	15.0	7.7	28	8.4	
- 0.2 %	15.0	7.7	28	8.4	
- 1.0 %	15.0	7.7	28	8.5	
- 3.0 %	15.0	7.7	28	8.5	
- 10.0 %	15.0	7.6	28	8.5	
- 33.0 %	15.0	7.4	28	8.5	
Max (84.4 %.v/v)	15.0	7.1	28	8.5	
SW390 - 0.003 %.v/v	15.0	7.7	28	8.4	
- 0.01 %	15.0	7.7	28	8.5	
- 0.2 %	15.0	7.7	28	8.5	
- 1.0 %	15.0	7.7	28	8.5	
- 3.0 %	15.0	7.7	28	8.5	
- 10.0 %	15.0	7.6	28	8.5	
- 33.0 %	15.0	7.4	28	8.5	
Max 18.78 %.v/v	15.0	7.1	28	8.0	
Technician Initials	RIE	RIE	RIE	RIE	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-030306 DO II-A-20
Sample Description SW388 x SW390 - Clear with orange precipitate
Data Verified By [signature] Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacon Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid II 13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Westwind Sealab / 13 Feb 06
Test Duration 10:10

Sample ID Fe (ppm)	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
~~100~~ Control	14.0	7.8	28	8.3	
0.0038	14.0	7.7	28	8.2	
0.01	14.0	7.7	28	8.2	
0.2	14.0	7.7	28	8.2	
1.0	14.0	7.7	28	8.2	
3.0	14.0	7.4	28	8.2	
10.0	14.0	7.3	28	8.2	
33.0	14.0	6.1	28	8.2	pH adjust → 7.3
100.0	14.0	3.1	28	8.2	pH adjust → 7.5
Technician Initials	~	~	~	~	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-020502 Salinity II-A-030306 DO II-A-20

Sample Description Clear with orange precipitate (Ferric Chloride)

Data Verified By Galfish Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacrest Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049

Lab Analysts SRS, JXS, LOC, RIE, MEL
Test Initiation Date 13 Feb 06

SAMPLE

Identification SW 9
Amount Received 2 x 1L
Date Collected 10 Feb 06
Date Received 13 Feb 06
Temperature (°C) 14.0 @ 15.0
pH 6.2 @ 6.9
Dissolved Oxygen (mg/L) 7.8 @ 8.1
Conductivity (µmhos/cm) —
Salinity (ppt) 17 @ 28
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

@ brine adjustment

TEST SPECIES

Organism Strongylocentrotus purpuratus
Source Westwind Sealab
Date Received 13 Feb 06
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 13 Feb 06
IC50 (and 95% CL) 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type 0.5µm Filtered, UV Sterilized Seawater
Temperature (°C) 14.0
pH 7.8
Dissolved Oxygen (mg/L) 8.3
Salinity (ppt) 28
Other —

TEST CONDITIONS

Temperature Range (°C) 14.0 - 15.0
pH Range 6.9 - 7.8
Dissolved Oxygen Range (mg/L) 8.1 - 8.4
Salinity Range (ppt) 28
Sperm:Egg Ratio 500:1
Test Duration 10-10
Other —

TEST RESULTS

IC_{50}: 188 (1.75 - 2.00) %v/v
IC_{25}: 136 (1.24 - 1.46) %v/v
NOEC: 1.0 %v/v
LOEC: 3.0 %v/v

Data Verified By [signature]
Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNTS (CONTROLS)

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb06 / 1725
Test Species Strongylocentrotus purpuratus
Test Duration 10 10
Sperm:Egg Ratio 500 : 1

Concentration ~~SDS (mg/L)~~	Replicate	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Tech. Initials
Reference Toxicant					
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
F-59 Blank	A	1	99		MM
	B	0	100		MM
	C	0	100		MM
	D	0	100		MM
Control Seawater					
Brine Control	A	91	9		MZ
	B	92	8		MZ
	C	95	5		MM
	D	94	6		MM

Data Verified By Qualified

Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor Environmental Engineering
Lab Project No. 04-1424-016
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received DF Westcoast Sealab / 13 Feb 06
Test Duration 10-10
Sperm:Egg Ratio 500:1

Sample ID SW9(9%W/O)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW 9 Egg Blank	A	0	100	Lots of Particulates (orange) on Septum	
	B	0	100		
	C	0	100		
	D	0	100		
0.003%	A	87	13	Clear	
	B	84	16		
	C	85	15		
	D	89	11		
0.01%	A	88	12		
	B	74	26		
	C	89	11		
	D	79	21		
0.1%	A	89	11		
	B	87	13		
	C	85	15		
	D	86	14		
1.0%	A	89	11		
	B	80	20		
	C	77	23		
	D	83	17		
3.0%	A	2	98	yellowish Colour (no particulates)	
	B	13	87		
	C	6	94		
	D	10	90		

Data Verified By Graham Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacan Environmental Engineering
Lab Project No. 04-1424-016
Lab Work Order No. 06C0049
Logbook Echinoid #13 Pages 75-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Carlsbad Scientific 13 Feb 06
Test Duration 10-10
Sperm:Egg Ratio 500:1

Sample ID	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW9 (QAV)	A	0	100	Orange pigment cells.	AWE
	B	1	99	Red Micelles (Large)	AWE
SW9	C	0	100	Clumping of eggs.	AWE
10.0%	D	0	100	oil slick	AWE
	A	0	100		AWE
	B	0	100		AWE
33%	C	0	100		AWE
	D	0	100		AWE
	A	0	100		AWE
(85.5)	B	0	100		AWE
MAX%	C	0	100		AWE
	D	0	100		AWE
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By Ralph K Date Verified March 9/06

Test: SC-Sperm Cell Fertilization test						Test ID: 0600049	
Species: SP-Strongylocentrotus purpuratus						Protocol: EPS1/RM/27-EC 92 (Sperm Cell)	
Sample ID: SW 9						Sample Type: GW-groundwater	
Start Date: 2/13/2006 17:25			End Date: 2/13/2006			Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	91	9	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	95	5	
	8	4	B-Control	100	94	6	
	9	1	0.003	100	87	13	
	10	2	0.003	100	84	16	
	11	3	0.003	100	85	15	
	12	4	0.003	100	89	11	
	13	1	0.010	100	88	12	
	14	2	0.010	100	74	26	
	15	3	0.010	100	89	11	
	16	4	0.010	100	79	21	
	17	1	0.200	100	89	11	
	18	2	0.200	100	87	13	
	19	3	0.200	100	82	18	
	20	4	0.200	100	86	14	
	21	1	1.000	100	89	11	
	22	2	1.000	100	80	20	
	23	3	1.000	100	77	23	
	24	4	1.000	100	83	17	
	25	1	3.000	100	2	98	
	26	2	3.000	100	13	87	
	27	3	3.000	100	6	94	
	28	4	3.000	100	10	90	
	29	1	10.000	100	0	100	
	30	2	10.000	100	1	99	
	31	3	10.000	100	0	100	
	32	4	10.000	100	0	100	
	33	1	33.000	100	0	100	
	34	2	33.000	100	0	100	
	35	3	33.000	100	0	100	
	36	4	33.000	100	0	100	
	37	1	85.500	100	0	100	
	38	2	85.500	100	0	100	
	39	3	85.500	100	0	100	
	40	4	85.500	100	0	100	

Comments: Seacor Environmental Engineering 04-1424-076(0600049)

Reviewed by: March 17/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	600049	Sample ID:	SW 9
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	2/10/2006	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacor Environmental Engineering 04-1424-076(0600049)				

Conc-%	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
B-Control	0.9100	0.9200	0.9500	0.9400
0.003	0.8700	0.8400	0.8500	0.8900
0.01	0.8800	0.7400	0.8900	0.7900
0.2	0.8900	0.8700	0.8200	0.8600
1	0.8900	0.8000	0.7700	0.8300
3	0.0200	0.1300	0.0600	0.1000
10	0.0000	0.0100	0.0000	0.0000
33	0.0000	0.0000	0.0000	0.0000
85.5	0.0000	0.0000	0.0000	0.0000

			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	0.8600	0.8200	0.8900	3.423	4				0.8613	1.0000
B-Control	0.9300	0.0183	0.9300	0.9100	0.9500	1.963	4					
0.003	0.8625	0.0222	0.8625	0.8400	0.8900	2.571	4	-0.084	2.451	0.0730	0.8613	1.0000
0.01	0.8250	0.0723	0.8250	0.7400	0.8900	8.769	4	1.176	2.451	0.0730	0.8425	0.9782
0.2	0.8600	0.0294	0.8600	0.8200	0.8900	3.423	4	0.000	2.451	0.0730	0.8425	0.9782
1	0.8225	0.0512	0.8225	0.7700	0.8900	6.229	4	1.260	2.451	0.0730	0.8225	0.9550
*3	0.0775	0.0479	0.0775	0.0200	0.1300	61.769	4	26.293	2.451	0.0730	0.0775	0.0900
*10	0.0025	0.0050	0.0025	0.0000	0.0100	200.000	4	28.813	2.451	0.0730	0.0025	0.0029
33	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000
85.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000

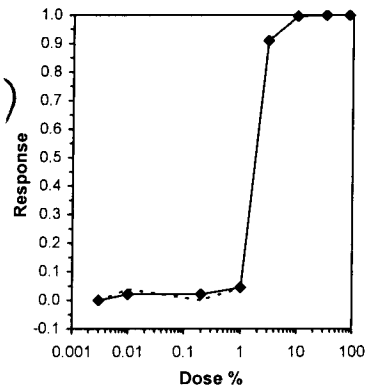
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97767	0.896	-0.1304	-0.0543
Bartlett's Test indicates equal variances (p = 0.03)	13.9438	16.8119		
The control means are significantly different (p = 6.79E-03)	4.04145	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	3	1.73205	100	0.07296	0.08483	0.62168	0.00177	6.2E-20	6, 21

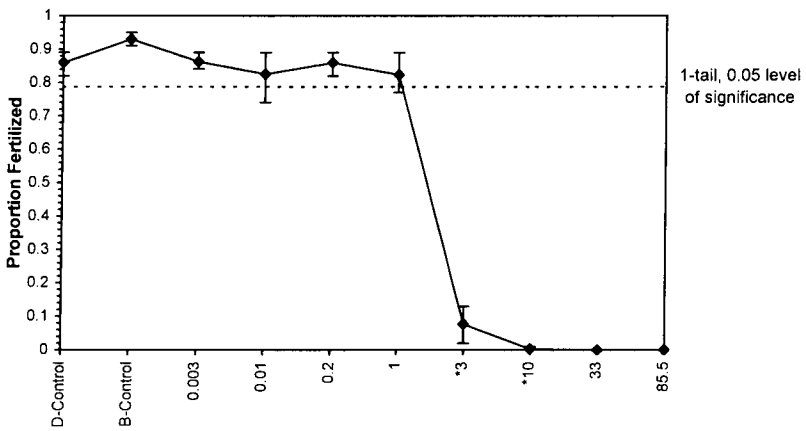
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	1.0080	0.3170	0.0000	1.1026	-1.0087
IC10	1.0901	0.0420	0.9628	1.1856	-1.6654
IC15	1.1756	0.0363	1.0424	1.2758	0.0507
IC20	1.2645	0.0360	1.1378	1.3684	0.0913
IC25	1.3571	0.0359	1.2385	1.4579	0.1274
IC40	1.6581	0.0373	1.5374	1.7666	0.1650
IC50	1.8799	0.0404	1.7524	1.9980	0.1134

$\%_p\ (v/v)$



Dose-Response Plot



Reviewed by Qadhi March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600049

Lab Analysts: SRS, JXS, LOC, RIE, MEL
Test Initiation Date: 13 Feb 06

SAMPLE

Identification: SW11
Amount Received: 2 x 1L
Date Collected: 10 Feb 06
Date Received: 13 Feb 06
Temperature (°C): 14.0 @ 15.0
pH: 5.9 @ 6.8
Dissolved Oxygen (mg/L): 5.8 @ 7.7
Conductivity (µmhos/cm): —
Salinity (ppt): 8 @ 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

@ Salinity adjustment

TEST SPECIES

Organism: Strongylocentrotus purpuratus
Source: Westcoast Sealab
Date Received: 13 Feb 06
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 13 Feb 06
IC50 (and 95% CL): 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5µm Filtered; UV Sterilized Seawater
Temperature (°C): 14.0
pH: 7.8
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 14.0 - 15.0
pH Range: 6.8 - 7.8
Dissolved Oxygen Range (mg/L): 7.7 - 8.5
Salinity Range (ppt): 28
Sperm:Egg Ratio: 500:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC_{50}: 0.09 (0.05 - 0.12) % v/v
IC_{25}: 0.01 (0.00 - 0.03) % v/v
NOEC: ~~<0.003~~ <0.003 % v/v
LOEC: 0.003 % v/v

Data Verified By: Ralph
Date Verified: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacon Environmental Engineering
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid # 13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Westcoast Sealab / 13 Feb 06
Test Duration 10:10
Sperm:Egg Ratio 500:1

Sample ID SW11 (% v/v)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW11 Egg BLANK	A	0	100	Orange colour.	MLL
	B	0	100	Large particulates	MLL
	C	0	100	Clinging to eggs.	MLL
	D	0	100	↓ 0.1 s/min	MLL
0.003%	A	71	29	Clear	MLL
	B	61	39	↓	MLL
	C	72	28	↓	MLL
	D	74	20	↓	MLL
0.01%	A	70	30	↓	MLL
	B	52	48	↓	MLL
	C	59	41	↓	MLL
	D	59	41	↓	MLL
0.2%	A	18	82	↓	MLL
	B	24	76	↓	MLL
	C	11	89	↓	MLL
	D	28	72	↓	MLL
1.0%	Flipped A	8 ~~92~~ MLL	92 ~~8~~ MLL	yellowish ligand	MLL
	B	10	90		MLL
	C	11	89		MLL
	D	5	95		MLL
3.0%	A	1	99	orange particulates	MLL
	B	5	95	in clumps &	MLL
	C	3	97	clumps D.F.1	MLL
	D	4	96	NON clinging to eggs	MLL

Data Verified By Galfish Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacan Environmental Engineering
Lab Project No. 04-1424-076
Lab Work Order No. 3600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received UBC Seclab / 13 Feb 06
Test Duration 10-10
Sperm:Egg Ratio 500:1

Sample ID SW1 (% v/v)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW11 10%	A	0	100	Orange particulates.	[illegible]
	B	3	97	Small charge some	[illegible]
	C	1	99	Clinging to eggs.	[illegible]
	D	1	99	v. l shell	[illegible]
33%	A	1	99		[illegible]
	B	0	100		[illegible]
	C	0	100		[illegible]
	D	0	100		[illegible]
MAX (76.5)	A	1	99	very fluid.	[illegible]
	B	0	100	Clinging particulates	[illegible]
	C	0	100	Look like	[illegible]
	D	0	100	Iron Filings on a Magnet	[illegible]
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By [signature] Date Verified March 9/06

Test: SC-Sperm Cell Fertilization test					Test ID: 0600049B		
Species: SP-Strongylocentrotus purpuratus					Protocol: EPS1/RM/27-EC 92 (Sperm Cell)		
Sample ID: SW 11					Sample Type: GW-groundwater		
Start Date: 2/13/2006 17:25			End Date: 2/13/2006		Lab ID: NVNLAB-Golder North Vancouver Laboratory		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	91	9	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	95	5	
	8	4	B-Control	100	94	6	
	9	1	0.003	100	71	29	
	10	2	0.003	100	61	39	
	11	3	0.003	100	72	28	
	12	4	0.003	100	74	26	
	13	1	0.010	100	70	30	
	14	2	0.010	100	52	48	
	15	3	0.010	100	59	41	
	16	4	0.010	100	59	41	
	17	1	0.200	100	18	82	
	18	2	0.200	102	24	78	
	19	3	0.200	100	11	89	
	20	4	0.200	100	28	72	
	21	1	1.000	100	8	92	
	22	2	1.000	100	10	90	
	23	3	1.000	100	11	89	
	24	4	1.000	100	5	95	
	25	1	3.000	100	1	99	
	26	2	3.000	100	5	95	
	27	3	3.000	100	3	97	
	28	4	3.000	100	4	96	
	29	1	10.000	100	0	100	
	30	2	10.000	100	3	97	
	31	3	10.000	100	1	99	
	32	4	10.000	100	1	99	
	33	1	33.000	100	1	99	
	34	2	33.000	100	0	100	
	35	3	33.000	100	0	100	
	36	4	33.000	100	0	100	
	37	1	76.500	100	1	99	
	38	2	76.500	100	0	100	
	39	3	76.500	100	0	100	
	40	4	76.500	100	0	100	

Comments: Seacor Environmental Engineering 04-1424-076 (0600049)

Reviewed by: March 17/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	0600049B	Sample ID:	SW 11
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	2/10/2006	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacor Environmental Engineering 04-1424-076 (0600049)				

Conc-%	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
B-Control	0.9100	0.9200	0.9500	0.9400
0.003	0.7100	0.6100	0.7200	0.7400
0.01	0.7000	0.5200	0.5900	0.5900
0.2	0.1800	0.2353	0.1100	0.2800
1	0.0800	0.1000	0.1100	0.0500
3	0.0100	0.0500	0.0300	0.0400
10	0.0000	0.0300	0.0100	0.0100
33	0.0100	0.0000	0.0000	0.0000
76.5	0.0100	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	1.1887	1.1326	1.2327	3.522	4				0.8600	1.0000
B-Control	0.9300	0.0183	1.3047	1.2661	1.3453	2.767	4					
*0.003	0.6950	0.0580	0.9868	0.8963	1.0357	6.278	4	4.958	2.513	0.1023	0.6950	0.8081
*0.01	0.6000	0.0744	0.8871	0.8054	0.9912	8.672	4	7.409	2.513	0.1023	0.6000	0.6977
*0.2	0.2013	0.0733	0.4601	0.3381	0.5576	20.631	4	17.900	2.513	0.1023	0.2015	0.2343
*1	0.0850	0.0265	0.2930	0.2255	0.3381	17.008	4	22.004	2.513	0.1023	0.0850	0.0988
*3	0.0325	0.0171	0.1753	0.1002	0.2255	30.981	4	24.897	2.513	0.1023	0.0325	0.0378
*10	0.0125	0.0126	0.1061	0.0500	0.1741	48.168	4	26.597	2.513	0.1023	0.0125	0.0145
*33	0.0025	0.0050	0.0626	0.0500	0.1002	40.080	4	27.667	2.513	0.1023	0.0025	0.0029
*76.5	0.0025	0.0050	0.0626	0.0500	0.1002	40.080	4	27.667	2.513	0.1023	0.0025	0.0029

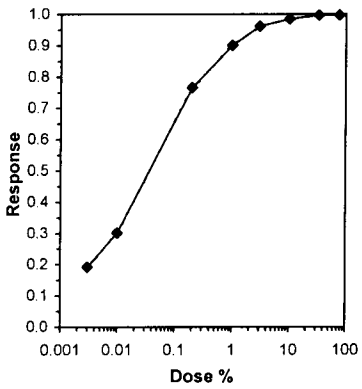
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96442	0.912	-0.2694	0.17938
Bartlett's Test indicates equal variances (p = 0.47)	7.68046	20.0902		
The control means are significantly different (p = 5.70E-03)	4.19798	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<0.003	0.003			0.07783	0.0904	0.77013	0.00331	7.5E-23	8, 27

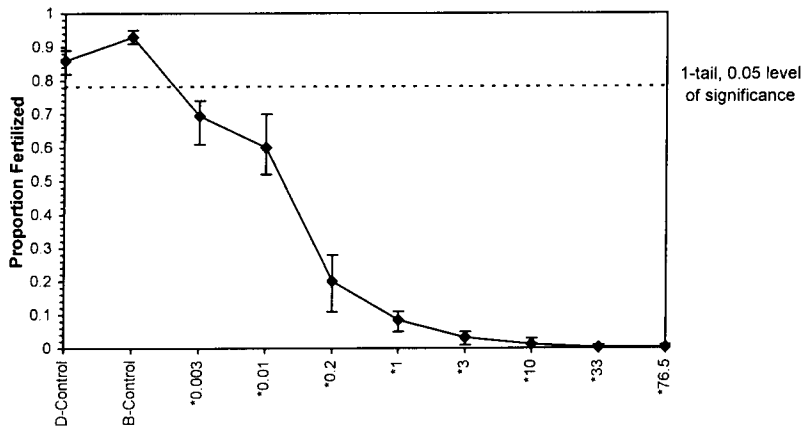
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.0008	0.0001	0.0005	0.0013	0.3423
IC10*	0.0016	0.0003	0.0009	0.0026	0.3426
IC15*	0.0023	0.0006	0.0014	0.0044	5.1905
IC20	0.0035	0.0020	0.0016	0.0101	5.2709
IC25	0.0067	0.0041	0.0006	0.0260	3.8017
IC40	0.0474	0.0130	0.0061	0.0808	0.1008
IC50	0.0871	0.0114	0.0519	0.1177	0.2773

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seaview Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 06C00049

Lab Analysts: SRS, JXS, LOC, RIE, MEL
Test Initiation Date: 13 Feb 06

SAMPLE

Identification: SW33
Amount Received: 2 x 1 L
Date Collected: 10 Feb 06
Date Received: 13 Feb 06
Temperature (°C): 14.0
pH: 6.3 @ - 6.9
Dissolved Oxygen (mg/L): 8.2 @ - 8.0
Conductivity (µmhos/cm): —
Salinity (ppt): 15 @ - 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

@ Salinity adjustment

TEST SPECIES

Organism: Strongylocentrotus purpuratus
Source: Westwind Sea Lab
Date Received: 13 Feb 06
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 13 Feb 06
IC50 (and 95% CL): 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5µm Filtered, UV Sterilized Seawater
Temperature (°C): 14.0
pH: 7.8
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 14.0 - ~~15.0~~ SRS
pH Range: 6.9 - 7.8
Dissolved Oxygen Range (mg/L): 8.0 - 8.5
Salinity Range (ppt): 28
Sperm:Egg Ratio: 500:1
Test Duration: 10:10
Other:

TEST RESULTS

IC_{50}: 0.002 (0.002 - 0.003) % v/v
IC_{25}: 0.001 (0.001 - 0.002) % v/v
~~NOEC~~ LOEC: ~~1.0 % v/v~~ 0.003 % v/v
NOEC: ~~0.25 % v/v~~ <0.003 % v/v

Data Verified By: [signature]
Date Verified: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor Environmental Engineering
Lab Project No. 04-1424-016
Lab Work Order No. 0600049
Logbook Comm. # 13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Vancomb Seabeb / 13 Feb 06
Test Duration 10-10
Sperm:Egg Ratio 500:1

Sample ID SW33(Y.V16)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW 33 Egg Blank	A	0	100	Murky ORANGE colour	MM
	B	0	100	Particulates. in Clumps	MC
	C	0	100	BLACK Bits.	MC
	D	0	100	Wood or Shell ?	MC
0.003%	A	23	77	Clear	MC
	B	14	846		MC
	C	37	63		MC
	D	51	49		MC
0.01%	A	35	65		MC
	B	16	84		MC
	C	34	66		MC
	D	46	54		MC
0.2%	A	33	67		MC
	B	41	59		MC
	C	32	68		MC
	D	22	78		MC
1.0%	A	30	70		MC
	B	13	87		MC
	C	19	81		MC
	D	24	76		MC
3.0%	A	6	94	Bit of Colour	MC
	B	4	96	Yellowish	MC
	C	6	94	Some particulates	MC
	D	13	87	Large, clingy	MC

Data Verified By Jacqui K Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Seacor Environmental Engineering
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600049
Logbook: Echinoid #13 Pages: 95-101

Test Initiation Date/Time: 13 Feb 06 / 1725
Test Species: Strongylocentrotus purpuratus
Source/Date Received: Lagoon Seawater / 13 Feb 06
Test Duration: 10-10
Sperm:Egg Ratio: 500:1

Sample ID SW33(v/v)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments Oil Slick on Surface	Tech. Initials
SW 33	A	0	100	Orange particles	
	B	3	97	Large, clinging	
10%	C	2	98	Black Chunks.	
	D	1	99	oil slick	
	A	0	100		
33%	B	0	100		
	C	0	100		
	D	1	99		
	A	0	100		
N/A	B	1	99		
	C	0	100		
(83 3)	D	0	100		
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D	egg with clinging		->  Black Chunk	
	A				
	B				
	C				
	D				

Data Verified By: Ralph K Date Verified: March 9/06

Test: SC-Sperm Cell Fertilization test						Test ID: 0600049C	
Species: SP-Strongylocentrotus purpuratus						Protocol: EPS1/RM/27-EC 92 (Sperm Cell)	
Sample ID: SW 33						Sample Type: GW-groundwater	
Start Date: 2/13/2006 17:25			End Date: 2/13/2006			Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	91	9	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	95	5	
	8	4	B-Control	100	94	6	
	9	1	0.003	100	23	77	
	10	2	0.003	100	14	86	
	11	3	0.003	100	37	63	
	12	4	0.003	100	51	49	
	13	1	0.010	100	35	65	
	14	2	0.010	100	16	84	
	15	3	0.010	100	34	66	
	16	4	0.010	100	46	54	
	17	1	0.200	100	33	67	
	18	2	0.200	100	41	59	
	19	3	0.200	100	32	68	
	20	4	0.200	100	22	78	
	21	1	1.000	100	30	70	
	22	2	1.000	100	13	87	
	23	3	1.000	100	19	81	
	24	4	1.000	100	24	76	
	25	1	3.000	100	6	94	
	26	2	3.000	100	4	96	
	27	3	3.000	100	6	94	
	28	4	3.000	100	13	87	
	29	1	10.000	100	0	100	
	30	2	10.000	100	3	97	
	31	3	10.000	100	2	98	
	32	4	10.000	100	1	99	
	33	1	33.000	100	0	100	
	34	2	33.000	100	0	100	
	35	3	33.000	100	0	100	
	36	4	33.000	100	1	99	
	37	1	83.300	100	0	100	
	38	2	83.300	100	1	99	
	39	3	83.300	100	0	100	
	40	4	83.300	100	0	100	

Comments: Seacor Environmental Engineering 04-1424-076 (0600049)

Reviewed by: March 17/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	0600049C	Sample ID:	SW 33
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	2/10/2006	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacor Environmental Engineering 04-1424-076 (0600049)				

Conc-%	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
B-Control	0.9100	0.9200	0.9500	0.9400
0.003	0.2300	0.1400	0.3700	0.5100
0.01	0.3500	0.1600	0.3400	0.4600
0.2	0.3300	0.4100	0.3200	0.2200
1	0.3000	0.1300	0.1900	0.2400
3	0.0600	0.0400	0.0600	0.1300
10	0.0000	0.0300	0.0200	0.0100
33	0.0000	0.0000	0.0000	0.0100
83.3	0.0000	0.0100	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	1.1887	1.1326	1.2327	3.522	4				0.8600	1.0000
B-Control	0.9300	0.0183	1.3047	1.2661	1.3453	2.767	4					
*0.003	0.3125	0.1621	0.5832	0.3835	0.7954	30.798	4	9.199	2.513	0.1654	0.3200	0.3721
*0.01	0.3275	0.1242	0.6031	0.4115	0.7454	23.097	4	8.897	2.513	0.1654	0.3200	0.3721
*0.2	0.3200	0.0779	0.5991	0.4882	0.6949	14.179	4	8.958	2.513	0.1654	0.3200	0.3721
*1	0.2150	0.0723	0.4779	0.3689	0.5796	18.765	4	10.800	2.513	0.1654	0.2150	0.2500
*3	0.0725	0.0395	0.2663	0.2014	0.3689	26.946	4	14.015	2.513	0.1654	0.0725	0.0843
*10	0.0150	0.0129	0.1165	0.0500	0.1741	46.067	4	16.290	2.513	0.1654	0.0150	0.0174
*33	0.0025	0.0050	0.0626	0.0500	0.1002	40.080	4	17.110	2.513	0.1654	0.0025	0.0029
*83.3	0.0025	0.0050	0.0626	0.0500	0.1002	40.080	4	17.110	2.513	0.1654	0.0025	0.0029

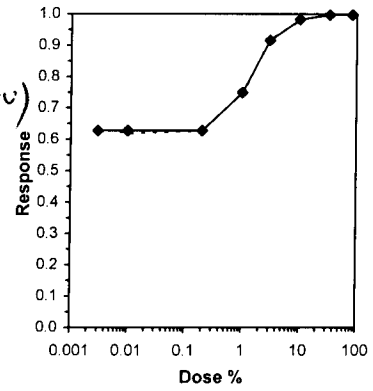
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96073	0.912	-0.1527	1.36601
Bartlett's Test indicates equal variances (p = 0.02)	17.6276	20.0902		
The control means are significantly different (p = 5.70E-03)	4.19798	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<0.003	0.003			0.13197	0.15328	0.52704	0.00866	2.8E-15	8, 27

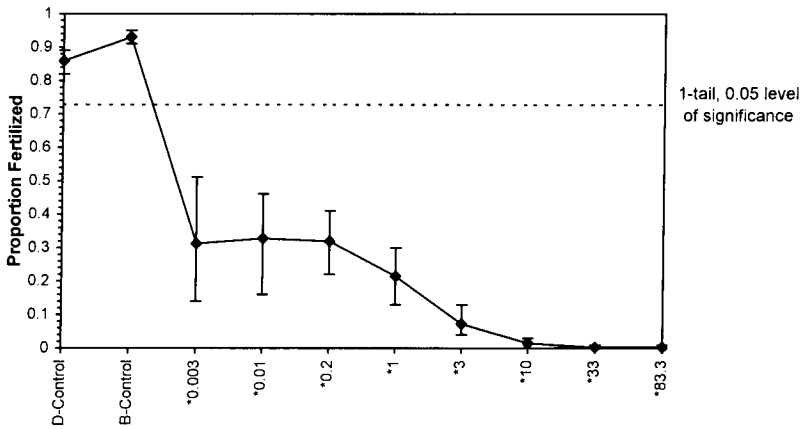
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.0002	0.0000	0.0002	0.0003	1.6869
IC10*	0.0005	0.0000	0.0004	0.0007	1.6870
IC15*	0.0007	0.0001	0.0006	0.0010	1.6872
IC20*	0.0010	0.0001	0.0008	0.0013	1.6873
IC25*	0.0012	0.0001	0.0010	0.0016	1.6875
IC40*	0.0019	0.0002	0.0016	0.0026	1.6879
IC50*	0.0024	0.0009	0.0020	0.0033	9.7365

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049

Lab Analysts SRS, JXS, LOC, RIE, MEL
Test Initiation Date 13 Feb 06

SAMPLE

Identification SW37
Amount Received 2 x 1L
Date Collected 10 Feb 06
Date Received 13 Feb 06
Temperature (°C) 14.0
pH 7.7 @ 7.9
Dissolved Oxygen (mg/L) 8.8 @ 8.5
Conductivity (µmhos/cm) —
Salinity (ppt) 22 @ 28
Ammonia (mg/L N) —
Chlorine (mg/L Cl) —
Other —

@ Salinity adjustment

TEST SPECIES

Organism Strongylocentrotus purpuratus
Source Westwind Sealab
Date Received 13 Feb 06
Reference Toxicant SDS
Current Reference Toxicant Result
Reference Toxicant Test Date 13 Feb 06
IC50 (and 95% CL) 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type 0.5µm Filtered, UV Sterilized Seawater
Temperature (°C) 14.0
pH 7.8
Dissolved Oxygen (mg/L) 8.3
Salinity (ppt) 28
Other —

TEST CONDITIONS

Temperature Range (°C) 14.0 ~~15.0~~
pH Range ~~8.3~~ ~~8.5~~ 7.7-7.9
Dissolved Oxygen Range (mg/L) ~~8.1~~ 8.5
Salinity Range (ppt) 28
Sperm:Egg Ratio 500:1
Test Duration 10:10
Other —

TEST RESULTS

IC_{50}: >91.6 %v/v
IC_{25}: 2.17 ~~(0.00-25.2) %v/v~~ (0.00-21.96) %v/v
LOEC: 1.0 %v/v
NOEC: 0.2 %v/v

Data Verified By [signature]
Date Verified March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Seneca Environmental Engineering
Lab Project No.: 31-1424-076
Lab Work Order No.: 0600049
Logbook: Echinoid #13 Pages: 95-101

Test Initiation Date/Time: 13 Feb 06 / 1725
Test Species: Strongylocentrotus purpuratus
Source/Date Received: UBC Strombi Seabeds / 13 Feb 06
Test Duration: 10:10
Sperm:Egg Ratio: 500:1

Sample ID (SW37 (2N16))	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW37 EGG BLANK	A	2	100	A few partially.	[illegible]
	B	0	100	Water Trash.	[illegible]
	C	0	100	Clear.	[illegible]
	D	0	100		[illegible]
0.003%	A	74	26		[illegible]
	B	73	27		[illegible]
	C	87	13		[illegible]
	D	89	11		[illegible]
0.01%	A	~~67~~	~~33~~	71/29 [illegible]	[illegible]
	B	90	10		[illegible]
	C	89	11		[illegible]
	D	81	19		[illegible]
0.2%	A	71	29		[illegible]
	B	70	30		[illegible]
	C	82	18		[illegible]
	D	76	24		[illegible]
1.0%	A	74	26		[illegible]
	B	55	45	67/33 [illegible] Avg: 61/39	[illegible]
	C	80	20	76/24 [illegible] Avg: 78/22	[illegible]
	D	50	50	54/46 [illegible] Avg: 52/48	[illegible]
3.0%	A	80	20	79/21 [illegible] Avg: 80/20	[illegible]
	B	55	45		[illegible]
	C	52	48		[illegible]
	D	62	38		[illegible]

Data Verified By: [illegible]
Date Verified: March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Seneca Environmental Engineering
Lab Project No.: 04-1424-016
Lab Work Order No.: 060049
Logbook: School # 13 Pages: 95-101

Test Initiation Date/Time: 13 Feb 06 / 1725
Test Species: Strongylocentrotus Purpuratus
Source/Date Received: Westcoast Seafish / 13 Feb 06
Test Duration: 10:10
Sperm:Egg Ratio: 500:1

Sample ID SW37 (7.0/0)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
Sw 37	A	60	40	clear	[illegible]
	B	64	36		[illegible]
10.0%	C	63	37		[illegible]
	D	73	27		[illegible]
	A	34	66	37/63 [illegible] Avg: 36/64	[illegible]
	B	53	47		[illegible]
33%	C	29	71	34/66 [illegible] Avg: 32/68	[illegible]
	D	64	36		[illegible]
	A	60	40	water trash	[illegible]
	B	40	30	& Chunkie Matt	[illegible]
MAX (91%)	C	52	48		[illegible]
	D	68	32		[illegible]
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By: [illegible] Date Verified: March 9/06

Test: SC-Sperm Cell Fertilization test						Test ID: 0600049D	
Species: SP-Strongylocentrotus purpuratus						Protocol: EPS1/RM/27-EC 92 (Sperm Cell)	
Sample ID: SW 37						Sample Type: GW-groundwater	
Start Date: 2/13/2006 17:25			End Date: 2/13/2006			Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	91	9	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	95	5	
	8	4	B-Control	100	94	6	
	9	1	0.003	100	74	26	
	10	2	0.003	100	73	27	
	11	3	0.003	100	87	13	
	12	4	0.003	100	89	11	
	13	1	0.010	100	71	29	
	14	2	0.010	100	90	10	
	15	3	0.010	100	89	11	
	16	4	0.010	100	81	19	
	17	1	0.200	100	71	29	
	18	2	0.200	100	70	30	
	19	3	0.200	100	82	18	
	20	4	0.200	100	76	24	
	21	1	1.000	100	74	26	
	22	2	1.000	100	61	39	
	23	3	1.000	100	78	22	
	24	4	1.000	100	52	48	
	25	1	3.000	100	80	20	
	26	2	3.000	100	55	45	
	27	3	3.000	100	52	48	
	28	4	3.000	100	62	38	
	29	1	10.000	100	60	40	
	30	2	10.000	100	64	36	
	31	3	10.000	100	63	37	
	32	4	10.000	100	73	27	
	33	1	33.000	100	36	64	
	34	2	33.000	100	53	47	
	35	3	33.000	100	32	68	
	36	4	33.000	100	64	36	
	37	1	91.600	100	60	40	
	38	2	91.600	100	70	30	
	39	3	91.600	100	52	48	
	40	4	91.600	100	68	32	

Comments: Seacor Environmental Engineering 04-1424-076 (0600049)

Reviewed by: March 17/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	0600049D	Sample ID:	SW 37
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	2/10/2006	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacor Environmental Engineering 04-1424-076 (0600049)				

Conc-%	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
B-Control	0.9100	0.9200	0.9500	0.9400
0.003	0.7400	0.7300	0.8700	0.8900
0.01	0.7100	0.9000	0.8900	0.8100
0.2	0.7100	0.7000	0.8200	0.7600
1	0.7400	0.6100	0.7800	0.5200
3	0.8000	0.5500	0.5200	0.6200
10	0.6000	0.6400	0.6300	0.7300
33	0.3600	0.5300	0.3200	0.6400
91.6	0.6000	0.7000	0.5200	0.6800

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	0.8600	0.8200	0.8900	3.423	4				0.8600	1.0000
B-Control	0.9300	0.0183	0.9300	0.9100	0.9500	1.963	4					
0.003	0.8075	0.0842	0.8075	0.7300	0.8900	10.429	4	0.783	2.513	0.1686	0.8175	0.9506
0.01	0.8275	0.0881	0.8275	0.7100	0.9000	10.644	4	0.485	2.513	0.1686	0.8175	0.9506
0.2	0.7475	0.0550	0.7475	0.7000	0.8200	7.358	4	1.677	2.513	0.1686	0.7475	0.8692
*1	0.6625	0.1195	0.6625	0.5200	0.7800	18.045	4	2.944	2.513	0.1686	0.6625	0.7703
*3	0.6225	0.1255	0.6225	0.5200	0.8000	20.166	4	3.541	2.513	0.1686	0.6363	0.7398
*10	0.6500	0.0560	0.6500	0.6000	0.7300	8.612	4	3.131	2.513	0.1686	0.6363	0.7398
*33	0.4625	0.1493	0.4625	0.3200	0.6400	32.282	4	5.926	2.513	0.1686	0.5438	0.6323
*91.6	0.6250	0.0823	0.6250	0.5200	0.7000	13.162	4	3.504	2.513	0.1686	0.5438	0.6323

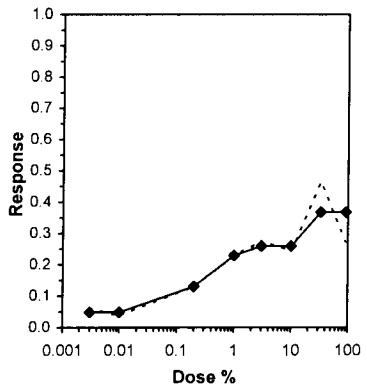
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96145	0.912	0.2157	-0.5204
Bartlett's Test indicates equal variances (p = 0.38)	8.6153	20.0902		
The control means are significantly different (p = 6.79E-03)	4.04145	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.2	1	0.44721	500	0.16858	0.19603	0.06374	0.009	5.0E-05	8, 27

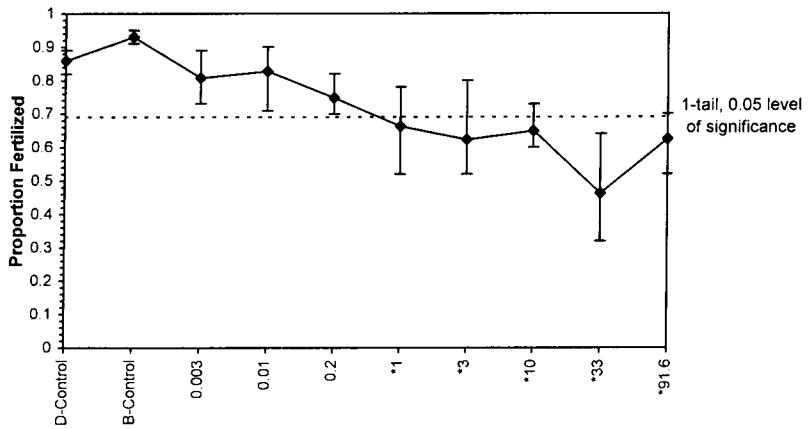
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	0.0112	0.0337	0.0000	0.1543	1.3849
IC10	0.1242	0.1069	0.0000	0.4482	3.5511
IC15	0.3251	0.3670	0.0037	2.0030	3.1275
IC20	0.7158	1.2006	0.0965	7.3026	2.4451
IC25	2.1748	4.6818	0.0000	21.9598	1.0053
IC40	>91.6				
IC50	>91.6				

(%v/v)



Dose-Response Plot



Reviewed by: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600049

Lab Analysts: SRS, JXS, LOC, RIE, MEL
Test Initiation Date: 13 Feb 06

SAMPLE

Identification: SW38B
Amount Received: 2x1L
Date Collected: 10 Feb 06
Date Received: 13 Feb 06
Temperature (°C): 14.0@ – 15.0
pH: 6.9@ – 7.1
Dissolved Oxygen (mg/L): 9.0@ – 8.5
Conductivity (µmhos/cm): —
Salinity (ppt): 16@ – 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

@ Salinity adjustment

TEST SPECIES

Organism: Strongylocentrotus purpuratus
Source: Westwind Sealab
Date Received: 13 Feb 06
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 13 Feb 06
IC50 (and 95% CL): 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5µm Filtered, UV Sterilized Seawater
Temperature (°C): 14.0
pH: 7.8
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 14.0 – 15.0
pH Range: 7.1 – 7.8
Dissolved Oxygen Range (mg/L): 8.1 – 8.5
Salinity Range (ppt): 28
Sperm:Egg Ratio: 500:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC_{50}: 2.36 (0.18 – 5.18) %v/v
IC_{25}: 0.47 (0.00 – 1.68) %v/v
LOEC: 1.0 %v/v
NOEC: 0.2 %v/v

Data Verified By: [signature]
Date Verified: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seven Environmental Engineering
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received UBC Seclab / 13 Feb 06
Test Duration 1010
Sperm:Egg Ratio 500:1

Sample ID SW38(1/16)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW 383	A	0	100	Inside of Angle	[illegible]
	B	0	100	Particulate	[illegible]
Egg	C	0	100	Oil Slick on Sand	[illegible]
B/Ank	D	0		Large Clumps	[illegible]
0.003%	A	88	12	clear	[illegible]
	B	89	11		[illegible]
	C	79	21		[illegible]
	D	59	41	62/38 mm Avg: 60/40	[illegible]
0.01%	A	87	13		[illegible]
	B	85	15		[illegible]
	C	74	26		[illegible]
	D	58	42	57/43 mm Avg: 58/42	[illegible]
0.1%	A	79	21		[illegible]
	B	88	12		[illegible]
	C	53 ~~57~~ ~~47~~	~~43~~ ~~47~~	59/41 mm Avg: 56/44	[illegible]
	D	62	38		[illegible]
1.0%	A	40	60		[illegible]
	B	57	43		[illegible]
	C	77	23		[illegible]
	D	43	67		[illegible]
3.0%	A	~~29 34~~	~~71 66~~		[illegible]
	B	61	39	59/41 mm Avg: 60/40	[illegible]
	C	31	69		[illegible]
	D	25	72		[illegible]

Data Verified By [signature] Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacon Environmental Engineering
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received BF Westcoast Seatech / 13 Feb 06
Test Duration 1010
Sperm:Egg Ratio 500:1

Sample ID SW38 (% v/v)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW38 10.0%	A	17	83	Slight yellow	[illegible]
	B	10	90	Colour to liquid	[illegible]
	C	13	87	+ Bit of particulate	[illegible]
	D	9	~~91~~ 91	Clinging / Large.	[illegible]
33%	A	0	100	+ oil stick	[illegible]
	B	2	98		[illegible]
	C	1	99		[illegible]
	D	3	97		[illegible]
MAX (644)	A	3	97		[illegible]
	B	1	99		[illegible]
	C	0	100		[illegible]
	D	1	99		[illegible]
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By [signature] Date Verified March 9/06

Test: SC-Sperm Cell Fertilization test					Test ID: 0600049E		
Species: SP-Strongylocentrotus purpuratus					Protocol: EPS1/RM/27-EC 92 (Sperm Cell)		
Sample ID: SW 38B					Sample Type: GW-groundwater		
Start Date: 2/13/2006 17:25			End Date: 2/13/2006		Lab ID: NVNLAB-Golder North Vancouver Laboratory		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	91	9	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	95	5	
	8	4	B-Control	100	94	6	
	9	1	0.003	100	88	12	
	10	2	0.003	100	89	11	
	11	3	0.003	100	79	21	
	12	4	0.003	100	60	40	
	13	1	0.010	100	87	13	
	14	2	0.010	100	85	15	
	15	3	0.010	100	74	26	
	16	4	0.010	100	58	42	
	17	1	0.200	100	79	21	
	18	2	0.200	100	88	12	
	19	3	0.200	100	56	44	
	20	4	0.200	100	62	38	
	21	1	1.000	100	40	60	
	22	2	1.000	100	57	43	
	23	3	1.000	100	77	23	
	24	4	1.000	100	43	67	
	25	1	3.000	100	34	66	
	26	2	3.000	100	60	40	
	27	3	3.000	100	31	69	
	28	4	3.000	100	28	72	
	29	1	10.000	100	17	83	
	30	2	10.000	100	10	90	
	31	3	10.000	100	13	87	
	32	4	10.000	100	9	91	
	33	1	33.000	100	0	100	
	34	2	33.000	100	2	98	
	35	3	33.000	100	1	99	
	36	4	33.000	100	3	97	
	37	1	84.400	100	3	97	
	38	2	84.400	100	1	99	
	39	3	84.400	100	0	100	
	40	4	84.400	100	1	99	

Comments: Seacor Environmental Engineering 04-1424-076 (0600049)

Reviewed by: Galpin March 17/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	0600049E	Sample ID:	SW 38B
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	2/10/2006	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacor Environmental Engineering 04-1424-076 (0600049)				

Conc-%	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
B-Control	0.9100	0.9200	0.9500	0.9400
0.003	0.8800	0.8900	0.7900	0.6000
0.01	0.8700	0.8500	0.7400	0.5800
0.2	0.7900	0.8800	0.5600	0.6200
1	0.4000	0.5700	0.7700	0.4300
3	0.3400	0.6000	0.3100	0.2800
10	0.1700	0.1000	0.1300	0.0900
33	0.0000	0.0200	0.0100	0.0300
84.4	0.0300	0.0100	0.0000	0.0100

			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	1.1887	1.1326	1.2327	3.522	4				0.8600	1.0000
B-Control	0.9300	0.0183	1.3047	1.2661	1.3453	2.767	4					
0.003	0.7900	0.1344	1.1077	0.8861	1.2327	14.452	4	0.911	2.513	0.2234	0.7900	0.9186
0.01	0.7600	0.1329	1.0691	0.8657	1.2019	14.382	4	1.345	2.513	0.2234	0.7600	0.8837
0.2	0.7125	0.1482	1.0160	0.8455	1.2171	16.824	4	1.943	2.513	0.2234	0.7125	0.8285
*1	0.5425	0.1688	0.8315	0.6847	1.0706	21.155	4	4.018	2.513	0.2234	0.5425	0.6308
*3	0.3825	0.1471	0.6642	0.5576	0.8861	22.628	4	5.901	2.513	0.2234	0.3825	0.4448
*10	0.1225	0.0359	0.3551	0.3047	0.4250	15.190	4	9.379	2.513	0.2234	0.1225	0.1424
*33	0.0150	0.0129	0.1165	0.0500	0.1741	46.067	4	12.063	2.513	0.2234	0.0150	0.0174
*84.4	0.0125	0.0126	0.1061	0.0500	0.1741	48.168	4	12.181	2.513	0.2234	0.0125	0.0145

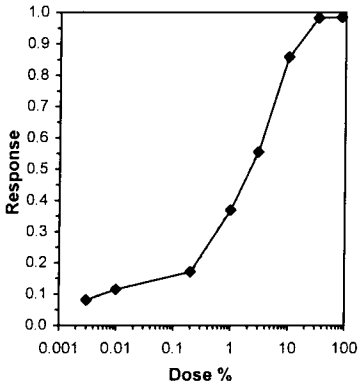
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98065	0.912	0.18167	-0.0303
Bartlett's Test indicates equal variances (p = 0.11)	12.9771	20.0902		
The control means are significantly different (p = 5.70E-03)	4.19798	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.2	1	0.44721	500	0.18491	0.21478	0.73454	0.0158	8.3E-14	8, 27

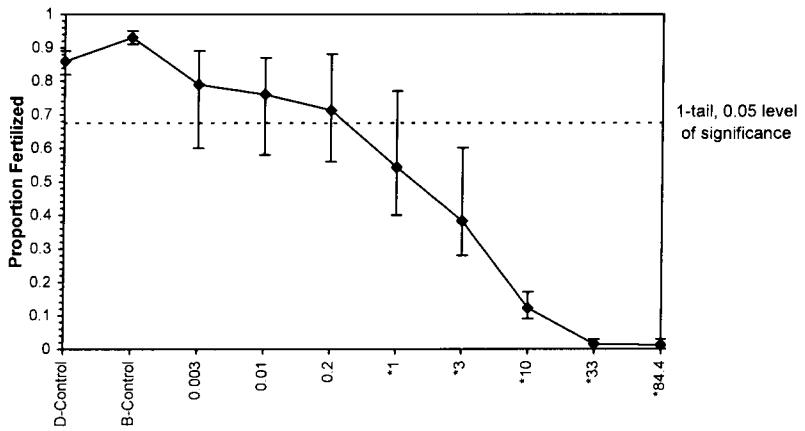
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05*	0.0018	0.0255	0.0003	0.0890	7.2991	
IC10	0.0067	0.0687	0.0000	0.4069	2.4981	
IC15	0.1221	0.1393	0.0000	0.5876	2.0714	
IC20	0.2917	0.2194	0.0000	1.3170	1.4921	
IC25	0.4698	0.2917	0.0000	1.6828	1.1252	
IC40	1.2433	0.5880	0.2849	4.1671	1.2667	
IC50	2.2561	0.8198	0.1391	5.1785	0.2920	(%v/v)

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by Galfish March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600049

Lab Analysts: SRS, JXS, LOC, RIE, MEL
Test Initiation Date: 13 Feb 06

SAMPLE

Identification: SW40
Amount Received: 2 x 1L
Date Collected: 10 Feb 06
Date Received: 13 Feb 06
Temperature (°C): 14.0 @ 15.0
pH: 6.8 @ 7.1
Dissolved Oxygen (mg/L): 7.6 @ 8.0
Conductivity (µmhos/cm): —
Salinity (ppt): 19 @ 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

@ Salinity Adjustment

TEST SPECIES

Organism: Strongylocentrotus purpuratus
Source: Westwind Sealab
Date Received: 13 Feb 06
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 13 Feb 06
IC50 (and 95% CL): 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5µm Filtered, UV Sterilized Seawater
Temperature (°C): 14.0
pH: 7.8
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 14.0 - 15.0
pH Range: 7.1 - 7.8
Dissolved Oxygen Range (mg/L): 8.0 - 8.5
Salinity Range (ppt): 28
Sperm:Egg Ratio: 500 : 1
Test Duration: 10 : 10
Other: —

TEST RESULTS

IC_{50}: 4.46 (3.93 - 5.06) %v/v
IC_{25}: 0.14 (0.00 - 3.24) %v/v
LOEC: 0.01 %v/v
NOEC: 0.003 %v/v

Data Verified By: [signature]
Date Verified: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacan Environmental Engineering
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received D.F. Westmont Sealab / 13 Feb 06
Test Duration 1010
Sperm:Egg Ratio 500:1

Sample ID SW40 (1/4/6)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW40	A	0	100	Orange particles	[illegible]
	B	0	100	Oil slick on	[illegible]
Egg Blank	C	1	99	Debris	[illegible]
	D	0	100	Large ciliates	[illegible]
0.003%	A	82	18	Clear	[illegible]
	B	82	18		[illegible]
	C	77	23		[illegible]
	D	79	21		[illegible]
0.01%	A	49	50	58/42 ave Adj: 54/46	[illegible]
	B	62	38	59/41 ave Adj: 60/40	[illegible]
	C	89	11	90/10 ave Adj: 98/10	[illegible]
	D	81	19	79/22 ave Adj: 80/20	[illegible]
0.2%	A	68	32		[illegible]
	B	54	46		[illegible]
	C	37	63	50/50 ave Adj: 44/56	[illegible]
	D	48	ave 52		[illegible]
1.0%	A	70	30	63/37 ave Adj: 66/34	[illegible]
	B	76	24	72/28 ave Adj: 74/26	[illegible]
	C	64	36		[illegible]
	D	74	26		[illegible]
3.0%	A	62	38	Some clingon particles	[illegible]
	B	54	46		[illegible]
	C	65	35		[illegible]
	D	61	ave 39		[illegible]

Data Verified By [illegible] Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Seacor Environmental Engineering
Lab Project No.: 04-1424-076
Lab Work Order No.: 06AX049
Logbook: Echinoid #13 Pages: 95-101

Test Initiation Date/Time: 13 Feb 06 / 1725
Test Species: Strongylocentrotus purpuratus
Source/Date Received: BF Westmin Seclab / 13 Feb 06
Test Duration: 10-10
Sperm:Egg Ratio: 500:1

Sample ID (SW40 (%.v/v))	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
SW40 10.0%	A	6	94	yellowish brown oil like orange particles.	MA
	B	2	98		MA
	C	3	97	Large clingons	MA
	D	4	96		MA
33.0%	A	0	100		MA
	B	0	100		MA
	C	0	100		MA
	D	0	100		MA
N/A (87.8)	A	0	100	Plus oil slick	MA
	B	0	100		MA
	C	0	100		MA
	D	0	100		MA
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By: Galjak Date Verified: March 9/06

Test: SC-Sperm Cell Fertilization test					Test ID: 0600049F		
Species: SP-Strongylocentrotus purpuratus					Protocol: DL 87		
Sample ID: SW 40					Sample Type: GW-groundwater		
Start Date: 2/13/2006 17:25			End Date: 2/13/2006		Lab ID: NVNLAB-Golder North Vancouver Laboratory		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	B-Control	100	91	9	
	6	2	B-Control	100	92	8	
	7	3	B-Control	100	95	5	
	8	4	B-Control	100	94	6	
	9	1	0.003	100	82	18	
	10	2	0.003	100	82	18	
	11	3	0.003	100	77	23	
	12	4	0.003	100	79	21	
	13	1	0.010	100	54	46	
	14	2	0.010	100	60	40	
	15	3	0.010	100	90	10	
	16	4	0.010	100	80	20	
	17	1	0.200	100	68	32	
	18	2	0.200	100	54	46	
	19	3	0.200	100	44	56	
	20	4	0.200	100	48	52	
	21	1	1.000	100	66	34	
	22	2	1.000	100	74	26	
	23	3	1.000	100	64	36	
	24	4	1.000	100	74	26	
	25	1	3.000	100	62	38	
	26	2	3.000	100	54	46	
	27	3	3.000	100	65	35	
	28	4	3.000	100	61	39	
	29	1	10.000	100	6	94	
	30	2	10.000	100	2	98	
	31	3	10.000	100	3	97	
	32	4	10.000	100	4	96	
	33	1	33.000	100	0	100	
	34	2	33.000	100	0	100	
	35	3	33.000	100	0	100	
	36	4	33.000	100	0	100	
	37	1	87.800	100	0	100	
	38	2	87.800	100	0	100	
	39	3	87.800	100	0	100	
	40	4	87.800	100	0	100	

Comments: Seacor Environmental Engineering 04-1424-076 (0600049)

Reviewed by: March 17/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	0600049F	Sample ID:	SW 40	
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater	
Sample Date:	2/10/2006	Protocol:	DL 87	Test Species:	SP-Strongylocentrotus purpuratus	
Comments:	Seacor Environmental Engineering 04-1424-076 (0600049)					

Conc-%	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
B-Control	0.9100	0.9200	0.9500	0.9400
0.003	0.8200	0.8200	0.7700	0.7900
0.01	0.5400	0.6000	0.9000	0.8000
0.2	0.6800	0.5400	0.4400	0.4800
1	0.6600	0.7400	0.6400	0.7400
3	0.6200	0.5400	0.6500	0.6100
10	0.0600	0.0200	0.0300	0.0400
33	0.0000	0.0000	0.0000	0.0000
87.8	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	1.1887	1.1326	1.2327	3.522	4				0.8600	1.0000
B-Control	0.9300	0.0183	1.3047	1.2661	1.3453	2.767	4					
0.003	0.8000	0.0245	1.1077	1.0706	1.1326	2.752	4	1.234	2.451	0.1608	0.8000	0.9302
*0.01	0.7100	0.1685	1.0169	0.8254	1.2490	19.320	4	2.618	2.451	0.1608	0.7100	0.8256
*0.2	0.5350	0.1050	0.8214	0.7253	0.9695	13.025	4	5.598	2.451	0.1608	0.6150	0.7151
*1	0.6950	0.0526	0.9868	0.9273	1.0357	5.796	4	3.078	2.451	0.1608	0.6150	0.7151
*3	0.6050	0.0465	0.8915	0.8254	0.9377	5.322	4	4.529	2.451	0.1608	0.6050	0.7035
*10	0.0375	0.0171	0.1912	0.1419	0.2475	23.376	4	15.205	2.451	0.1608	0.0375	0.0436
33	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
87.8	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000

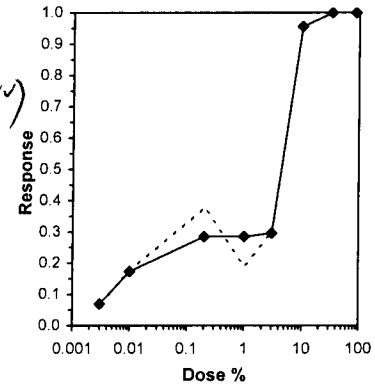
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95745	0.896	0.42895	2.07169
Bartlett's Test indicates equal variances (p = 0.02)	15.4427	16.8119		
The control means are significantly different (p = 5.70E-03)	4.19798	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.003	0.01	0.00548	33333.3	0.12789	0.14855	0.43665	0.00861	2.0E-11	6, 21

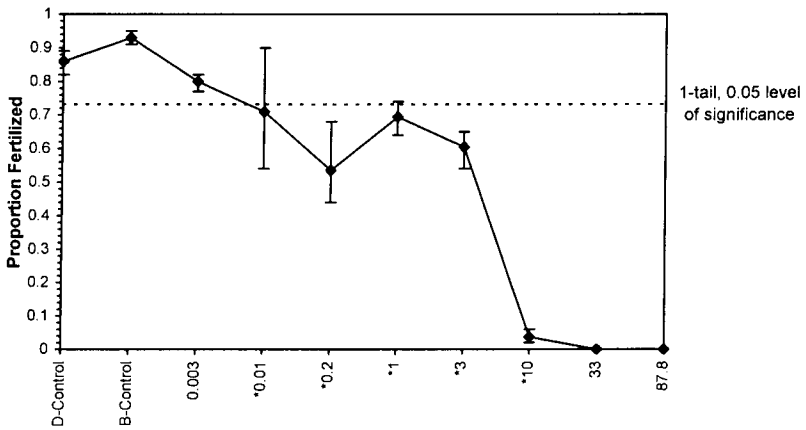
Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.0021	0.0038	0.0012	0.0245	6.0659
IC10	0.0050	0.0139	0.0020	0.0806	2.5517
IC15	0.0084	0.0305	0.0035	0.1537	1.3832
IC20	0.0511	0.1409	0.0000	0.2230	6.6216
IC25	0.1364	0.5970	0.0000	3.2644	2.5542
IC40	3.6877	0.1391	3.1279	4.0304	-0.0546
IC50	4.4643	0.1346	3.9329	4.8093	-0.1171

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by Qalfik
March 17 06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600049

Lab Analysts: SRS, JXS, LOC, RIE, MEL
Test Initiation Date: 13 Feb 06

SAMPLE

Identification: Fe Reftox (100 ppm Solution)
Amount ~~Received~~ Prep'd: 1 L
Date ~~Collected~~ Prep'd: 13 Feb 06
Date Received: —
Temperature (°C): 14.0
pH: 3.1 @ 7.5
Dissolved Oxygen (mg/L): 8.2
Conductivity (µmhos/cm): —
Salinity (ppt): 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

@ pH adjustment

TEST SPECIES

Organism: Strongylocentrotus purpuratus
Source: Westwind Sealab
Date Received: 13 Feb 06
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 13 Feb 06
IC50 (and 95% CL): 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV = 36

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5µm Filtered, UV Sterilized Seawater
Temperature (°C): 14.0
pH: 7.8
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 14.0
pH Range: 7.3 - 7.8
Dissolved Oxygen Range (mg/L): 8.2 - 8.3
Salinity Range (ppt): 28
Sperm:Egg Ratio: 500:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC_{50}: 0.98 (0.72-1.38) ppm Fe
IC_{25}: 0.51 ~~(0.37-0.67) ppm Fe~~ (0.37-0.67) ppm Fe
LOEC: 1.0 ppm Fe
NOEC: ~~0.51~~ 0.2 ppm Fe

Data Verified By: [signature]
Date Verified: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Seacan Environmental Engineering
Lab Project No.: 04-1424-076
Lab Work Order No.: 06000049
Logbook: Echinoid #13 Pages: 95-101

Test Initiation Date/Time: 13 Feb 06 / 1725
Test Species: Strongylocentrotus purpuratus
Source/Date Received: Westcoast Seafood 13 Feb 06
Test Duration: 10-10
Sperm:Egg Ratio: 500:1

FE Ref Not Filtered

Sample ID Fe (ppm)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
Egg Blank	A	0	100	Circle Of Aborg pedicells	
	B	0	100		
	C	0	100		
	D	0	100		
0.003	A	88	12	Clear.	
	B	86	14		
	C	87	13		
	D	85	15		
0.01	A	85	15		
	B	83	17		
	C	92	8	87/13 ave Ag 90/10	
	D	82	18		
0.2	A	83	17		
	B	85	15		
	C	74	26	79/21 ave Ag 76/24	
	D	86	14		
1.0	A	48	52	Some larger pedicells	
	B	33	67	Clinging to gametes.	
	C	36	64		
	D	53	47		
3.0	A	0	100	Artif Ejaculate	
	B	1	99	Eggs Cover in Legs	
	C	2	98	Large Orange Patches	
	D	2	98	Clinging.	

Data Verified By: Ralph

Date Verified: March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client Seacor Environmental Engineering
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echino. # 13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received UBC Strunk Seabeds / 13 Feb 06
Test Duration 10-10
Sperm:Egg Ratio 500:1

Fe Reagent-filtered

Sample ID (Fe (ppm))	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
0.0	A	3	97	yellower color ok	AM
	B	2	98	Cilgered Large	AM
	C	0	100	Clinging Partial.	AM
	D	1	99		AM
33.0	A	0	100	Total Slide	AM
	B	0	100		AM
	C	0	100		AM
	D	0	100		AM
100.0	A	0	100	Thick clumping	AM
	B	0	100	& Clinging	AM
	C	0	100	Orange Pluteus	AM
	D	0	100		AM
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By [signature] Date Verified March 9/06

Test: SC-Sperm Cell Fertilization test						Test ID: 0600049G	
Species: SP-Strongylocentrotus purpuratus						Protocol: EPS1/RM/27-EC 92 (Sperm Cell)	
Sample ID: FE REFTOX						Sample Type: GW-groundwater	
Start Date: 2/13/2006 17:25			End Date: 2/13/2006			Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	0.003	100	88	12	
	6	2	0.003	100	86	14	
	7	3	0.003	100	87	13	
	8	4	0.003	100	85	15	
	9	1	0.010	100	85	15	
	10	2	0.010	100	83	17	
	11	3	0.010	100	90	10	
	12	4	0.010	100	82	18	
	13	1	0.200	100	83	17	
	14	2	0.200	100	85	15	
	15	3	0.200	100	76	24	
	16	4	0.200	100	86	14	
	17	1	1.000	100	48	52	
	18	2	1.000	100	33	67	
	19	3	1.000	100	36	64	
	20	4	1.000	100	53	47	
	21	1	3.000	100	0	100	
	22	2	3.000	100	1	99	
	23	3	3.000	100	2	98	
	24	4	3.000	100	2	98	
	25	1	10.000	100	3	97	
	26	2	10.000	100	2	98	
	27	3	10.000	100	0	100	
	28	4	10.000	100	1	99	
	29	1	33.000	100	0	100	
	30	2	33.000	100	0	100	
	31	3	33.000	100	0	100	
	32	4	33.000	100	0	100	
	33	1	100.000	100	0	100	
	34	2	100.000	100	0	100	
	35	3	100.000	100	0	100	
	36	4	100.000	100	0	100	

Comments: Seacor Environmental Engineering 04-1424-076 (0600049)

Reviewed by: March 07/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 17:25	Test ID:	0600049G	Sample ID:	FE REFTOX
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	2/10/2006	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacor Environmental Engineering 04-1424-076 (0600049)				

Conc-ppm	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
0.003	0.8800	0.8600	0.8700	0.8500
0.01	0.8500	0.8300	0.9000	0.8200
0.2	0.8300	0.8500	0.7600	0.8600
1	0.4800	0.3300	0.3600	0.5300
3	0.0000	0.0100	0.0200	0.0200
10	0.0300	0.0200	0.0000	0.0100
33	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

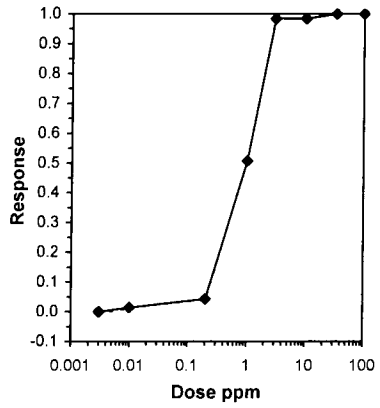
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-ppm	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8600	0.0294	1.1887	1.1326	1.2327	3.522	4				0.8625	1.0000
0.003	0.8650	0.0129	1.1948	1.1731	1.2171	1.583	4	-0.155	2.451	0.0979	0.8625	1.0000
0.01	0.8500	0.0356	1.1751	1.1326	1.2490	4.430	4	0.338	2.451	0.0979	0.8500	0.9855
0.2	0.8250	0.0451	1.1413	1.0588	1.1873	5.046	4	1.187	2.451	0.0979	0.8250	0.9565
*1	0.4250	0.0954	0.7091	0.6119	0.8154	13.677	4	12.008	2.451	0.0979	0.4250	0.4928
*3	0.0125	0.0096	0.1085	0.0500	0.1419	40.246	4	27.045	2.451	0.0979	0.0138	0.0159
*10	0.0150	0.0129	0.1165	0.0500	0.1741	46.067	4	26.844	2.451	0.0979	0.0138	0.0159
33	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98389	0.896	-0.0807	-0.4315
Bartlett's Test indicates equal variances (p = 0.37)	6.51123	16.8119		

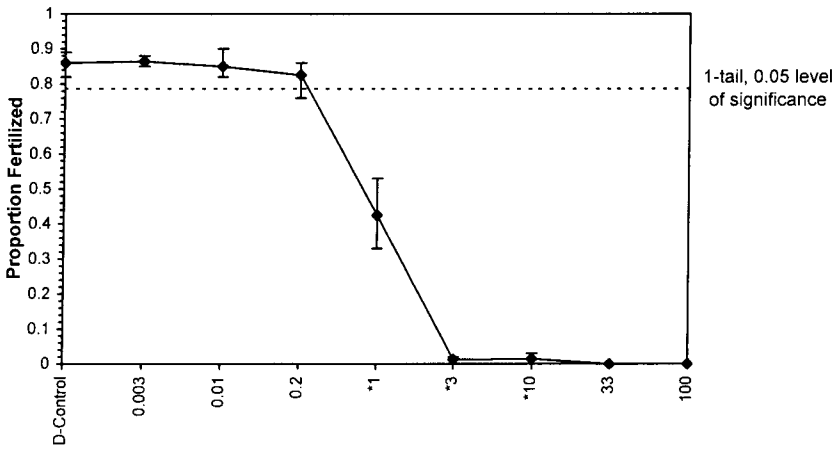
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.2	1	0.44721		0.07422	0.08621	1.0117	0.00319	1.8E-19	6, 21

Log-Linear Interpolation (200 Resamples)

Point	ppm	SD	95% CL(Exp)		Skew	
IC05	0.2087	0.0635	0.0000	0.2757	-0.9262	
IC10	0.2771	0.0319	0.1554	0.3484	-0.4468	
IC15	0.3494	0.0330	0.2422	0.4328	-0.2273	
IC20	0.4258	0.0369	0.3138	0.5388	0.0065	
IC25	0.5065	0.0434	0.3710	0.6690	0.2487	
IC40	0.7772	0.0764	0.5787	1.0953	0.6757	
IC50	0.9841	0.1034	0.7227	1.3798	0.4587	ppm Fe



Dose-Response Plot



Reviewed by March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600049

Lab Analysts: SRS, JXS, LOC, RIE, MEL
Test Initiation Date: 13 Feb 06

SAMPLE

Identification: SDS Solution 06-S-001
Amount ~~Received~~ Rec'd: 2L
Date ~~Collected~~ Rec'd: 19-Jan 06
Date Received: —
Temperature (°C): —
pH: —
Dissolved Oxygen (mg/L): —
Conductivity (µmhos/cm): —
Salinity (ppt): —
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

TEST SPECIES

Organism: Strongylocentrotus purpuratus
Source: Westwind Sealab
Date Received: 13 Feb 06
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 13 Feb 06
IC50 (and 95% CL): 2.7 (2.4-3.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
2.8 ± 2.0 mg/L SDS CV=36

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5µm Filtered; UV Sterilized & Seawater
Temperature (°C): 14.0
pH: 7.8
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 14.0
pH Range: 7.6-7.8
Dissolved Oxygen Range (mg/L): 8.3-8.4
Salinity Range (ppt): 28
Sperm:Egg Ratio: 500:1
Test Duration: 10:16
Other: —

TEST RESULTS

IC_{50}: 2.7 (2.4-3.4) mg/L SDS
IC_{25}: 2.2 (2.1-2.5) mg/L SDS
NOEC: 1.8 mg/L SDS
LOEC: 3.2 mg/L SDS

Data Verified By: [signature]
Date Verified: March 17/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101

Test Initiation Date/Time 13 Feb 06 / 1725
Test Species Strongylocentrotus purpuratus
Source/Date Received Westwind Sealab / 13 Feb 06
Test Duration 10 10

Sample ID SDS Reftox (mg/L	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SDS Control	14.0	7.8	28	8.3	
1.0	14.0	7.6	28	8.4	
1.8	14.0	7.7	28	8.4	
3.2	14.0	7.7	28	8.4	
5.6	14.0	7.7	28	8.4	
10.0	14.0	7.7	28	8.4	
Technician Initials	~	~	~	~	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-02050 Salinity II-A-030306 DO II-A-20

Sample Description

Data Verified By Gail K Date Verified March 9/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNTS (CONTROLS)

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600049
Logbook Echinoid #13 Pages 95-101
Test Initiation Date/Time 13 Feb06 / 1725
Test Species Strongylocentrotus purpuratus
Test Duration 10 10
Sperm:Egg Ratio 500:1

Concentration SDS (mg/L)	Replicate	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Tech. Initials
Reference Toxicant					
1.0	A	83	17		[illegible]
	B	95	5		[illegible]
	C	90	10		[illegible]
	D	90	10		[illegible]
1.8	A	86	14		[illegible]
	B	91	9		[illegible]
	C	84	16		[illegible]
	D	90	10		[illegible]
3.2	A	4	96	6/194 [illegible] Adj: 5/195	[illegible]
	B	9	91	7/193 [illegible] Adj: 8/192	[illegible]
	C	42	58	50/50 [illegible] Adj: 46/54	[illegible]
	D	25	75	36/164 [illegible] Adj: 30/170	[illegible]
5.6	A	0	100		[illegible]
	B	1	99		[illegible]
	C	1	99		[illegible]
	D	2	98		[illegible]
10.0	A	1	99		[illegible]
	B	1	99		[illegible]
	C	0	100		[illegible]
	D	2	95		[illegible]
Control Seawater					
Control	A	82	18		[illegible]
	B	86	14		[illegible]
	C	87	13		[illegible]
	D	89	11		[illegible]

Data Verified By [signature] Date Verified March 9/06

Test: SC-Sperm Cell Fertilization test — Test ID: rtspsds061

Species: ~~DE-Dendraster excentricus~~ Strongylocentrotus purpuratus — Protocol: EPS1/RM/27-EC 92 (Sperm Cell)

Sample ID: REF-Ref Toxicant — Sample Type: SDS-Sodium dodecyl sulfate

Start Date: 2/13/2006 15:25 — End Date: 2/13/2006 — Lab ID: NVNLAB-Golder North Vancouver Laboratory

Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	82	18	
	2	2	D-Control	100	86	14	
	3	3	D-Control	100	87	13	
	4	4	D-Control	100	89	11	
	5	1	1.000	100	83	17	
	6	2	1.000	100	95	5	
	7	3	1.000	100	90	10	
	8	4	1.000	100	90	10	
	9	1	1.800	100	86	14	
	10	2	1.800	100	91	9	
	11	3	1.800	100	84	16	
	12	4	1.800	100	90	10	
	13	1	3.200	100	5	95	
	14	2	3.200	100	8	92	
	15	3	3.200	100	46	54	
	16	4	3.200	100	30	70	
	17	1	5.600	100	0	100	
	18	2	5.600	100	1	99	
	19	3	5.600	100	1	99	
	20	4	5.600	100	2	98	
	21	1	10.000	100	1	99	
	22	2	10.000	100	1	99	
	23	3	10.000	100	0	100	
	24	4	10.000	100	2	98	

Comments: Seacore Environmental 04-1424-076 (0600049)

Reviewed by: March 9/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	2/13/2006 15:25	Test ID:	rtspsds061	Sample ID:	REF-Ref Toxicant
End Date:	2/13/2006	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	SDS-Sodium dodecyl sulfate
Sample Date:		Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	SP-Strongylocentrotus purpuratus
Comments:	Seacore Environmental 04-1424-076 (0600049)				

Conc-mg/L	1	2	3	4
D-Control	0.8200	0.8600	0.8700	0.8900
1	0.8300	0.9500	0.9000	0.9000
1.8	0.8600	0.9100	0.8400	0.9000
3.2	0.0500	0.0800	0.4600	0.3000
5.6	0.0000	0.0100	0.0100	0.0200
10	0.0100	0.0100	0.0000	0.0200

			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
D-Control	0.8600	0.0294	1.1887	1.1326	1.2327	3.522	4			0.8775	1.0000
1	0.8950	0.0493	1.2473	1.1458	1.3453	6.531	4	23.00	10.00	0.8775	1.0000
1.8	0.8775	0.0330	1.2154	1.1593	1.2661	4.153	4	20.50	10.00	0.8775	1.0000
*3.2	0.2225	0.1936	0.4593	0.2255	0.7454	53.438	4	10.00	10.00	0.2225	0.2536
*5.6	0.0100	0.0082	0.0981	0.0500	0.1419	38.329	4	10.00	10.00	0.0100	0.0114
*10	0.0100	0.0082	0.0981	0.0500	0.1419	38.329	4	10.00	10.00	0.0100	0.0114

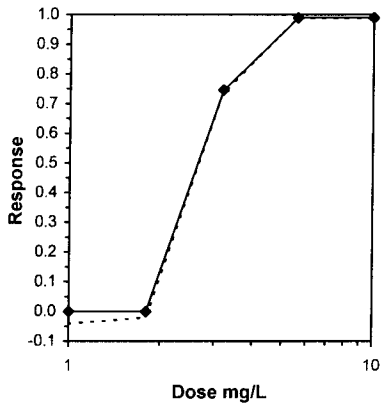
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.90754	0.884	0.34756	3.24698
Bartlett's Test indicates unequal variances (p = 2.58E-03)	18.3146	15.0863		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	1.8	3.2	2.4	

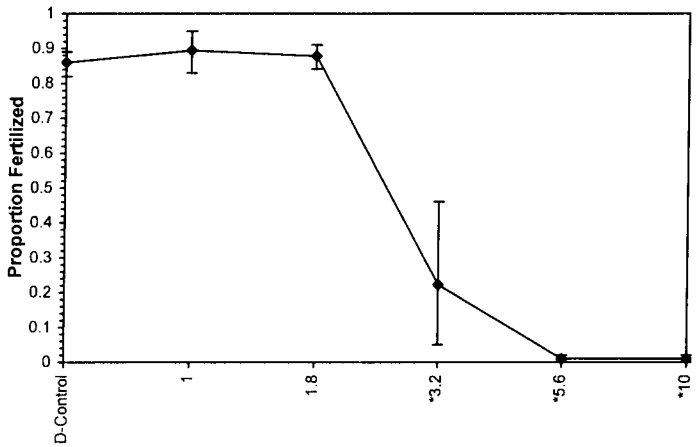
Log-Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew
IC05	1.8771	0.0254	1.7812	1.9161	-2.6380
IC10	1.9563	0.0296	1.8523	2.0398	0.3408
IC15	2.0377	0.0404	1.9273	2.1672	0.7203
IC20	2.1213	0.0530	1.9961	2.2996	0.8528
IC25	2.2073	0.0669	2.0623	2.4535	0.9071
IC40	2.4795	0.1152	2.2409	2.9720	0.9664
IC50	2.6738	0.1528	2.3618	3.3574	0.9961

mg/L 3.25



Dose-Response Plot



Reviewed by: March 9/06

APPENDIX II

Raw Data and Statistical Analyses:
48-h Bivalve (*Mytilus galloprovincialis*) Larval Development Toxicity Test

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT (WATER) TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1421-076
Lab Work Order No.: 0600034

Lab Analysts: SRS, JAS, MEL, LOC
Test Type: 48h Bivalve Larval Development
Test Initiation Date: 1 Feb 06

SAMPLE

Identification: SW9
Amount Received: 1.5L (1x1L; 500mL)
Date Collected: 26 JAN 06
Date Received: 28 JAN 06
Temperature (°C): 15.0
pH: 6.2 @ → 6.8
Dissolved Oxygen (mg/L): 7.4 @ → 8.5
Conductivity (µmhos/cm): —
Salinity (ppt): 20 @ → 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

① Salinity Adjustment

TEST SPECIES INFORMATION

Organism: Mytilus galloprovincialis
Source: M-Rep
Date Received: 1 Feb 06
Reference Toxicant: Cu
Current Reference Toxicant Results (incl. 95% CL)
Reference Toxicant Test Date: 1 Feb 06
EC50 (proportion normal): 7.0 (6.7-7.3) mg/L Cu
EC50 (proportion alive/normal): 6.5 (6.2-6.8) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
Proportion normal: 12.2 ± 3.1 mg/L CV = 13%
Proportion alive/normal: 10.8 ± 3.5 mg/L CV = 16%

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5 µm filtered, UV sterilized Seawater
Temperature (°C): 15.0
pH: 7.9
Dissolved Oxygen (mg/L): 8.5
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 - 16.0
pH Range: 6.7 - 8.3
Dissolved Oxygen Range (mg/L): 8.4 - 8.5
Salinity Range (ppt): 28 - 29
Photoperiod (L:D h): 16:8
Initial Embryo Density: 295 / 10 mL
Test Volume (mL): 10
Other: —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	EC50 (95% CL)	EC25 (95% CL)
Proportion Normal	%(v/v)	0.2	1.0	21.9 (21.1-23.8)	12.8 (12.5-14.5)
Proportion Alive		1.0	3.0	>89.3	2.6 (2.0-3.2)
Proportion Alive/Normal		1.0	3.0	13.7 (12-15.6)	2.1 (1.5-2.3)

Other:

Data Verified By: [signature]
Date Verified: March 22/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
48-h LARVAL DEVELOPMENT TOXICITY TEST – DAILY WATER QUALITY DATA

Client Cascade Environmental

Lab Project No. 04-1424-076

Lab Work Order No. 06CX0034

Logbook BLD # 14 Pages 180-183

Test Initiation Date/Time 1 Feb 06 / 1635

Test Termination Date 3 Feb 06 / 1635

Test Species Mytilus galloprovincialis

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
	0	24	48	0	24	48	0	24	48	0	24	48
Control	15.0	15.0	16.0	7.7	7.87	8.3	28	28	28	8.5	8.4	8.4
Boric Control	15.0	15.0	16.0	8.3	8.0	8.3	28	28	29	8.5	8.4	8.4
Technician Initials	TH	LL	SRS	TH	LL	SRS	TH	LL	LL	TH	LL	SRS

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-030306 DO 11.13

Comments

Test Set Up By SRS Data Verified By [signature] Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
48-h LARVAL DEVELOPMENT TOXICITY TEST – DAILY WATER QUALITY DATA

Client Teck Cominco Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06000341
Logbook BLI # 14 Pages 180-183

Test Initiation Date/Time 1 Feb 2006 / 1635
Test Termination Date 3 Feb 06 / 1635
Test Species Mytilus galloprovincialis

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
SW9 (% v/v)	0	24	48	0	24	48	0	24	48	0	24	48
Control	15.0	16.0	16.0	7.7	7.7	8.1	28	28	28	8.5	8.4	8.4
0.003	15.0	16.0	16.0	7.7	7.7	8.1	28	28	28	8.4	8.4	8.4
0.01	15.0	16.0	16.0	7.7	7.7	8.1	28	28	28	8.4	8.4	8.4
0.2	15.0	16.0	16.0	7.7	7.7	8.1	28	28	28	8.5	8.4	8.4
1.0	15.0	16.0	16.0	7.7	7.7	8.1	28	28	28	8.5	8.4	8.4
3.0	15.0	16.0	16.0	7.6	7.7	8.1	28	28	28	8.4	8.4	8.4
10.0	15.0	16.0	16.0	7.4	7.5	8.0	28	28	28	8.5	8.4	8.4
33.0	15.0	16.0	16.0	7.1	7.1	7.9	28	28	28	8.5	8.4	8.4
Max (89.3)	15.0	16.0	16.0	6.7	6.7	7.6	28	28	28	8.5	8.4	8.4
Technician Initials			SRS									

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-030306 DO 11.13
Comments

Test Set Up By SRS Data Verified By Ralph K Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client: Seacon Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600034
Logbook: BID#14 Pages: 180-183
Initial Embryo Density: 295/10ml
Sample ID: SW9

Test Species: Mytilus galloprovincialis
Source/Date Received: M-Rep / 1 Feb 06
Test Initiation Date/Time: 1 Feb 06 / 1635
Test Termination Date: 3 Feb 06 / 1635
Test Volume (mL): 10
Aliquot Size (mL): ~~8~~ 10.0

Sample ID SW9 (% v/v)	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
SW9	A	235	15			clear/NO	MRE
	B	262	19			Particulates	MRE
0.003	C	301	~~08~~ 8				MRE
	D	300	16				MRE
0.01	A	254	9				MRE
	B	311	9				MRE
	C	284	10				MRE
	D	303	18				MRE
0.2	A	272	16				MRE
	B	282	17				MRE
	C	322	22				MRE
	D	292	7				MRE
1.0	A	231	20			A Bit of	MRE
	B	274	43			Particulate	MRE
	C	289	27			matter	MRE
	D	293	28				MRE
3.0	A	147	44			More Particulate	MRE
	B	180	47			Slightly	MRE
	C	156	32			Orange	MRE
	D	130	34				MRE

Data Verified By: [signature]
Date Verified: March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client Seacon Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06000034
Logbook BLD #14 Pages 180-183
Initial Embryo Density 295/10mL
Sample ID SW9

Test Species Mytilus galloprovincialis
Source/Date Received 1 Feb 06 / M-Rep
Test Initiation Date/Time 1 Feb 06 / 1635
Test Termination Date 3 Feb 06 / 1635
Test Volume (mL) 10
Aliquot Size (mL) ~~5~~ 10

Sample ID (SW9 (%v/v))	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
SW9 10.0	A	136	42			C. Mayc	AK
	B	137	20			P. Microcalym	MB
	C	161	33				CBC
	D	150	44				AE
33.0	A	25	126				MC
	B	26	154				CBC
	C	41	115				AE
	D	29	129				MC
89.3 ~~35.00~~ MAX	A	0	135				MC
	B	0	175				MK
	C	0	166				MZ
	D	0	165				MC
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Data Verified By Garph
Date Verified March 21/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (CONTROLS)

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600034
Logbook BLD #14 Pages 180 183
Initial Embryo Density 295 /10 mL

Test Species Mytilus galloprovincialis
Test Initiation Date/Time 9 Feb 06 11635
Test Termination Date 9 Feb 06 11635
Test Volume (mL) 10 mL

Concentration	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
Reference Toxicant							
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
Control Seawater							
Brine Control	A	252	5				MM
	B	365	8				MM
	C	330	6				MM
	D	298	7				MM

Data Verified By Ralph Date Verified March 20/06

Test: BV-Bivalve Larval Survival and Development Test					Test ID: 0600034c	
Species: MG-Mytilus galloprovincialis					Protocol: EPAW 95-EPA West Coast	
Sample ID: SW 9					Sample Type: GW-groundwater	
Start Date: 2/1/2006 16:35			End Date: 2/3/2006 16:3		Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Initial Density	Number Normal	Number Abnormal	Notes
	1	1	D-Control	295	265	5	
	2	2	D-Control	295	273	10	
	3	3	D-Control	295	359	10	
	4	4	D-Control	295	315	15	
	5	1	B-Control	295	252	5	
	6	2	B-Control	295	365	8	
	7	3	B-Control	295	330	6	
	8	4	B-Control	295	298	7	
	9	1	0.003	295	235	15	
	10	2	0.003	295	262	19	
	11	3	0.003	295	301	8	
	12	4	0.003	295	300	16	
	13	1	0.010	295	254	9	
	14	2	0.010	295	311	9	
	15	3	0.010	295	284	10	
	16	4	0.010	295	303	18	
	17	1	0.200	295	272	16	
	18	2	0.200	295	282	17	
	19	3	0.200	295	322	22	
	20	4	0.200	295	292	7	
	21	1	1.000	295	231	20	
	22	2	1.000	295	274	43	
	23	3	1.000	295	289	27	
	24	4	1.000	295	293	28	
	25	1	3.000	295	147	44	
	26	2	3.000	295	180	47	
	27	3	3.000	295	156	32	
	28	4	3.000	295	130	34	
	29	1	10.000	295	176	42	
	30	2	10.000	295	137	20	
	31	3	10.000	295	161	33	
	32	4	10.000	295	180	44	
	33	1	33.000	295	25	126	
	34	2	33.000	295	26	134	
	35	3	33.000	295	41	115	
	36	4	33.000	295	29	129	
	37	1	89.300	295	0	135	
	38	2	89.300	295	0	175	
	39	3	89.300	295	0	166	
	40	4	89.300	295	0	165	

Comments: 04-1424-034 (0600034)

Reviewed by: March 2006

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034c	Sample ID:	SW 9
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

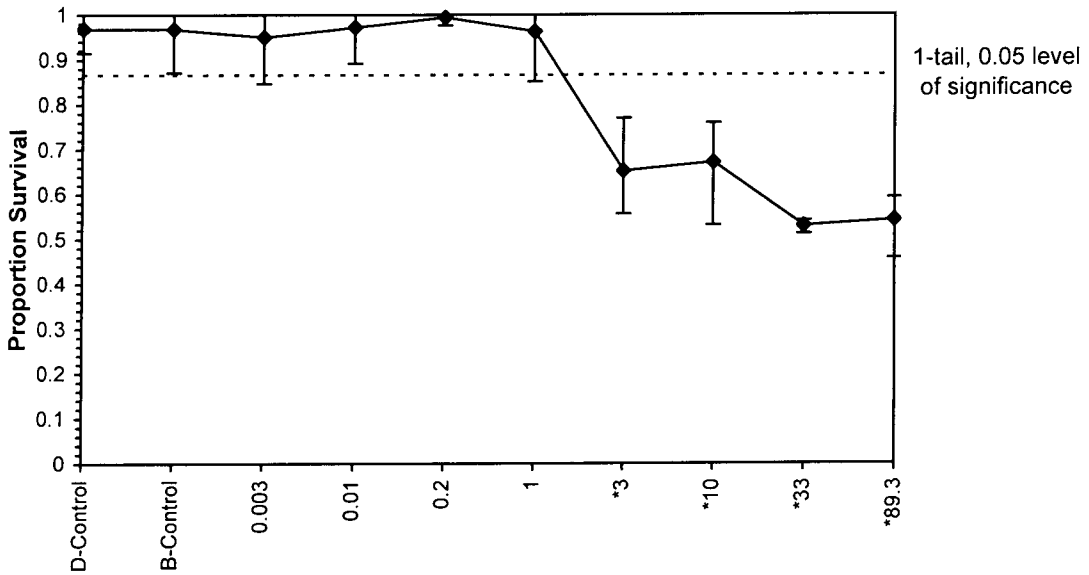
Conc-%	1	2	3	4
D-Control	0.9153	0.9593	1.0000	1.0000
B-Control	0.8712	1.0000	1.0000	1.0000
0.003	0.8475	0.9525	1.0000	1.0000
0.01	0.8915	1.0000	0.9966	1.0000
0.2	0.9763	1.0000	1.0000	1.0000
1	0.8508	1.0000	1.0000	1.0000
3	0.6475	0.7695	0.6373	0.5559
10	0.7390	0.5322	0.6576	0.7593
33	0.5119	0.5424	0.5288	0.5356
89.3	0.4576	0.5932	0.5627	0.5593

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	0.9686	0.0404	1.4316	1.2754	1.5417	9.259	4			
B-Control	0.9678	0.0644	1.4572	1.2037	1.5417	11.597	4			
0.003	0.9500	0.0719	1.4010	1.1695	1.5417	12.744	4	0.355	2.513	0.2167
0.01	0.9720	0.0537	1.4578	1.2352	1.5417	10.223	4	-0.303	2.513	0.2167
0.2	0.9941	0.0119	1.5103	1.4161	1.5417	4.156	4	-0.912	2.513	0.2167
1	0.9627	0.0746	1.4498	1.1743	1.5417	12.670	4	-0.211	2.513	0.2167
*3	0.6525	0.0881	0.9428	0.8414	1.0700	10.035	4	5.669	2.513	0.2167
*10	0.6720	0.1031	0.9640	0.8176	1.0580	11.297	4	5.423	2.513	0.2167
*33	0.5297	0.0131	0.8151	0.7973	0.8278	1.609	4	7.150	2.513	0.2167
*89.3	0.5432	0.0591	0.8288	0.7430	0.8792	7.152	4	6.991	2.513	0.2167

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91415	0.912	-0.956	0.37909
Bartlett's Test indicates equal variances (p = 0.05)	15.5285	20.0902		
The control means are not significantly different (p = 0.82)	0.23806	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	3	1.73205	100	0.10216	0.10416	0.36351	0.01487	1.9E-10	8, 27

Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034c	Sample ID:	SW 9	
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater	
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis	
Comments:	04-1424-034 (0600034)					

Conc-%	1	2	3	4
D-Control	0.9153	0.9593	1.0000	1.0000
B-Control	0.8712	1.0000	1.0000	1.0000
0.003	0.8475	0.9525	1.0000	1.0000
0.01	0.8915	1.0000	0.9966	1.0000
0.2	0.9763	1.0000	1.0000	1.0000
1	0.8508	1.0000	1.0000	1.0000
3	0.6475	0.7695	0.6373	0.5559
10	0.7390	0.5322	0.6576	0.7593
33	0.5119	0.5424	0.5288	0.5356
89.3	0.4576	0.5932	0.5627	0.5593

			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9686	0.0404	1.4316	1.2754	1.5417	9.259	4				0.9712	1.0000
B-Control	0.9678	0.0644	1.4572	1.2037	1.5417	11.597	4					
0.003	0.9500	0.0719	1.4010	1.1695	1.5417	12.744	4	0.355	2.513	0.2167	0.9712	1.0000
0.01	0.9720	0.0537	1.4578	1.2352	1.5417	10.223	4	-0.303	2.513	0.2167	0.9712	1.0000
0.2	0.9941	0.0119	1.5103	1.4161	1.5417	4.156	4	-0.912	2.513	0.2167	0.9712	1.0000
1	0.9627	0.0746	1.4498	1.1743	1.5417	12.670	4	-0.211	2.513	0.2167	0.9627	0.9913
*3	0.6525	0.0881	0.9428	0.8414	1.0700	10.035	4	5.669	2.513	0.2167	0.6623	0.6819
*10	0.6720	0.1031	0.9640	0.8176	1.0580	11.297	4	5.423	2.513	0.2167	0.6623	0.6819
*33	0.5297	0.0131	0.8151	0.7973	0.8278	1.609	4	7.150	2.513	0.2167	0.5364	0.5524
*89.3	0.5432	0.0591	0.8288	0.7430	0.8792	7.152	4	6.991	2.513	0.2167	0.5364	0.5524

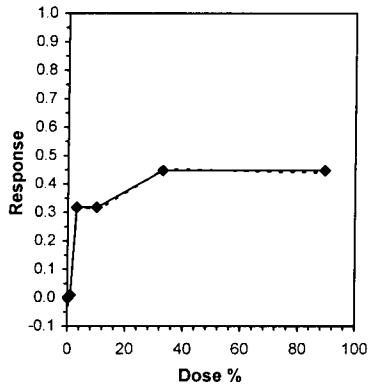
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91415	0.912	-0.956	0.37909
Bartlett's Test indicates equal variances (p = 0.05)	15.5285	20.0902		
The control means are not significantly different (p = 0.82)	0.23806	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	3	1.73205	100	0.10216	0.10416	0.36351	0.01487	1.9E-10	8, 27

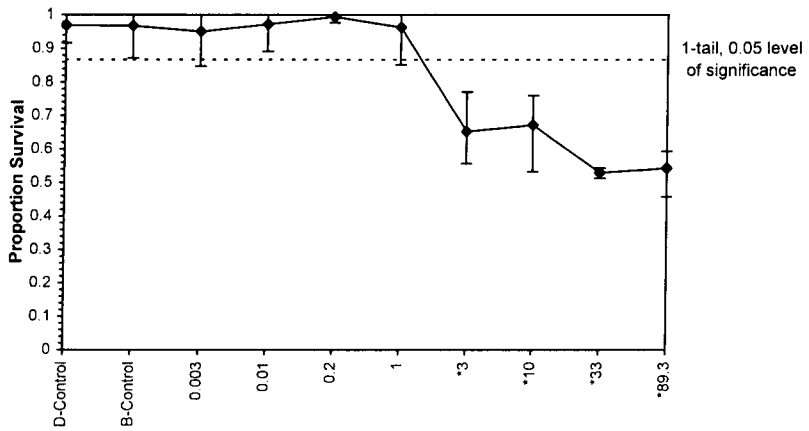
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	1.267	0.212	0.172	1.449	-1.6343
IC10	1.590	0.163	0.911	1.894	-1.0192
IC15	1.913	0.161	1.367	2.338	-0.3735
IC20	2.237	0.173	1.752	2.773	0.1002
IC25	2.560	0.638	2.047	3.218	9.7319
IC40	24.543	4.869	0.000	30.050	-1.6910
IC50	>89.3				

(%v/v)



Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034c	Sample ID:	SW 9
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

Conc-%	1	2	3	4
D-Control	0.9815	0.9647	0.9729	0.9545
B-Control	0.9805	0.9786	0.9821	0.9770
0.003	0.9400	0.9324	0.9741	0.9494
0.01	0.9658	0.9719	0.9660	0.9439
0.2	0.9444	0.9431	0.9360	0.9766
1	0.9203	0.8644	0.9146	0.9128
3	0.7696	0.7930	0.8298	0.7927
10	0.8073	0.8726	0.8299	0.8036
33	0.1656	0.1625	0.2628	0.1835
89.3	0.0000	0.0000	0.0000	0.0000

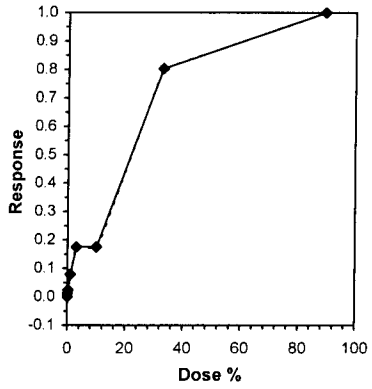
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9684	0.0115	1.3943	1.3559	1.4343	2.398	4				0.9750	1.0000
B-Control	0.9796	0.0022	1.4275	1.4187	1.4368	0.554	4					
0.003	0.9490	0.0181	1.3460	1.3077	1.4092	3.316	4	1.626	2.480	0.0737	0.9633	0.9880
0.01	0.9619	0.0123	1.3760	1.3317	1.4023	2.226	4	0.617	2.480	0.0737	0.9633	0.9880
0.2	0.9501	0.0181	1.3488	1.3151	1.4172	3.429	4	1.533	2.480	0.0737	0.9516	0.9760
*1	0.9030	0.0260	1.2558	1.1936	1.2846	3.336	4	4.662	2.480	0.0737	0.8983	0.9213
*3	0.7963	0.0249	1.1030	1.0702	1.1455	2.834	4	9.805	2.480	0.0737	0.8046	0.8252
*10	0.8284	0.0317	1.1449	1.1116	1.2058	3.785	4	8.397	2.480	0.0737	0.8046	0.8252
*33	0.1936	0.0471	0.4537	0.4149	0.5383	12.710	4	31.659	2.480	0.0737	0.1925	0.1974
89.3	0.0000	0.0000	0.0397	0.0378	0.0430	5.850	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94845	0.904	0.61073	-0.347
Bartlett's Test indicates equal variances (p = 0.97)	1.81	18.4753		
The control means are not significantly different (p = 0.10)	1.93286	2.44691		

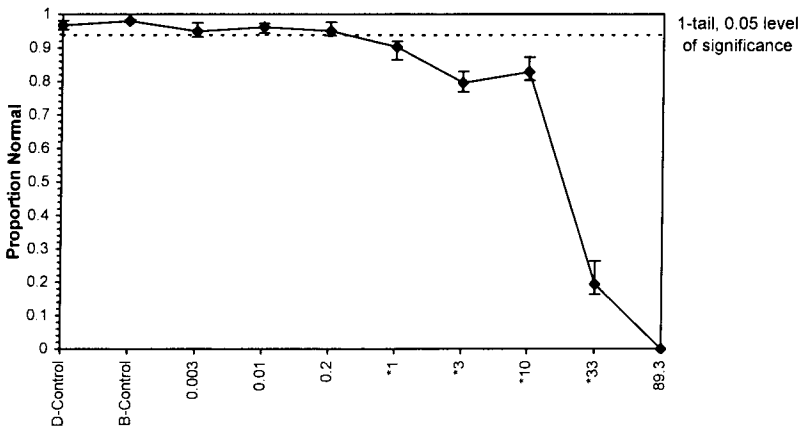
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.2	1	0.44721	500	0.03046	0.03143	0.38899	0.00177	3.4E-20	7, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	0.581	0.160	0.348	1.348	0.4881
IC10	1.444	0.250	0.786	2.396	-0.7802
IC15	2.484	2.490	2.331	14.918	2.2597
IC20	10.923	0.362	10.619	12.792	0.2023
IC25	12.755	0.352	12.457	14.541	0.2417
IC40	18.250	0.386	17.677	19.900	0.3831
IC50	21.914	0.452	21.132	23.836	0.4945



Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034c	Sample ID:	SW 9
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

Conc-%	1	2	3	4
D-Control	0.8983	0.9254	1.0000	1.0000
B-Control	0.8542	1.0000	1.0000	1.0000
0.003	0.7966	0.8881	1.0000	1.0000
0.01	0.8610	1.0000	0.9627	1.0000
0.2	0.9220	0.9559	1.0000	0.9898
1	0.7831	0.9288	0.9797	0.9932
3	0.4983	0.6102	0.5288	0.4407
10	0.5966	0.4644	0.5458	0.6102
33	0.0847	0.0881	0.1390	0.0983
89.3	0.0000	0.0000	0.0000	0.0000

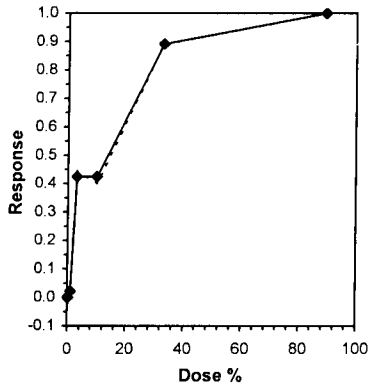
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9559	0.0521	1.3484	1.2462	1.4413	6.912	4				0.9524	1.0000
B-Control	0.9636	0.0729	1.3295	1.1791	1.3931	7.593	4					
0.003	0.9212	0.0984	1.2928	1.1029	1.4455	12.098	4	0.715	2.480	0.1929	0.9524	1.0000
0.01	0.9559	0.0657	1.3553	1.1888	1.4527	8.517	4	-0.088	2.480	0.1929	0.9524	1.0000
0.2	0.9669	0.0354	1.3952	1.2878	1.4698	6.291	4	-0.601	2.480	0.1929	0.9524	1.0000
1	0.9212	0.0962	1.3258	1.0863	1.4884	13.409	4	0.292	2.480	0.1929	0.9322	0.9787
*3	0.5195	0.0706	0.8051	0.7259	0.8965	8.829	4	6.985	2.480	0.1929	0.5485	0.5759
*10	0.5542	0.0660	0.8400	0.7498	0.8965	7.904	4	6.536	2.480	0.1929	0.5485	0.5759
*33	0.1025	0.0250	0.3244	0.2954	0.3820	12.227	4	13.164	2.480	0.1929	0.1032	0.1083
89.3	0.0000	0.0000	0.0397	0.0378	0.0430	5.850	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96344	0.904	-0.5798	0.03994
Bartlett's Test indicates equal variances (p = 0.35)	7.85747	18.4753		
The control means are not significantly different (p = 0.79)	0.2756	2.44691		

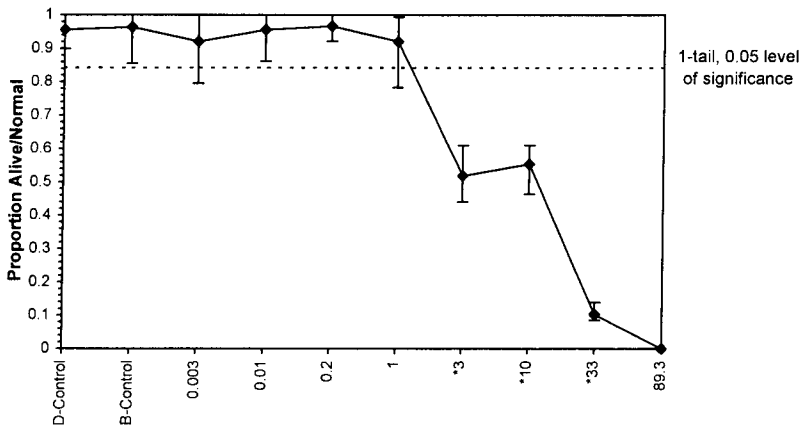
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	3	1.73205	100	0.11413	0.11996	0.60381	0.0121	9.0E-13	7, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	1.143	0.381	0.000	1.304	-1.0809
IC10	1.391	0.197	0.290	1.553	-1.2244
IC15	1.639	0.166	0.835	1.814	-1.0509
IC20	1.887	0.149	1.210	2.073	-0.9272
IC25	2.136	0.135	1.539	2.341	-0.6785
IC40	2.880	1.832	2.399	14.649	3.5481
IC50	13.733	1.697	7.181	15.607	-2.8433



Dose-Response Plot



Reviewed by: March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT (WATER) TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1421-076
Lab Work Order No.: C600034

Lab Analysts: SRS, JAS, MEZ, LOC
Test Type: 96h Bivalve Larval Development
Test Initiation Date: 1 Feb 06

SAMPLE

Identification: SW11
Amount Received: 1.5L (1x1L; 1x500 ml)
Date Collected: 26 JAN 06
Date Received: 28 JAN 06
Temperature (°C): 15.0
pH: 4.9 @ → 5.9
Dissolved Oxygen (mg/L): 8.6 @ → 8.2
Conductivity (µmhos/cm): —
Salinity (ppt): 10 @ → 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

@ Salinity Adjustment

TEST SPECIES INFORMATION

Organism: Mytilus galloprovincialis
Source: M-Rep
Date Received: 1 Feb 06
Reference Toxicant: Cu
Current Reference Toxicant Results (incl. 95% CL)
Reference Toxicant Test Date: 1 Feb 06
EC50 (proportion normal): 7.0 (6.7-7.3) mg/L Cu
EC50 (proportion alive/normal): 6.5 (6.2-6.8) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
Proportion normal: 12.2 ± 3.1 mg/L CV = 13%
Proportion alive/normal: 10.8 ± 3.5 mg/L CV = 16%

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5 µm filtered, UV sterilized Seawater
Temperature (°C): 15.0
pH: 7.9
Dissolved Oxygen (mg/L): 8.5
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 - 16.0
pH Range: 5.8 → 8.3
Dissolved Oxygen Range (mg/L): 8.3 → 8.5
Salinity Range (ppt): 28 - 29
Photoperiod (L:D h): 16:8
Initial Embryo Density: 295 / 10 ml
Test Volume (mL): 10
Other: —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	EC50 (95% CL)	EC25 (95% CL)
Proportion Normal	% (v/v)	0.003	0.01	5.3 (5.0-5.8)	2.5 (1.5-4.0)
Proportion Alive		0.01	0.2	23.2 (20.3-25.3)	0.55 (0.00-15.82)
Proportion Alive/Normal		0.003	0.01	0.86 (0.53-4.29)	0.13 (0.08-0.16)

Other: —

Data Verified By: [signature]
Date Verified: March 22/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
48-h LARVAL DEVELOPMENT TOXICITY TEST – DAILY WATER QUALITY DATA

Client Cascor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06CC0034
Logbook BL-1 # 14 Pages 180-183

Test Initiation Date/Time 1 Feb 06 / 1635
Test Termination Date 3 Feb 06 / 1635
Test Species Lytechinus pictus

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
SW11 (%v/v)	0	24	48	0	24	48	0	24	48	0	24	48
Control	15.0	16.0	16.0	7.7	7.7	8.3	28	28	28	8.5	8.4	8.4
0.003	15.0	16.0	16.0	7.7	7.7	8.0	28	28	28	8.3	8.4	8.4
0.01	15.0	16.0	16.0	7.7	7.7	8.0	28	28	28	8.5	8.4	8.4
0.2	15.0	16.0	16.0	7.6	7.7	8.0	28	28	28	8.5	8.4	8.4
1.0	15.0	16.0	16.0	7.6	7.5	8.0	28	28	28	8.5	8.4	8.4
3.0	15.0	16.0	16.0	7.4	7.3	7.9	28	28	28	8.5	8.4	8.4
10.0	15.0	16.0	16.0	7.1	6.8	7.4	28	28	28	8.5	8.4	8.4
33.0	15.0	16.0	16.0	6.8	6.3	6.7	28	28	28	8.5	8.4	8.4
Max (78.8 %v/v)	15.0	16.0	16.0	6.1	5.8	6.0	28	28	28	8.5	8.4	8.4
Technician Initials			SRS									

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-020306 DO 11-13
Comments

Test Set Up By SRS Data Verified By Qualpak Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client: Seacon Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 06020341
Logbook: BLD # 14 Pages: 180-183
Initial Embryo Density: 295/10 mL
Sample ID: SW 11

Test Species: Mytilus galloprovincialis
Source/Date Received: M-Rep / 1 Feb 06
Test Initiation Date/Time: 1 Feb 06 / 1635
Test Termination Date: 3 Feb 06 / 1635
Test Volume (mL): 10
Aliquot Size (mL): @ 10

Sample ID (SW11 (%v/v))	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
SW 11	A	315	21			Clear	
	B	260	11				
0.003	C	277	14				
	D	282	14				
	A	255	15				
0.01	B	281	20			~	
	C	293	31				
	D	248	28				
	A	193	69				
0.2	B	166	67				
See over for Note	C	171	44				
	D	160	36				
	A	127	31			Orange	
1.0	B	135	35			Particulates	
	C	119	27			& Large	
	D	132	51			Cloudy	
	A	158	68			Colour +	
3.0	B	141	37			Small Particles	
	C	130	43				
	D	111	54				

Data Verified By: [signature]
Date Verified: March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client Seacorp Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 0600034
Logbook BLD #14 Pages 180-183
Initial Embryo Density 295 / 10 ml
Sample ID SW11

Test Species Mytilus galloprovincialis
Source/Date Received M-Rep / 1 Feb 06
Test Initiation Date/Time 1 Feb 06 / 1635
Test Termination Date 3 Feb 06 / 1635
Test Volume (mL) 10
Aliquot Size (mL) 2 @ 10 ml

Sample ID (%v/v)	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
SW11	A	4	256			orange color	MR
	B	2	256			Small particles	MR
10.0	C	3	264				MR
	D	5	270				MR
	A	0	109				MR
	B	0	119				MR
33.0	C	0	118				MR
	D	0	122				MR
	A	0	95			Lots of Bigger	MR
	B	0	103			Chunks as	MR
MAR 78.8	C	0	106			well	MR
	D	0	107				MR
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Data Verified By [signature] Date Verified March 21/06

Test: BV-Bivalve Larval Survival and Development Test					Test ID: 0600034b		
Species: MG-Mytilus galloprovincialis					Protocol: EPAW 95-EPA West Coast		
Sample ID: SW 11					Sample Type: GW-groundwater		
Start Date: 2/1/2006 16:35				End Date: 2/3/2006 16:3	Lab ID: NVNLAB-Golder North Vancouver Laboratory		
Pos	ID	Rep	Group	Initial Density	Number Normal	Number Abnormal	Notes
	1	1	D-Control	295	265	5	
	2	2	D-Control	295	273	10	
	3	3	D-Control	295	359	10	
	4	4	D-Control	295	315	15	
	5	1	B-Control	295	252	5	
	6	2	B-Control	295	365	8	
	7	3	B-Control	295	330	6	
	8	4	B-Control	295	298	7	
	9	1	0.003	295	315	21	
	10	2	0.003	295	260	11	
	11	3	0.003	295	277	14	
	12	4	0.003	295	282	14	
	13	1	0.010	295	255	15	
	14	2	0.010	295	281	20	
	15	3	0.010	295	293	31	
	16	4	0.010	295	248	28	
	17	1	0.200	295	193	64	
	18	2	0.200	295	166	67	
	19	3	0.200	295	171	44	
	20	4	0.200	295	160	36	
	21	1	1.000	295	127	31	
	22	2	1.000	295	135	35	
	23	3	1.000	295	119	27	
	24	4	1.000	295	132	51	
	25	1	3.000	295	158	68	
	26	2	3.000	295	141	37	
	27	3	3.000	295	130	43	
	28	4	3.000	295	111	54	
	29	1	10.000	295	4	256	
	30	2	10.000	295	2	256	
	31	3	10.000	295	3	264	
	32	4	10.000	295	5	270	
	33	1	33.000	295	0	109	
	34	2	33.000	295	0	119	
	35	3	33.000	295	0	118	
	36	4	33.000	295	0	122	
	37	1	78.800	295	0	75	
	38	2	78.800	295	0	103	
	39	3	78.800	295	0	106	
	40	4	78.800	295	0	107	

Comments: 04-1424-034 (0600034)

Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034b	Sample ID:	SW 11
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanco	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

Conc-%	1	2	3	4
D-Control	0.9153	0.9593	1.0000	1.0000
B-Control	0.8712	1.0000	1.0000	1.0000
0.003	1.0000	0.9186	0.9864	1.0000
0.01	0.9153	1.0000	1.0000	0.9356
0.2	0.8712	0.7898	0.7288	0.6644
1	0.5356	0.5763	0.4949	0.6203
3	0.7661	0.6034	0.5864	0.5593
10	0.8814	0.8746	0.9051	0.9322
33	0.3695	0.4034	0.4000	0.4136
78.8	0.2542	0.3492	0.3593	0.3627

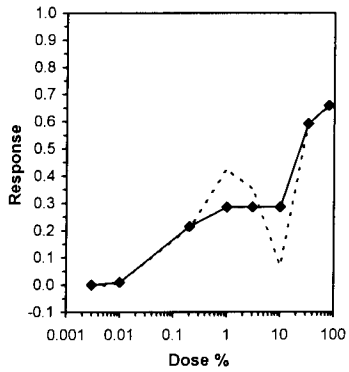
			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9686	0.0404	1.4316	1.2754	1.5417	9.259	4				0.9725	1.0000
B-Control	0.9678	0.0644	1.4572	1.2037	1.5417	11.597	4					
0.003	0.9763	0.0389	1.4547	1.2816	1.5417	8.429	4	-0.340	2.513	0.1709	0.9725	1.0000
0.01	0.9627	0.0438	1.4182	1.2754	1.5417	10.112	4	0.197	2.513	0.1709	0.9627	0.9900
*0.2	0.7636	0.0882	1.0686	0.9529	1.2037	10.018	4	5.341	2.513	0.1709	0.7636	0.7852
*1	0.5568	0.0538	0.8426	0.7803	0.9069	6.450	4	8.665	2.513	0.1709	0.6946	0.7143
*3	0.6288	0.0933	0.9182	0.8449	1.0660	10.919	4	7.553	2.513	0.1709	0.6946	0.7143
*10	0.8983	0.0261	1.2482	1.2088	1.3074	3.579	4	2.698	2.513	0.1709	0.6946	0.7143
*33	0.3966	0.0190	0.6812	0.6534	0.6985	2.857	4	11.039	2.513	0.1709	0.3966	0.4078
*78.8	0.3314	0.0517	0.6124	0.5285	0.6463	9.192	4	12.050	2.513	0.1709	0.3314	0.3407

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97044	0.912	-0.1203	-0.5754
Bartlett's Test indicates equal variances (p = 0.13)	12.5794	20.0902		
The control means are not significantly different (p = 0.82)	0.23806	2.44691		

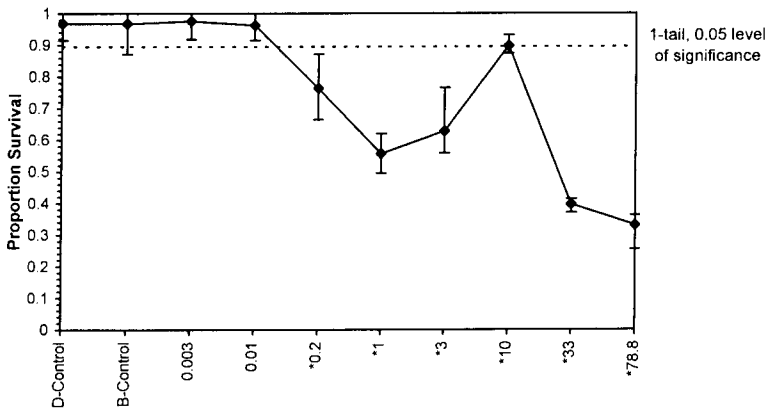
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.01	0.2	0.04472	10000	0.07383	0.07528	0.43346	0.00924	7.4E-14	8, 27

Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05	0.045	0.016	0.000	0.077	-0.2174	
IC10	0.089	0.022	0.023	0.152	0.4340	
IC15	0.136	0.036	0.062	0.299	1.8762	
IC20	0.185	0.102	0.101	0.667	1.3680	
IC25	0.546	1.664	0.000	15.816	5.3992	
IC40	15.757	0.767	13.176	18.008	0.0588	
IC50	23.216	0.848	20.272	25.285	-0.0870	(%v/v)



Dose-Response Plot



NOTE: According to USEPA protocol, point estimates should be done using linear interpolation assuming the responses are monotonically non-increasing and follow a piecewise linear response function. Since the responses shown are neither, a log-linear interpolation was chosen as best fit for the data.

Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034b	Sample ID:	SW 11
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

Conc-%	1	2	3	4
D-Control	0.9153	0.9593	1.0000	1.0000
B-Control	0.8712	1.0000	1.0000	1.0000
0.003	1.0000	0.9186	0.9864	1.0000
0.01	0.9153	1.0000	1.0000	0.9356
0.2	0.8712	0.7898	0.7288	0.6644
1	0.5356	0.5763	0.4949	0.6203
3	0.7661	0.6034	0.5864	0.5593
10	0.8814	0.8746	0.9051	0.9322
33	0.3695	0.4034	0.4000	0.4136
78.8	0.2542	0.3492	0.3593	0.3627

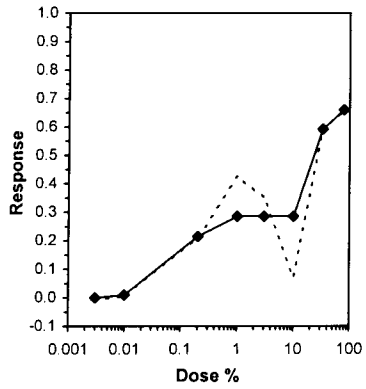
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
D-Control	0.9686	0.0404	1.4316	1.2754	1.5417	9.259	4				37	1180
B-Control	0.9678	0.0644	1.4572	1.2037	1.5417	11.597	4					
0.003	0.9763	0.0389	1.4547	1.2816	1.5417	8.429	4	-0.340	2.513	0.1709	28	1180
0.01	0.9627	0.0438	1.4182	1.2754	1.5417	10.112	4	0.197	2.513	0.1709	44	1180
*0.2	0.7636	0.0882	1.0686	0.9529	1.2037	10.018	4	5.341	2.513	0.1709	279	1180
*1	0.5568	0.0538	0.8426	0.7803	0.9069	6.450	4	8.665	2.513	0.1709	523	1180
*3	0.6288	0.0933	0.9182	0.8449	1.0660	10.919	4	7.553	2.513	0.1709	438	1180
*10	0.8983	0.0261	1.2482	1.2088	1.3074	3.579	4	2.698	2.513	0.1709	120	1180
*33	0.3966	0.0190	0.6812	0.6534	0.6985	2.857	4	11.039	2.513	0.1709	712	1180
*78.8	0.3314	0.0517	0.6124	0.5285	0.6463	9.192	4	12.050	2.513	0.1709	789	1180

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97044	0.912	-0.1203	-0.5754
Bartlett's Test indicates equal variances (p = 0.13)	12.5794	20.0902		
The control means are not significantly different (p = 0.82)	0.23806	2.44691		

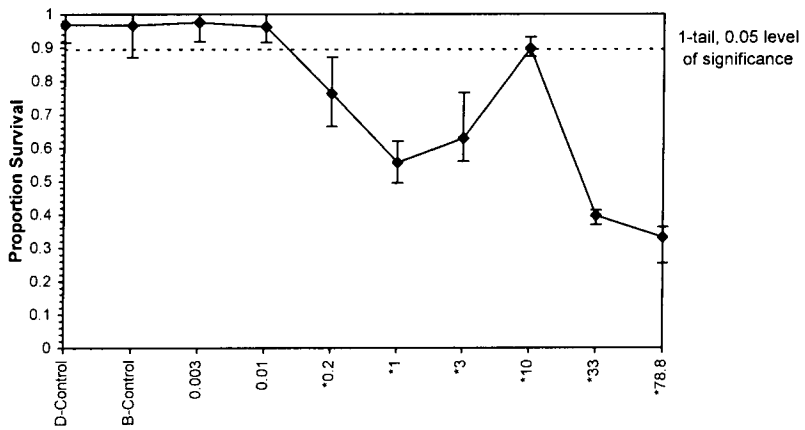
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.01	0.2	0.04472	10000	0.07383	0.07528	0.43346	0.00924	7.4E-14	8, 27

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-34.1%	24.573	22.080	27.347 %(v/v)



Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034b	Sample ID:	SW 11
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vancc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

Conc-%	1	2	3	4
D-Control	0.9815	0.9647	0.9729	0.9545
B-Control	0.9805	0.9786	0.9821	0.9770
0.003	0.9375	0.9594	0.9519	0.9527
0.01	0.9444	0.9336	0.9043	0.8986
0.2	0.7510	0.7124	0.7953	0.8163
1	0.8038	0.7941	0.8151	0.7213
3	0.6991	0.7921	0.7514	0.6727
10	0.0154	0.0078	0.0112	0.0182
33	0.0000	0.0000	0.0000	0.0000
78.8	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9684	0.0115	1.3943	1.3559	1.4343	2.398	4				0.9750	1.0000
B-Control	0.9796	0.0022	1.4275	1.4187	1.4368	0.554	4					
0.003	0.9504	0.0092	1.3468	1.3181	1.3679	1.546	4	1.564	2.451	0.0745	0.9500	0.9744
*0.01	0.9202	0.0223	1.2865	1.2466	1.3329	3.238	4	3.550	2.451	0.0745	0.9149	0.9384
*0.2	0.7688	0.0464	1.0706	1.0048	1.1279	5.131	4	10.655	2.451	0.0745	0.7680	0.7877
*1	0.7836	0.0424	1.0882	1.0147	1.1263	4.612	4	10.077	2.451	0.0745	0.7680	0.7877
*3	0.7289	0.0534	1.0246	0.9618	1.0974	5.916	4	12.171	2.451	0.0745	0.7178	0.7362
*10	0.0131	0.0046	0.1135	0.0882	0.1353	18.246	4	42.157	2.451	0.0745	0.0134	0.0137
33	0.0000	0.0000	0.0463	0.0453	0.0479	2.460	4				0.0000	0.0000
78.8	0.0000	0.0000	0.0510	0.0484	0.0578	8.883	4				0.0000	0.0000

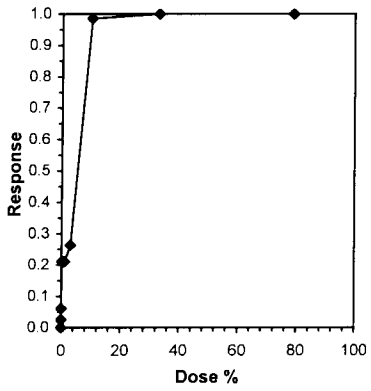
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97228	0.896	-0.2075	-0.6207
Bartlett's Test indicates equal variances (p = 0.51)	5.27998	16.8119		
The control means are not significantly different (p = 0.10)	1.93286	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.003	0.01	0.00548	33333.3	0.03084	0.03182	0.76138	0.00185	1.2E-20	6, 21

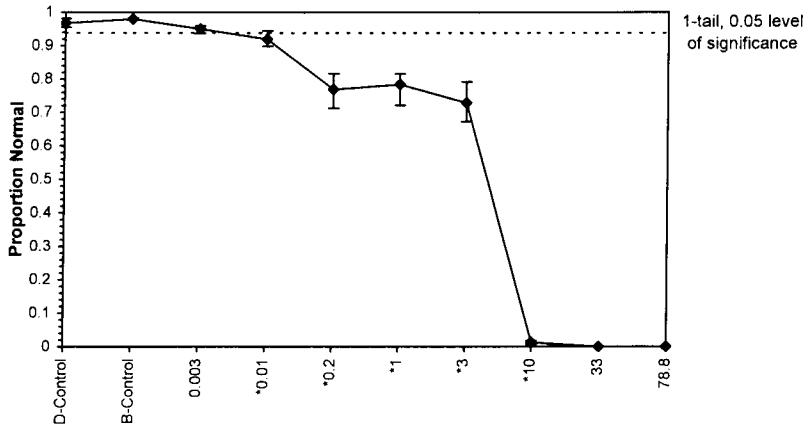
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	0.0077	0.0079	0.0068	0.0478	1.4467
IC10	0.0584	0.0117	0.0457	0.1254	0.3706
IC15	0.1214	0.0152	0.1092	0.2011	0.4065
IC20	0.1845	0.6616	0.1628	3.1179	0.6906
IC25	2.4652	0.4482	1.5349	3.9544	-0.9233
IC40	4.3199	0.1801	3.9157	4.9860	-0.2334
IC50	5.2887	0.1494	4.9584	5.8423	-0.2281

% (v/v)



Dose-Response Plot



Reviewed by: Ralph March 20/06

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034b	Sample ID:	SW 11
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

Conc-%	1	2	3	4
D-Control	0.8983	0.9254	1.0000	1.0000
B-Control	0.8542	1.0000	1.0000	1.0000
0.003	1.0000	0.8814	0.9390	0.9559
0.01	0.8644	0.9525	0.9932	0.8407
0.2	0.6542	0.5627	0.5797	0.5424
1	0.4305	0.4576	0.4034	0.4475
3	0.5356	0.4780	0.4407	0.3763
10	0.0136	0.0068	0.0102	0.0169
33	0.0000	0.0000	0.0000	0.0000
78.8	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9559	0.0521	1.3484	1.2462	1.4413	6.912	4				0.9500	1.0000
B-Control	0.9636	0.0729	1.3295	1.1791	1.3931	7.593	4					
0.003	0.9441	0.0491	1.3403	1.2191	1.4615	7.472	4	0.137	2.451	0.1461	0.9500	1.0000
0.01	0.9127	0.0721	1.2984	1.1602	1.4884	11.675	4	0.840	2.451	0.1461	0.9255	0.9742
*0.2	0.5847	0.0488	0.8709	0.8278	0.9422	5.734	4	8.012	2.451	0.1461	0.5972	0.6286
*1	0.4347	0.0237	0.7199	0.6882	0.7430	3.328	4	10.546	2.451	0.1461	0.4489	0.4726
*3	0.4576	0.0668	0.7427	0.6604	0.8210	9.073	4	10.164	2.451	0.1461	0.4489	0.4726
*10	0.0119	0.0044	0.1077	0.0824	0.1306	19.234	4	20.818	2.451	0.1461	0.0124	0.0131
33	0.0000	0.0000	0.0463	0.0453	0.0479	2.460	4				0.0000	0.0000
78.8	0.0000	0.0000	0.0510	0.0484	0.0578	8.883	4				0.0000	0.0000

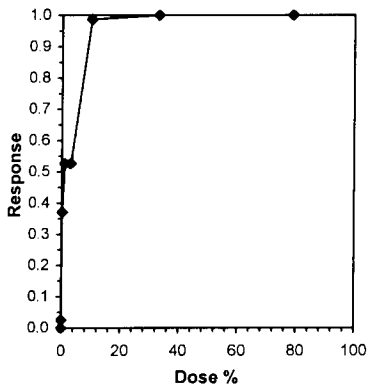
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9772	0.896	0.31394	0.50059
Bartlett's Test indicates equal variances (p = 0.03)	13.5709	16.8119		
The control means are not significantly different (p = 0.79)	0.2756	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.01	0.2	0.04472	10000	0.0811	0.08524	0.82473	0.0071	5.4E-15	6, 21

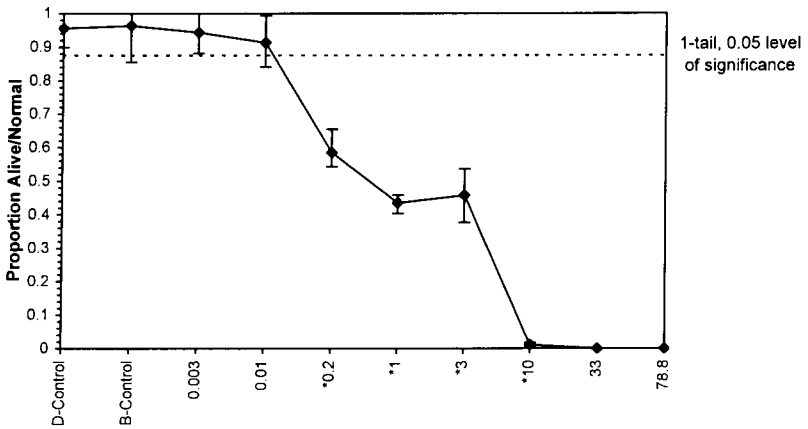
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	0.0233	0.0101	0.0000	0.0424	0.7775
IC10	0.0508	0.0156	0.0000	0.0679	-0.2768
IC15	0.0783	0.0151	0.0056	0.0952	-0.5027
IC20	0.1058	0.0137	0.0407	0.1242	-0.2387
IC25	0.1333	0.0132	0.0766	0.1560	0.1261
IC40	0.3466	0.0941	0.0848	0.5589	0.8678
IC50	0.8594	0.4230	0.5275	4.2896	4.7727

% (v/v)



Dose-Response Plot



Reviewed by: March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT (WATER) TOXICITY TEST DATA SUMMARY

Client: Seacon Environmental
Lab Project No.: 04-1421-076
Lab Work Order No.: C6CC034

Lab Analysts: SRS, JxS, MEZ, LCC
Test Type: 96h Bivalve Larval Development
Test Initiation Date: 1Feb06

SAMPLE

Identification: SW37
Amount Received: 1 5L (1x1.0L & 1x0.5L)
Date Collected: 26 JAN 06
Date Received: 28 JAN 06
Temperature (°C): 15.0
pH: 7.9 @ → 7.8
Dissolved Oxygen (mg/L): 9.2 @ → 8.5
Conductivity (µmhos/cm): —
Salinity (ppt): 26 @ → 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

TEST SPECIES INFORMATION

Organism: Mytilus galloprovincialis
Source: M-Rep
Date Received: 1Feb06
Reference Toxicant: Cu
Current Reference Toxicant Results (incl. 95% CL)
Reference Toxicant Test Date: 1 Feb 06
EC50 (proportion normal): 7.0 (6.7-7.3) mg/L Cu
EC50 (proportion alive/normal): 6.5 (6.2-6.8) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
Proportion normal: 12.2 ± 3.1 mg/L CV = 13%
Proportion alive/normal: 10.8 ± 3.5 mg/L CV = 16%

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5 µm filtered, UV sterilized Seawater
Temperature (°C): 15.0
pH: 7.9
Dissolved Oxygen (mg/L): 8.5
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 – 16.0
pH Range: 7.7 – 8.3
Dissolved Oxygen Range (mg/L): 8.4 – 8.5
Salinity Range (ppt): 28 – 29
Photoperiod (L:D h): 16:8
Initial Embryo Density: 295 / 10 ml
Test Volume (mL): 10
Other: —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	EC50 (95% CL)	EC25 (95% CL)
Proportion Normal	% (v/v)	88.2	>88.2	>88.2	>88.2
Proportion Alive		88.2	>88.2	>88.2	>88.2
Proportion Alive/Normal		88.2	>88.2	>88.2	>88.2

Other:

Data Verified By: Ralph Q Date Verified: March 22/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
48-h LARVAL DEVELOPMENT TOXICITY TEST – DAILY WATER QUALITY DATA

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06000324
Logbook BLD # 14 Pages 180-183

Test Initiation Date/Time ~~31 Feb 2006~~ 1 Feb 06 / 1635
Test Termination Date ~~3~~ 3 Feb 06 / 1635
Test Species Mytilus galloprovincialis

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
SW 37 (%v/v)	0	24	48	0	24	48	0	24	48	0	24	48
Control	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.5	8.4	8.4
0.003	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.4	8.4	8.4
0.01	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.4	8.4	8.4
0.2	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.4	8.4	8.4
1.0	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.4	8.4	8.4
3.0	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.4	8.4	8.4
10.0	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.4	8.4	8.4
33.0	15.0	15.0	16.0	7.8	7.7	8.2	28	28	28	8.4	8.4	8.4
Mox (88.2)	15.0	15.0	16.0	7.8	7.7	8.2	28	28	29	8.4	8.4	8.4
Technician Initials			SRS			SRS			SRS			SRS

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-030306 DO II-A3
Comments

Test Set Up By SRS Data Verified By Gaffey Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06000341
Logbook BLD #14 Pages 180-183
Initial Embryo Density 295/10 ml
Sample ID SW 37

Test Species Mytilus galloprovincialis
Source/Date Received M. Rep / 1 Feb 06
Test Initiation Date/Time 1 Feb 06 / 1635
Test Termination Date 3 Feb 06 / 1635
Test Volume (mL) 10
Aliquot Size (mL) 8 10

Sample ID (SW37 (%v/v))	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
Sw 37	A	265	20			Clear	
	B	271	21				
0.003	C	256	18				
	D	309	14				
	A	265	23				
0.01	B	276	17				
	C	299	23				
	D	282	30				
	A	312	23				
0.2	B	276	23				
	C	296	23				
	D	261	29				
	A	287	34				
1.0	B	257	45				
	C	222	25				
	D	229	41				
	A	186	94				
3.0	B	326	28				
	C	316	33				
	D	281	32				

Data Verified By [signature] Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client: Seacon Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 06000034
Logbook: BLD #14 Pages: 180-183
Initial Embryo Density: 295/10 mL
Sample ID: SW37

Test Species: Mytilus galloprovincialis
Source/Date Received: M. leg / 1Feb06
Test Initiation Date/Time: 1Feb06 / 1635
Test Termination Date: 3Feb06 / 1635
Test Volume (mL): 10
Aliquot Size (mL): ~~5~~ 10

Sample ID (SW37 (% v/v))	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
SW37 10.0	A	276	38				
	B	297	21				
	C	209	32				
	D	264	26				
33.0	A	308	28			some large	
	B	304	18			Chunks	
	C	273	13			Bits	
	D	250	15				
MAX 88.2	A	347	17				
	B	324	18				
	C	347	18				
	D	348	15				
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Data Verified By: [signature] Date Verified: March 20/06

Test: BV-Bivalve Larval Survival and Development Test					Test ID: 0600034d		
Species: MG-Mytilus galloprovincialis					Protocol: EPAW 95-EPA West Coast		
Sample ID: SW 37					Sample Type: GW-groundwater		
Start Date: 2/1/2006 16:35				End Date: 2/3/2006 16:3	Lab ID: NVNLAB-Golder North Vancouver Laboratory		
Pos	ID	Rep	Group	Initial Density	Number Normal	Number Abnormal	Notes
	1	1	D-Control	295	265	5	
	2	2	D-Control	295	273	10	
	3	3	D-Control	295	359	10	
	4	4	D-Control	295	315	15	
	5	1	B-Control	295	252	5	
	6	2	B-Control	295	365	8	
	7	3	B-Control	295	330	6	
	8	4	B-Control	295	298	7	
	9	1	0.003	295	265	20	
	10	2	0.003	295	271	21	
	11	3	0.003	295	356	18	
	12	4	0.003	295	309	14	
	13	1	0.01	295	265	23	
	14	2	0.01	295	276	17	
	15	3	0.01	295	299	23	
	16	4	0.01	295	282	30	
	17	1	0.2	295	312	23	
	18	2	0.2	295	276	23	
	19	3	0.2	295	296	23	
	20	4	0.2	295	261	29	
	21	1	1.0	295	287	34	
	22	2	1.0	295	257	45	
	23	3	1.0	295	222	25	
	24	4	1.0	295	229	41	
	25	1	3.0	295	186	94	
	26	2	3.0	295	326	28	
	27	3	3.0	295	316	33	
	28	4	3.0	295	281	32	
	29	1	10.0	295	276	38	
	30	2	10.0	295	297	21	
	31	3	10.0	295	269	33	
	32	4	10.0	295	264	26	
	33	1	33.0	295	308	28	
	34	2	33.0	295	304	18	
	35	3	33.0	295	273	13	
	36	4	33.0	295	250	15	
	37	1	88.2	295	347	17	
	38	2	88.2	295	324	18	
	39	3	88.2	295	375	18	
	40	4	88.2	295	348	15	

Comments: 04-1424-034 (0600034)

Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034d	Sample ID:	SW 37
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

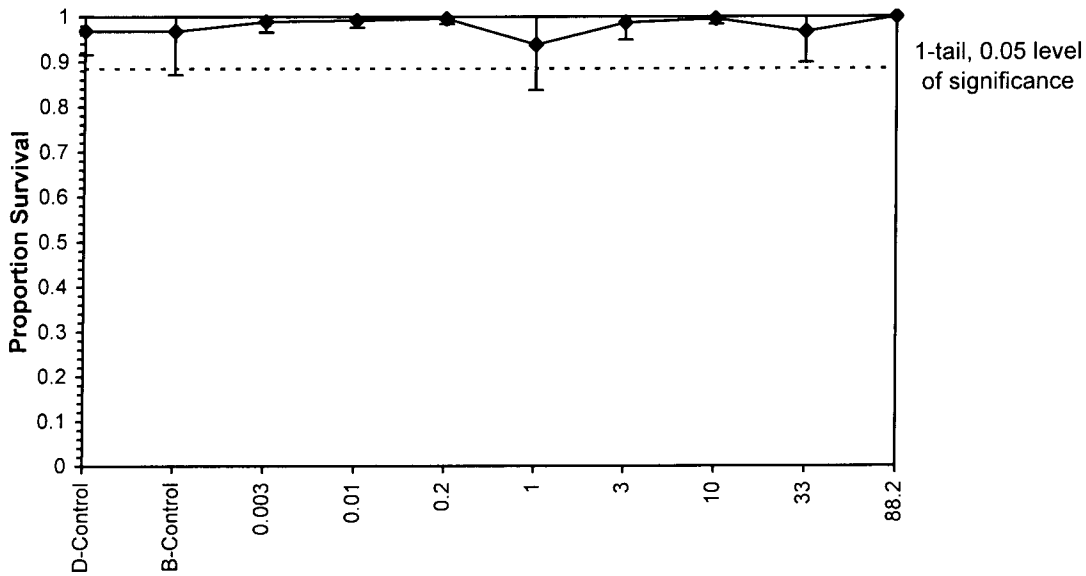
Conc-%	1	2	3	4
D-Control	0.9153	0.9593	1.0000	1.0000
B-Control	0.8712	1.0000	1.0000	1.0000
0.003	0.9661	0.9898	1.0000	1.0000
0.01	0.9763	0.9932	1.0000	1.0000
0.2	1.0000	1.0000	1.0000	0.9831
1	1.0000	1.0000	0.8373	0.9153
3	0.9492	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	0.9831
33	1.0000	1.0000	0.9695	0.8983
88.2	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	0.9686	0.0404	1.4316	1.2754	1.5417	9.259	4			
B-Control	0.9678	0.0644	1.4572	1.2037	1.5417	11.597	4			
0.003	0.9890	0.0160	1.4847	1.3856	1.5417	5.000	4	-0.714	2.513	0.1868
0.01	0.9924	0.0112	1.4970	1.4161	1.5417	3.972	4	-0.879	2.513	0.1868
0.2	0.9958	0.0085	1.5163	1.4402	1.5417	3.345	4	-1.140	2.513	0.1868
1	0.9381	0.0782	1.3786	1.1556	1.5417	14.114	4	0.714	2.513	0.1868
3	0.9873	0.0254	1.4921	1.3433	1.5417	6.646	4	-0.814	2.513	0.1868
10	0.9958	0.0085	1.5163	1.4402	1.5417	3.345	4	-1.140	2.513	0.1868
33	0.9669	0.0480	1.4312	1.2462	1.5417	9.875	4	0.006	2.513	0.1868
88.2	1.0000	0.0000	1.5417	1.5417	1.5417	0.000	4	-1.481	2.513	0.1868

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95511	0.912	-0.5099	0.05088
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.82)	0.23806	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	88.2	>88.2		1.13379	0.0833	0.08494	0.0109	0.01105	0.46776	8, 27

Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034d	Sample ID:	SW 37
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

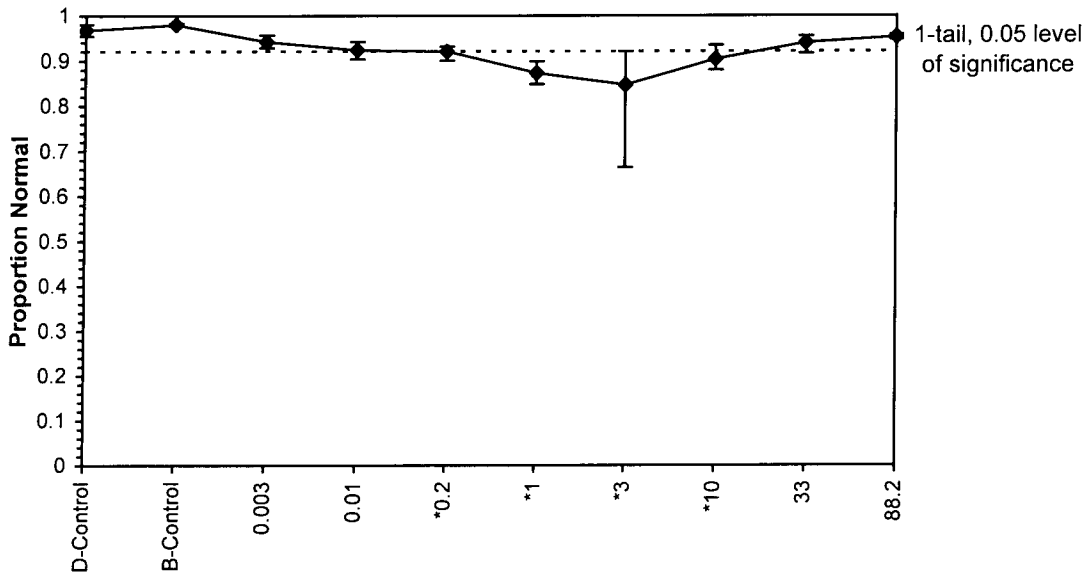
Conc-%	1	2	3	4
D-Control	0.9815	0.9647	0.9729	0.9545
B-Control	0.9805	0.9786	0.9821	0.9770
0.003	0.9298	0.9281	0.9519	0.9567
0.01	0.9201	0.9420	0.9286	0.9038
0.2	0.9313	0.9231	0.9279	0.9000
1	0.8941	0.8510	0.8988	0.8481
3	0.6643	0.9209	0.9054	0.8978
10	0.8790	0.9340	0.8907	0.9103
33	0.9167	0.9441	0.9545	0.9434
88.2	0.9533	0.9474	0.9542	0.9587

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	0.9684	0.0115	1.3943	1.3559	1.4343	2.398	4			
B-Control	0.9796	0.0022	1.4275	1.4187	1.4368	0.554	4			
0.003	0.9416	0.0148	1.3282	1.2993	1.3611	2.391	4	1.553	2.513	0.1071
0.01	0.9236	0.0160	1.2919	1.2555	1.3275	2.331	4	2.405	2.513	0.1071
*0.2	0.9206	0.0141	1.2859	1.2490	1.3057	1.975	4	2.546	2.513	0.1071
*1	0.8730	0.0271	1.2078	1.1705	1.2470	3.391	4	4.378	2.513	0.1071
*3	0.8471	0.1223	1.1855	0.9528	1.2857	13.164	4	4.902	2.513	0.1071
*10	0.9035	0.0241	1.2567	1.2155	1.3109	3.331	4	3.230	2.513	0.1071
33	0.9397	0.0162	1.3241	1.2780	1.3559	2.486	4	1.648	2.513	0.1071
88.2	0.9534	0.0047	1.3534	1.3393	1.3661	0.812	4	0.962	2.513	0.1071

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.81707	0.912	-2.2497	10.1868
Bartlett's Test indicates unequal variances (p = 1.00E-03)	26.1204	20.0902		
The control means are not significantly different (p = 0.10)	1.93286	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	88.2	>88.2		1.13379	0.04744	0.04895	0.01814	0.00363	7.1E-04	8, 27

Dose-Response Plot



Reviewed by March 20/06

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034d	Sample ID:	SW 37
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	GW-groundwater
Sample Date:	1/26/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-034 (0600034)				

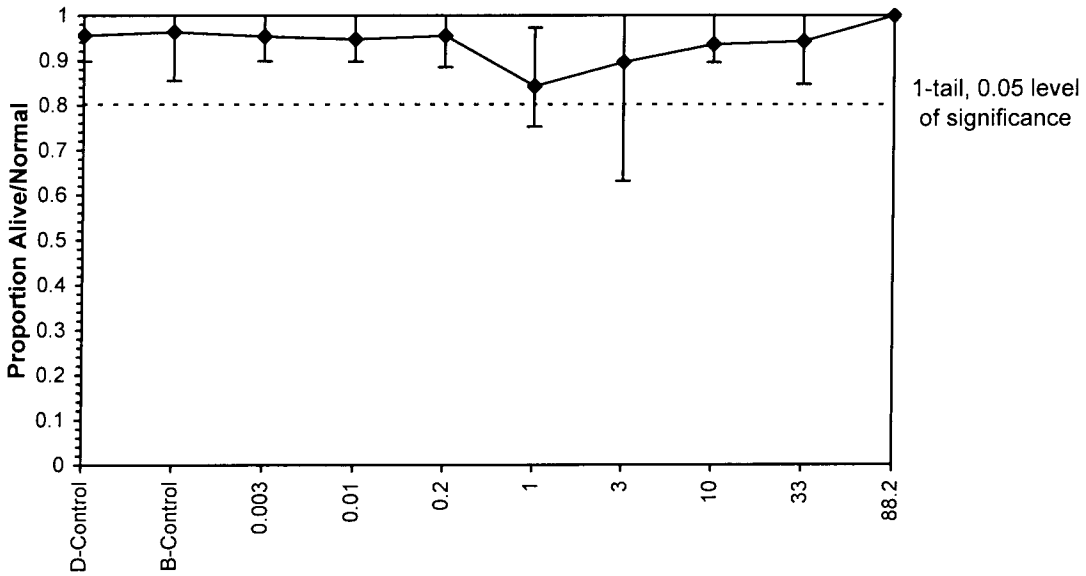
Conc-%	1	2	3	4
D-Control	0.8983	0.9254	1.0000	1.0000
B-Control	0.8542	1.0000	1.0000	1.0000
0.003	0.8983	0.9186	1.0000	1.0000
0.01	0.8983	0.9356	1.0000	0.9559
0.2	1.0000	0.9356	1.0000	0.8847
1	0.9729	0.8712	0.7525	0.7763
3	0.6305	1.0000	1.0000	0.9525
10	0.9356	1.0000	0.9119	0.8949
33	1.0000	1.0000	0.9254	0.8475
88.2	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	0.9559	0.0521	1.3484	1.2462	1.4413	6.912	4			
B-Control	0.9636	0.0729	1.3295	1.1791	1.3931	7.593	4			
0.003	0.9542	0.0535	1.3543	1.2462	1.4527	7.797	4	-0.060	2.513	0.2445
0.01	0.9475	0.0424	1.3465	1.2462	1.4663	6.864	4	0.020	2.513	0.2445
0.2	0.9551	0.0559	1.3678	1.2244	1.4663	8.738	4	-0.199	2.513	0.2445
1	0.8432	0.1005	1.1843	1.0501	1.4054	13.661	4	1.687	2.513	0.2445
3	0.8958	0.1782	1.3071	0.9174	1.4836	20.411	4	0.425	2.513	0.2445
10	0.9356	0.0461	1.3214	1.2407	1.4615	7.427	4	0.278	2.513	0.2445
33	0.9432	0.0729	1.3481	1.1695	1.4762	10.674	4	0.003	2.513	0.2445
88.2	1.0000	0.0000	1.4490	1.4413	1.4527	0.369	4	-1.033	2.513	0.2445

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95813	0.912	-0.7355	1.65094
Bartlett's Test indicates unequal variances (p = 7.47E-03)	20.8808	20.0902		
The control means are not significantly different (p = 0.79)	0.2756	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	88.2	>88.2		1.13379	0.15396	0.16183	0.01929	0.01893	0.4458	8, 27

Dose-Response Plot



Reviewed by: March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT (WATER) TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1421-076
Lab Work Order No.: C6C0034

Lab Analysts: SRS, JAS, MEZ, LOC
Test Type: 96h Bivalve Larval Development
Test Initiation Date: 1Feb06

SAMPLE

Identification: Fe Reftox (1000ppm Solution)
Amount ~~Received~~ Prep'd: 1L
Date ~~Collected~~ Prep'd: 31JAN06
Date Received: —
Temperature (°C): 15.0
pH: 7.0
Dissolved Oxygen (mg/L): 8.4
Conductivity (µmhos/cm): —
Salinity (ppt): 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

TEST SPECIES INFORMATION

Organism: Mytilus galloprovincialis
Source: M-Rep
Date Received: 1Feb06
Reference Toxicant: Cu
Current Reference Toxicant Results (incl. 95% CL)
Reference Toxicant Test Date: 1Feb06
EC50 (proportion normal): 7.0 (6.7-7.3) mg/L Cu
EC50 (proportion alive/normal): 6.5 (6.2-6.8) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
Proportion normal: 12.2 ± 3.1 mg/L CV = 13%
Proportion alive/normal: 10.8 ± 3.5 mg/L CV = 16%

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5 µm filtered, UV sterilized Seawater
Temperature (°C): 15.0
pH: 7.9
Dissolved Oxygen (mg/L): 8.5
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0-16.0
pH Range: 6.9-8.2
Dissolved Oxygen Range (mg/L): 8.4-8.5
Salinity Range (ppt): 28
Photoperiod (L:D h): 16:8
Initial Embryo Density: 295 / 10 ml
Test Volume (mL): 10
Other: —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	EC50 (95% CL)	EC25 (95% CL)
Proportion Normal	ppm	0.01	0.2	0.84 (0.82-0.97)	0.40 (0.45 0.50)
Proportion Alive		0.2	1.0	7100	0.60 (0.53-0.64)
Proportion Alive/Normal		0.2	1.0	0.64 (0.60-0.72)	0.35 (0.29-0.~~45~~ 39)

Other: —

Data Verified By: Original signed
Date Verified: March 22/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
48-h LARVAL DEVELOPMENT TOXICITY TEST – DAILY WATER QUALITY DATA

Client Teck Cominco Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06CXXX34
Logbook BLO # 14 Pages 180-183

Test Initiation Date/Time 1 Feb 06 / 1635
Test Termination Date 3~~2~~ Feb 06 / 1635
Test Species Mytilus galloprovincialis

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
Fe ReMox (ppm)	0	24	48	0	24	48	0	24	48	0	24	48
Fe Control	15.0	15.0	16.0	7.7	7.7	8.3	28	28	28	8.5	8.4	8.4
~~33~~ 0.003	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.5	8.4	8.4
0.01	15.0	15.0	16.0	7.7	7.7	8.2	28	28	28	8.5	8.4	8.4
0.3	15.0	15.0	16.0	7.7	7.7	8.1	28	28	28	8.5	8.4	8.4
1	15.0	15.0	16.0	7.6	7.7	8.2	28	28	28	8.5	8.4	8.4
3	15.0	15.0	16.0	7.4	7.2	8.2	28	28	28	8.5	8.4	8.4
10	15.0	15.0	16.0	7.0	7.4	8.1	28	28	28	8.4	8.4	8.4
33	15.0	15.0	16.0	6.9	7.1	7.9	28	28	28	8.4	8.4	8.4
100	15.0	15.0	16.0	7.0	7.1	7.7	28	28	28	8.4	8.4	8.4
Technician Initials			SRS			SRS			SRS			

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-080306 DO 11.13
Comments

Test Set Up By SRS Data Verified By [signature] Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client: Seacon Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600034
Logbook: BLD #14 Pages: 180-183
Initial Embryo Density: 295/10 mL
Sample ID: Fe Reflux

Test Species: Mytilus galloprovincialis
Source/Date Received: M-Rep / 1 Feb 06
Test Initiation Date/Time: 1 Feb 06 / 1635
Test Termination Date: 3 Feb 06 / 1635
Test Volume (mL): 10
Aliquot Size (mL): ~~8~~ 10

Sample ID Fe Reflux (ppm)	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
Fe Control	A	282	3				
	B	291	9				
	C	311	8				
	D	326	13				
0.003	A	317	9				
	B	325	10				
	C	295	15				
	D	245	9				
0.01	A	291	10				
	B	277	11				
	C	327	16				
	D	303	16				
0.2	A	266	23				
	B	245	32				
	C	304	30				
	D	258	29				
1.0	A	26	86			start of Particulate matter	
	B	33	88			All larvae have	
	C	38	89			particulate?	
	D	25	76			Clinging to them	

Data Verified By: Original

Date Verified: March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (SAMPLES)

Client: Seacon Environmental
Lab Project No.: 04-1424-076
Lab Work Order No.: 0600034
Logbook: BLD #14 Pages: 180-183
Initial Embryo Density: 295/10 mL
Sample ID: Fe Reftox
Fe Reftox (PPM)

Test Species: Mytilus galloprovincialis
Source/Date Received: M-Rep / 1 Feb 06
Test Initiation Date/Time: 1 Feb 06 / 1635
Test Termination Date: 3 Feb 06 / 1635
Test Volume (mL): 10
Aliquot Size (mL): ~~8~~ 10

Sample ID (Fe Reftox (ppm))	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae	Large	
3.0	A	18	81			Particulates.	MEL
	B	26	83			clinging to	MEL
	C	29	105			gametes.	MEL
	D	20	79				MEL
10.0	A	138	54			smaller particulate.	MEL
	B	NO Count - Dropped Test Tube) not				clinging	MEL
	C	186	38			clinging	MEL
	D	174	24			orange colour	MEL
33.0	A	3	161				MEL
	B	3	194				MEL
	C	1	163				MEL
	D	2	170				MEL
100.0	A	1	236				MEL
	B	1	231				MEL
	C	0	223			small nematod	MEL
	D	0	213				
	A						
	B						
	C						
	D						

Data Verified By: Qualtek Date Verified: [illegible] /06

Note @ 10.0 (PPM) particulates are 1/3 to 1/4 the size of the previous particulates and they are not adhearing to the gonads.

3.0 PPM 

10.0 PPM 

Test: BV-Bivalve Larval Survival and Development Test						Test ID: 0600034a	
Species: MG-Mytilus galloprovincialis						Protocol: EPAW 95-EPA West Coast	
Sample ID: FE REFTOX						Sample Type: OC-Other Chemical	
Start Date: 2/1/2006 16:35				End Date: 2/3/2006 16:3		Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Initial Density	Number Normal	Number Abnormal	Notes
	1	1	D-Control	295	282	3	
	2	2	D-Control	295	291	9	
	3	3	D-Control	295	311	8	
	4	4	D-Control	295	326	13	
	5	1	0.003	295	317	9	
	6	2	0.003	295	325	10	
	7	3	0.003	295	295	15	
	8	4	0.003	295	245	9	
	9	1	0.010	295	291	10	
	10	2	0.010	295	277	11	
	11	3	0.010	295	327	16	
	12	4	0.010	295	303	16	
	13	1	0.200	295	266	23	
	14	2	0.200	295	245	32	
	15	3	0.200	295	305	30	
	16	4	0.200	295	258	29	
	17	1	1.000	295	26	86	
	18	2	1.000	295	33	88	
	19	3	1.000	295	38	89	
	20	4	1.000	295	25	76	
	21	1	3.000	295	18	81	
	22	2	3.000	295	26	83	
	23	3	3.000	295	29	105	
	24	4	3.000	295	20	79	
	25	1	10.000	295	138	54	
	26	2	10.000	295	186	38	
	27	3	10.000	295	174	24	
	28	1	33.000	295	3	161	
	29	2	33.000	295	3	194	
	30	3	33.000	295	1	163	
	31	4	33.000	295	2	170	
	32	1	100.000	295	1	236	
	33	2	100.000	295	1	231	
	34	3	100.000	295	0	223	
	35	4	100.000	295	0	213	

Comments: 04-1424-076 (0600034)

Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034a	Sample ID:	FE REFTOX
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	OC-Other Chemical
Sample Date:	1/31/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-076 (0600034)				

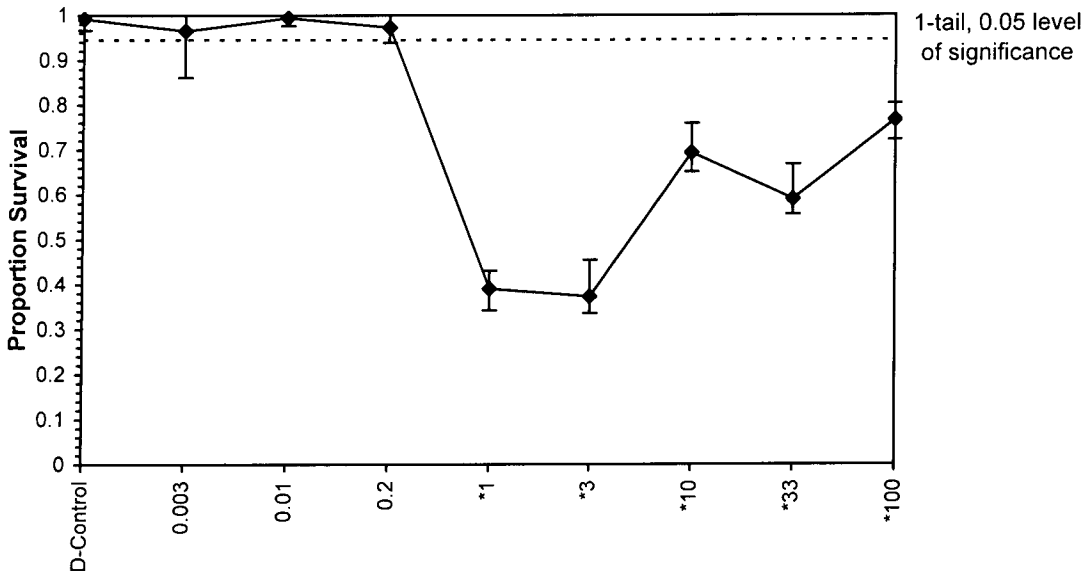
Conc-ppm	1	2	3	4
D-Control	0.9661	1.0000	1.0000	1.0000
0.003	1.0000	1.0000	1.0000	0.8610
0.01	1.0000	0.9763	1.0000	1.0000
0.2	0.9797	0.9390	1.0000	0.9729
1	0.3797	0.4102	0.4305	0.3424
3	0.3356	0.3695	0.4542	0.3356
10	0.6508	0.7593	0.6712	
33	0.5559	0.6678	0.5559	0.5831
100	0.8034	0.7864	0.7559	0.7220

			Transform: Arcsin Square Root						1-Tailed			
Conc-ppm	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD		
D-Control	0.9915	0.0169	1.5027	1.3856	1.5417	5.193	4				10	1180
0.003	0.9653	0.0695	1.4535	1.1888	1.5417	12.141	4	0.825	2.684	0.1602	41	1180
0.01	0.9941	0.0119	1.5103	1.4161	1.5417	4.156	4	-0.128	2.684	0.1602	7	1180
0.2	0.9729	0.0254	1.4240	1.3212	1.5417	6.382	4	1.318	2.684	0.1602	32	1180
*1	0.3907	0.0384	0.6749	0.6250	0.7157	5.851	4	13.870	2.684	0.1602	719	1180
*3	0.3737	0.0560	0.6572	0.6179	0.7396	8.738	4	14.167	2.684	0.1602	739	1180
*10	0.6938	0.0577	0.9856	0.9386	1.0580	6.458	3	8.021	2.684	0.1730	271	885
*33	0.5907	0.0530	0.8771	0.8414	0.9565	6.216	4	10.483	2.684	0.1602	483	1180
*100	0.7669	0.0358	1.0678	1.0155	1.1114	3.951	4	7.286	2.684	0.1602	275	1180

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91452	0.91	-1.3272	3.59586
Bartlett's Test indicates equal variances (p = 0.22)	10.7555	20.0902		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.2	1	0.44721		0.04658	0.0468	0.49433	0.00712	1.4E-15	8, 26

Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Survival

Start Date:	2/1/2006 16:35	Test ID:	0600034a	Sample ID:	FE REFTOX
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	OC-Other Chemical
Sample Date:	1/31/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-076 (0600034)				

Conc-ppm	1	2	3	4
D-Control	0.9661	1.0000	1.0000	1.0000
0.003	1.0000	1.0000	1.0000	0.8610
0.01	1.0000	0.9763	1.0000	1.0000
0.2	0.9797	0.9390	1.0000	0.9729
1	0.3797	0.4102	0.4305	0.3424
3	0.3356	0.3695	0.4542	0.3356
10	0.6508	0.7593	0.6712	
33	0.5559	0.6678	0.5559	0.5831
100	0.8034	0.7864	0.7559	0.7220

			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-ppm	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9915	0.0169	1.5027	1.3856	1.5417	5.193	4				0.9915	1.0000
0.003	0.9653	0.0695	1.4535	1.1888	1.5417	12.141	4	0.825	2.684	0.1602	0.9797	0.9880
0.01	0.9941	0.0119	1.5103	1.4161	1.5417	4.156	4	-0.128	2.684	0.1602	0.9797	0.9880
0.2	0.9729	0.0254	1.4240	1.3212	1.5417	6.382	4	1.318	2.684	0.1602	0.9729	0.9812
*1	0.3907	0.0384	0.6749	0.6250	0.7157	5.851	4	13.870	2.684	0.1602	0.5632	0.5680
*3	0.3737	0.0560	0.6572	0.6179	0.7396	8.738	4	14.167	2.684	0.1602	0.5632	0.5680
*10	0.6938	0.0577	0.9856	0.9386	1.0580	6.458	3	8.021	2.684	0.1730	0.5632	0.5680
*33	0.5907	0.0530	0.8771	0.8414	0.9565	6.216	4	10.483	2.684	0.1602	0.5632	0.5680
*100	0.7669	0.0358	1.0678	1.0155	1.1114	3.951	4	7.286	2.684	0.1602	0.5632	0.5680

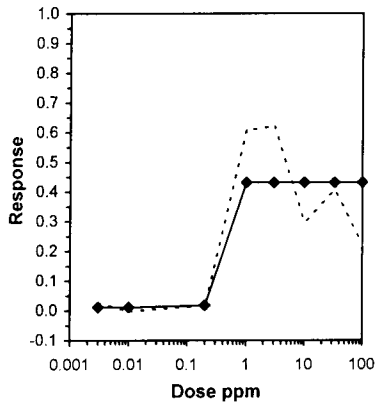
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91452	0.91	-1.3272	3.59586
Bartlett's Test indicates equal variances (p = 0.22)	10.7555	20.0902		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.2	1	0.44721		0.04658	0.0468	0.49433	0.00712	1.4E-15	8, 26

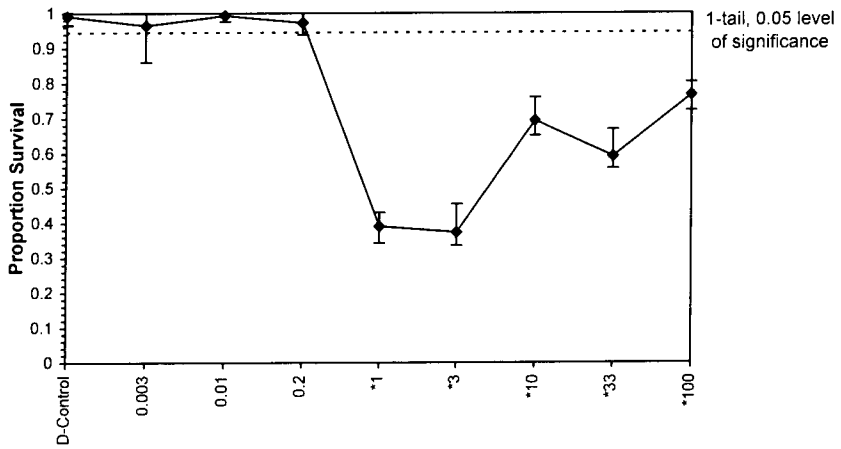
Log-Linear Interpolation (200 Resamples)

Point	ppm	SD	95% CL(Exp)		Skew
IC05	0.2472	0.0209	0.1795	0.2849	-1.9044
IC10	0.3267	0.0171	0.2606	0.3637	-0.2243
IC15	0.4113	0.0167	0.3510	0.4494	-0.0957
IC20	0.5013	0.0169	0.4377	0.5436	0.0389
IC25	0.5970	0.0178	0.5316	0.6409	0.1483
IC40	0.9224	0.0263	0.8461	1.0158	0.2762
IC50	>100				

ppm Fe



Dose-Response Plot



Reviewed by [signature] March 21/06

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034a	Sample ID:	FE REFTOX
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	OC-Other Chemical
Sample Date:	1/31/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-076 (0600034)				

Conc-ppm	1	2	3	4
D-Control	0.9895	0.9700	0.9749	0.9617
0.003	0.9724	0.9701	0.9516	0.9646
0.01	0.9668	0.9618	0.9534	0.9498
0.2	0.9204	0.8845	0.9104	0.8990
1	0.2321	0.2727	0.2992	0.2475
3	0.1818	0.2385	0.2164	0.2020
10	0.7188	0.8304	0.8788	
33	0.0183	0.0152	0.0061	0.0116
100	0.0042	0.0043	0.0000	0.0000

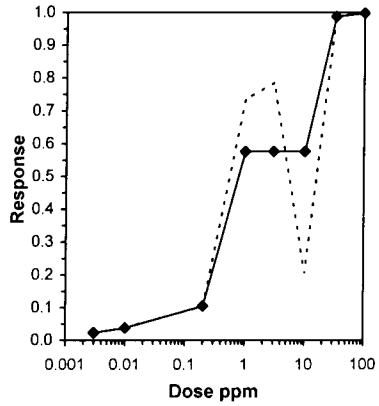
			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-ppm	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9740	0.0117	1.4125	1.3737	1.4680	2.843	4				1.0000	1.0000
0.003	0.9647	0.0093	1.3829	1.3490	1.4039	1.768	4	1.070	2.684	0.0744	0.9767	0.9767
0.01	0.9579	0.0077	1.3649	1.3449	1.3875	1.424	4	1.718	2.684	0.0744	0.9623	0.9623
*0.2	0.9036	0.0155	1.2557	1.2240	1.2848	2.080	4	5.654	2.684	0.0744	0.8947	0.8947
*1	0.2629	0.0294	0.5379	0.5027	0.5788	6.200	4	31.541	2.684	0.0744	0.4237	0.4237
*3	0.2097	0.0239	0.4752	0.4405	0.5103	6.182	4	33.803	2.684	0.0744	0.4237	0.4237
*10	0.8093	0.0821	1.1244	1.0118	1.2152	9.199	3	9.619	2.684	0.0804	0.4237	0.4237
*33	0.0128	0.0052	0.1114	0.0782	0.1357	22.330	4	46.922	2.684	0.0744	0.0131	0.0131
*100	0.0021	0.0025	0.0496	0.0335	0.0657	36.636	4	49.150	2.684	0.0744	0.0022	0.0022

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.947	0.91	-0.4572	3.15473
Bartlett's Test indicates equal variances (p = 0.09)	13.7225	20.0902		

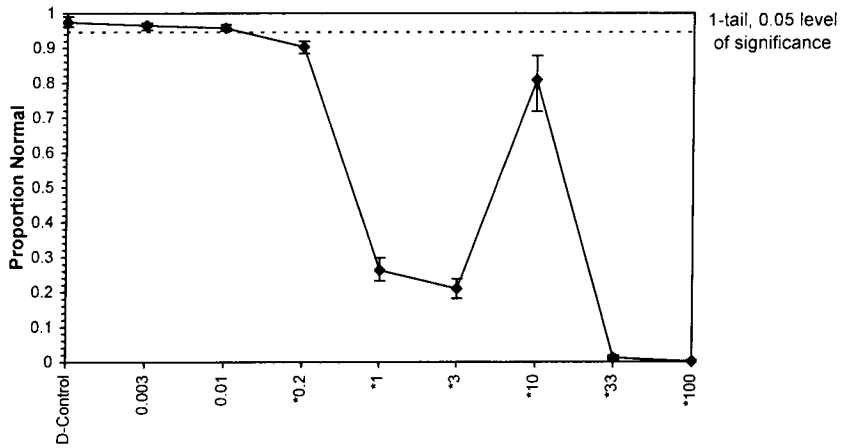
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.01	0.2	0.04472		0.02833	0.02905	1.25533	0.00154	3.3E-29	8, 26

Log-Linear Interpolation (200 Resamples)

Point	ppm	SD	95% CL(Exp)		Skew
IC05	0.0421	0.0230	0.1011	0.2493	0.3241
IC10	0.1840	0.0101	0.2329	0.2948	-0.1983
IC15	0.2597	0.0099	0.2920	0.3564	-0.2634
IC20	0.3299	0.0101	0.3625	0.4259	-0.2728
IC25	0.4040	0.0110	0.4313	0.5021	-0.2267
IC40	0.6520	0.0172	0.6595	0.7587	-0.0852
IC50	0.8412	0.0240	0.8189	0.9668	-0.0710 ppm Fe



Dose-Response Plot



Reviewed by: March 2/1/06

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	2/1/2006 16:35	Test ID:	0600034a	Sample ID:	FE REFTOX
End Date:	2/3/2006 16:35	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	OC-Other Chemical
Sample Date:	1/31/2006	Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	04-1424-076 (0600034)				

Conc-ppm	1	2	3	4
D-Control	0.9559	0.9864	1.0000	1.0000
0.003	1.0000	1.0000	1.0000	0.8305
0.01	0.9864	0.9390	1.0000	1.0000
0.2	0.9017	0.8305	1.0000	0.8746
1	0.0881	0.1119	0.1288	0.0847
3	0.0610	0.0881	0.0983	0.0678
10	0.4678	0.6305	0.5898	
33	0.0102	0.0102	0.0034	0.0068
100	0.0034	0.0034	0.0000	0.0000

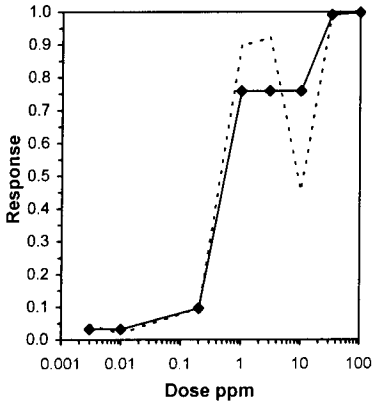
			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-ppm	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9856	0.0208	1.4095	1.3593	1.4541	2.973	4				1.0000	1.0000
0.003	0.9576	0.0847	1.3508	1.1465	1.4413	10.155	4	1.059	2.684	0.1489	0.9673	0.9673
0.01	0.9814	0.0290	1.4166	1.3212	1.4541	4.497	4	-0.127	2.684	0.1489	0.9673	0.9673
0.2	0.9017	0.0718	1.2716	1.1465	1.4794	11.410	4	2.486	2.684	0.1489	0.9035	0.9035
*1	0.1034	0.0208	0.3262	0.2954	0.3671	10.404	4	19.527	2.684	0.1489	0.2413	0.2413
*3	0.0788	0.0174	0.2833	0.2496	0.3189	11.396	4	20.300	2.684	0.1489	0.2413	0.2413
*10	0.5627	0.0847	0.8488	0.7532	0.9174	10.059	3	9.358	2.684	0.1608	0.2413	0.2413
*33	0.0076	0.0032	0.0857	0.0583	0.1010	23.662	4	23.863	2.684	0.1489	0.0087	0.0087
*100	0.0017	0.0020	0.0461	0.0335	0.0583	30.560	4	24.577	2.684	0.1489	0.0022	0.0022

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93347	0.91	-0.1905	3.31421
Bartlett's Test indicates unequal variances (p = 2.92E-03)	23.3685	20.0902		

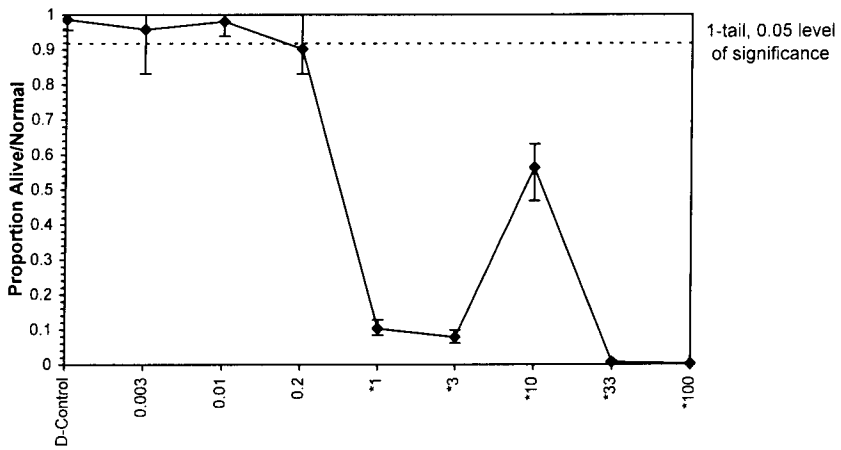
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.2	1	0.44721		0.06736	0.06914	1.42295	0.00616	3.8E-22	8, 26

Log-Linear Interpolation (200 Resamples)

Point	ppm	SD	95% CL(Exp)		Skew	
IC05	0.0584	0.0582	0.0000	0.3126	0.5904	
IC10	0.2033	0.0399	0.0689	0.2967	-0.6566	
IC15	0.2506	0.0277	0.1761	0.3406	-0.0975	
IC20	0.2997	0.0264	0.2315	0.3871	-0.0405	
IC25	0.3509	0.0252	0.2889	0.4371	-0.0268	
IC40	0.5166	0.0217	0.4665	0.5946	0.0025	
IC50	0.6382	0.0199	0.6003	0.7159	-0.0236	ppm Fe



Dose-Response Plot



Reviewed by: March 21/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT (WATER) TOXICITY TEST DATA SUMMARY

Client: Seacor Environmental
Lab Project No.: 04-1421-076
Lab Work Order No.: 0600034

Lab Analysts: SRS, JAS, MEL, LOC
Test Type: 96h Biotic Larval Development
Test Initiation Date: 1Feb06

SAMPLE

Identification: Cu Reftox solution 05-Cu-007
Amount ~~Received~~ Rec'd: 1L
Date ~~Collected~~ Rec'd: 29 Nov 05
Date Received: —
Temperature (°C): —
pH: —
Dissolved Oxygen (mg/L): —
Conductivity (µmhos/cm): —
Salinity (ppt): —
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: —

TEST SPECIES INFORMATION

Organism: Mytilus galloprovincialis
Source: M-Rep
Date Received: 1Feb06
Reference Toxicant: Cu
Current Reference Toxicant Results (incl. 95% CL)
Reference Toxicant Test Date: 1 Feb 06
EC50 (proportion normal): 7.0 (6.7-7.3) mg/L Cu
EC50 (proportion alive/normal): 6.5 (6.2-6.8) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
Proportion normal: 12.2 ± 3.1 mg/L CV=13%
Proportion alive/normal: 10.8 ± 3.5 mg/L CV=16%

DILUTION/CONTROL WATER (initial water quality)

Water Type: 0.5 µm filtered, UV sterilized Seawater
Temperature (°C): 15.0
pH: 7.9
Dissolved Oxygen (mg/L): 8.5
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 – 16.0
pH Range: 7.6 – 8.3
Dissolved Oxygen Range (mg/L): 8.4 – 8.5
Salinity Range (ppt): 28
Photoperiod (L:D h): 16:8
Initial Embryo Density: 295 / 10 ml
Test Volume (mL): 10
Other: —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	EC50 (95% CL)	EC25 (95% CL)
Proportion Normal	mg/L	2.5	5.0	7.0 (6.7-7.3)	—
Proportion Alive		—	—	—	—
Proportion Alive/Normal		2.5	5.0	6.5 (6.2-6.8)	—

Other: —

Data Verified By: [signature]
Date Verified: March 22/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
48-h LARVAL DEVELOPMENT TOXICITY TEST – DAILY WATER QUALITY DATA

Client Cascor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06CX0034
Logbook BL0 TO: 14 Pages 180-183

Test Initiation Date/Time ~~31 Feb~~ 1 Mar 06 / 1635
Test Termination Date ~~31 Feb~~ 3 Mar 06 / 1635
Test Species Mytilus galloprovincialis

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
Cu Reftox (mg/L)	0	24	48	0	24	48	0	24	48	0	24	48
Cu Control	15.0	15.0	16.0	7.7	7.6	8.3	28	28	28	8.5	8.4	8.4
2.5	15.0	15.0	16.0	7.7	7.6	8.3	28	28	28	8.5	8.4	8.4
5.0	15.0	15.0	16.0	7.7	7.6	8.3	28	28	28	8.5	8.4	8.4
10.0	15.0	15.0	16.0	7.7	7.6	8.3	28	28	28	8.5	8.4	8.4
20.0	15.0	15.0	16.0	7.7	7.6	8.3	28	28	28	8.5	8.4	8.4
40.0	15.0	15.0	16.0	7.7	7.6	8.3	27	28	28	8.5	8.4	8.4
Technician Initials			JRJ			SDI			SDI			SDI

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020501 Salinity II-A-020206 DO 11.13
Comments

Test Set Up By SRS Data Verified By Ralph K Date Verified March 20/06

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
LARVAL DEVELOPMENT TOXICITY TEST – WATER (CONTROLS)

Client Seacor Environmental
Lab Project No. 04-1424-076
Lab Work Order No. 06000034
Logbook BLD #14 Pages 180-183
Initial Embryo Density 295/10ml

Test Species Mytilus galloprovincialis
Test Initiation Date/Time 31 Feb 2006 / 1635
Test Termination Date 3 Mar 2006 / 1635
Test Volume (mL) 10ml

Concentration	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
Reference Toxicant	Cu Reflex (ug/L)						
2.5	A	300	9				
	B	270	14				
	C	297	16				
	D	264	8				
5.0	A	229	46				
	B	206	29				
	C	230	45				
	D	202	57				
10.0	A	33	164				
	B	41	149				
	C	25	158				
	D	21	207				
20.0	A	1	258				
	B	1	199				
	C	1	205				
	D	1	220				
40.0	A	0	40				
	B	0	33				
	C	0	34				
	D	0	29				
Control Seawater							
Control	A	265	5				
	B	273	10				
	C	359	10				
	D	315	15				

Data Verified By Qaqhq Date Verified March 13/06

Test: BV-Bivalve Larval Survival and Development Test						Test ID: rtmgcu0601	
Species: MG-Mytilus galloprovincialis						Protocol: EPAW 95-EPA West Coast	
Sample ID: REF-Ref Toxicant						Sample Type: CU-Copper	
Start Date: 2/1/2006		End Date: 2/3/2006				Lab ID: NVNLAB-Golder North Vancouver Laboratory	
Pos	ID	Rep	Group	Initial Density	Number Normal	Number Abnormal	Notes
	1	1	D-Control	295	265	5	
	2	2	D-Control	295	273	10	
	3	3	D-Control	295	359	10	
	4	4	D-Control	295	315	15	
	5	1	2.500	295	300	9	
	6	2	2.500	295	270	14	
	7	3	2.500	295	297	16	
	8	4	2.500	295	264	8	
	9	1	5.000	295	229	46	
	10	2	5.000	295	206	29	
	11	3	5.000	295	230	48	
	12	4	5.000	295	202	57	
	13	1	10.000	295	33	164	
	14	2	10.000	295	41	149	
	15	3	10.000	295	25	158	
	16	4	10.000	295	21	207	
	17	1	20.000	295	1	258	
	18	2	20.000	295	1	199	
	19	3	20.000	295	1	205	
	20	4	20.000	295	1	220	
	21	1	40.000	295	0	40	
	22	2	40.000	295	0	33	
	23	3	40.000	295	0	34	
	24	4	40.000	295	0	29	

Comments: Seacore Environmental 04-1424-076 (0600034)

Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	2/1/2006	Test ID:	rtmgcu0601	Sample ID:	REF-Ref Toxicant
End Date:	2/3/2006	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	Seacore Environmental 04-1424-076 (0600034)				

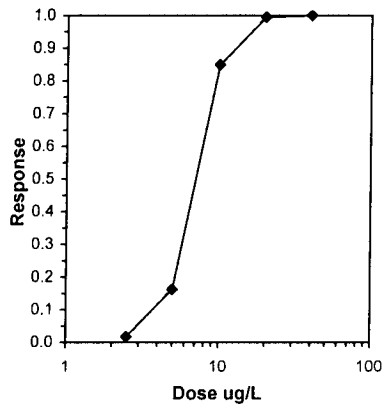
Conc-ug/L	1	2	3	4
D-Control	0.9815	0.9647	0.9729	0.9545
2.5	0.9709	0.9507	0.9489	0.9706
5	0.8327	0.8766	0.8273	0.7799
10	0.1675	0.2158	0.1366	0.0921
20	0.0039	0.0050	0.0049	0.0045
40	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9684	0.0115	1.3943	1.3559	1.4343	2.398	4			1	40
2.5	0.9603	0.0121	1.3718	1.3427	1.3993	2.278	4	14.00	10.00	2	47
*5	0.8291	0.0395	1.1465	1.0825	1.2118	4.613	4	10.00	10.00	33	180
*10	0.1530	0.0521	0.3979	0.3084	0.4831	18.476	4	10.00	10.00	578	678
*20	0.0046	0.0005	0.0675	0.0622	0.0708	5.676	4	10.00	10.00	878	882
40	0.0000	0.0000	0.0863	0.0791	0.0930	6.585	4			136	136

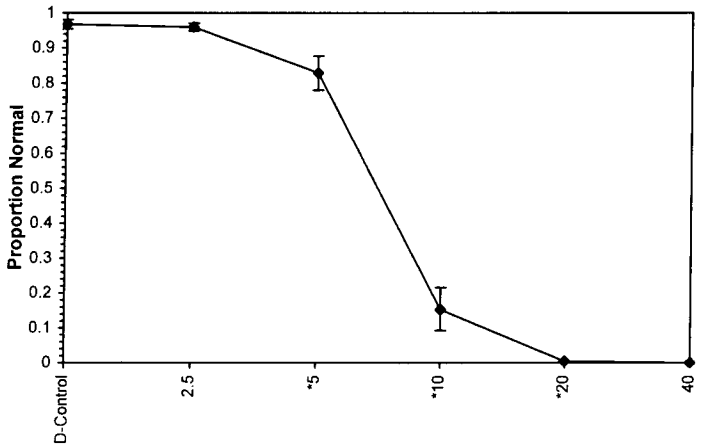
Auxiliary Tests				Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)				0.97793	0.868	-0.0645	0.80471
Bartlett's Test indicates unequal variances (p = 9.76E-03)				13.3333	13.2767		
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**			
Steel's Many-One Rank Test	2.5	5	3.53553				

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%				
5.0%	6.9935	6.6733	7.3290	
10.0%	7.0096	6.7061	7.3269	
20.0%	7.0315	6.8145	7.2554	
Auto-1.8%	6.9842	6.6680	7.3155	µg/L



Dose-Response Plot



Reviewed by: March 20/06

Bivalve Larval Survival and Development Test-Proportion Alive/Normal

Start Date:	2/1/2006	Test ID:	rtmgcu0601	Sample ID:	REF-Ref Toxicant
End Date:	2/3/2006	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	MG-Mytilus galloprovincialis
Comments:	Seacore Environmental 04-1424-076 (0600034)				

Conc-ug/L	1	2	3	4
D-Control	0.8983	0.9254	1.0000	1.0000
2.5	1.0000	0.9153	1.0000	0.8949
5	0.7763	0.6983	0.7797	0.6847
10	0.1119	0.1390	0.0847	0.0712
20	0.0034	0.0034	0.0034	0.0034
40	0.0000	0.0000	0.0000	0.0000

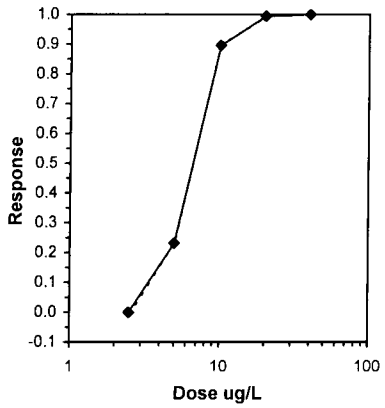
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9559	0.0521	1.3484	1.2462	1.4413	6.912	4			2	40
2.5	0.9525	0.0554	1.3412	1.2407	1.4455	7.352	4	17.00	10.00	2	47
*5	0.7347	0.0502	1.0311	0.9746	1.0822	5.530	4	10.00	10.00	48	180
*10	0.1017	0.0301	0.3221	0.2701	0.3820	15.386	4	10.00	10.00	611	678
*20	0.0034	0.0000	0.0583	0.0583	0.0583	0.000	4	10.00	10.00	878	882
40	0.0000	0.0000	0.0863	0.0791	0.0930	6.585	4			136	136

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95604	0.868	-0.0128	-1.0069
Equality of variance cannot be confirmed				

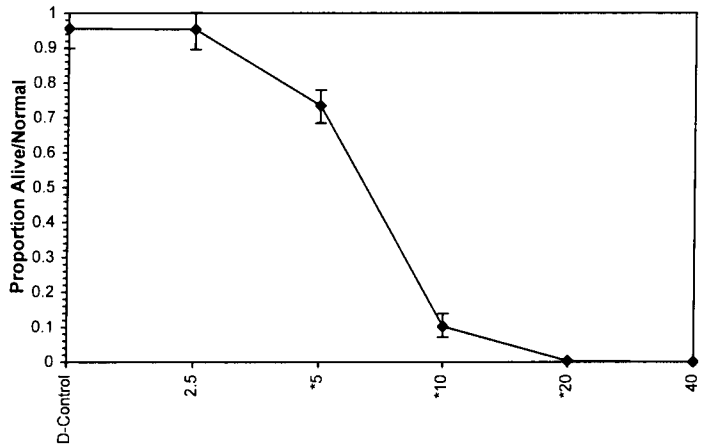
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	2.5	5	3.53553	

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%	6.4945	6.1988	6.8042
5.0%	6.4461	6.1321	6.7762
10.0%	6.4794	6.1602	6.8153
20.0%	6.6064	5.9806	7.2976
Auto-0.0%	6.4945	6.1988	6.8042



Dose-Response Plot



Reviewed by [signature] March 20/06

FEB 1 7 2006

ALS Environmental

CERTIFICATE OF ANALYSIS

Date:	February 13, 2006
ALS File No.	X1687
Report On:	0600034 Seawater Analysis
Report To:	**Golder Associates Ltd.** 195 Pemberton Ave North Vancouver, BC V7P 2R4
Attention:	**Mr. Shawn Seguin**
Received:	February 3, 2006

ALS ENVIRONMENTAL
per:

Heather A. Ross-Easton, B.Sc. - Project Chemist
Natasha Markovic-Mirovic, B.Sc. - Project Chemist

File No. X1687

RESULTS OF ANALYSIS - Water

Sample ID		CONTROL -0HR	SW9-OHR	SW11-OHR	SW37-OHR	CONTROL -48HR
Sample Date		OVER N 06-02-01	OVER N 06-02-01	OVER N 06-02-01	OVER N 06-02-01	OVER N 06-02-03
ALS ID		*1*	*2*	*3*	*4*	*5*
Nutrients						
Ammonia Nitrogen	N	0.029	0.203	0.183	0.025	<0.020

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

A Campbell Brothers Limited Company

File No. X1687

RESULTS OF ANALYSIS - Water

Sample ID		SW9-48HR	SW11 -48HR	SW37 -48HR	CONTROL -0HR	SW9-OHR
		OVER N	OVER N	OVER N	OVER S	OVER S
Sample Date		06-02-03	06-02-03	06-02-03	06-02-01	06-02-01
ALS ID		*6*	*7*	*8*	*9*	*10*
Nutrients						
Ammonia Nitrogen	N	0.219	0.251	<0.020	-	-
Inorganic Parameters						
Sulphide	S	-	-	-	<0.020	<0.020

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

A Campbell Brothers Limited Company

File No. X1687

RESULTS OF ANALYSIS - Water

Sample ID	SW11-OHR	SW37-OHR	CONTROL -48HR	SW9-48HR	SW11 -48HR
	OVER S	OVER S	OVER S	OVER S	OVER S
Sample Date	06-02-01	06-02-01	06-02-03	06-02-03	06-02-03
ALS ID	*11*	*12*	*13*	*14*	*15*
Inorganic Parameters					
Sulphide S	<0.020	<0.020	<0.020	<0.020	<0.020

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

A Campbell Brothers Limited Company

File No. X1687

RESULTS OF ANALYSIS - Water

Sample ID	SW37 -48HR OVER S
Sample Date	06-02-03
ALS ID	*16*

Inorganic Parameters

Sulphide	S	<0.020

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

A Campbell Brothers Limited Company

File No. X1687

Appendix 1 - QUALITY CONTROL - Replicates

Water		SW37-OHR OVER S 06-02-01	SW37-OHR OVER S QC # 486246
Inorganic Parameters			
Sulphide	S	<0.020	<0.020

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

A Campbell Brothers Limited Company

File No. X1687

Appendix 1 - QUALITY CONTROL - Reference Materials

Water

		Result	Target	Units	DL	ALSQC#	Method
SPEX Nutrients, 12-59N							
Nutrients							
Ammonia Nitrogen	N	1.93	1.92	mg/L	0.02	486583	a

Methods:
a = Electrode

A Campbell Brothers Limited Company

File No. X1687

Appendix 1 - QUALITY CONTROL - Spikes

Water

	Result	Target	Units	DL	ALSQC#	Method
Inorganic Parameters						
Sulphide S	0.97	1.00	mg/L	0.02	486885	a

Methods:
a = Colourimetry

A Campbell Brothers Limited Company

File No. X1687

Appendix 1 - QUALITY CONTROL - Blanks

Water

		Result	Target	Units	DL	ALSQC#	Method
Nutrients							
Ammonia Nitrogen	N	<0.02	<0.02	mg/L	0.02	486582	a
Inorganic Parameters							
Sulphide S		<0.02	<0.02	mg/L	0.02	486884	b

Methods:
a = Electrode
b = Colourimetry

A Campbell Brothers Limited Company

File No. X1687

Appendix 2 - DETECTION LIMITS - Water

		Detection Limit	
Nutrients			
Ammonia Nitrogen	N	0.020	mg/L
Inorganic Parameters			
Sulphide	S	0.020	mg/L

DLs indicated are the Minimum (Lowest) Reported Detection Limits for this work order.
The DL achieved for any given sample may differ from these values.

A Campbell Brothers Limited Company

Appendix 3 - METHODOLOGY

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

Ammonia in Water by Selective Ion Electrode

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Sulphide in Water

This analysis is carried out using procedures adapted from APHA Method 4500-S2 "Sulphide". Sulphide is determined using the methlyene blue colourimetric method.

Recommended Holding Time:
Sample: 7 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report

A Campbell Brothers Limited Company

CHAIN-OF-CUSTODY / TEST REQUEST FORM

1646

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

Client Name _____ Client Contact _____ Ship to _____

Address _____ Phone _____

Fax _____

Sampled by _____ Attn. _____ Shipping Date _____

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested					4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)

PO/Reference No. _____

Project Title _____

Results Needed By _____

Comments/Instructions _____

1) Released by: _____ Date: _____ Company: _____ Time: _____ Courier Name: _____	2) Released by: _____ Date: _____ Company: _____ Time: _____ Courier Name: _____	*Shaded area to be completed by Golder Laboratory upon sample receipt.* Golder Project No. _____ Golder Work Order No. _____ Condition Upon Receipt _____ Receipt Sample Temp. (°C) _____
1) Received by: _____ Date: _____ Company: _____ Time: _____	1) Received by: _____ Date: _____ Company: _____ Time: _____	

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Distribution of copies: White, Yellow — accompany the shipment
Pink — kept by consignor (e.g. shipper)
Yellow — kept by consignee (e.g. receiver)
White — returned to consignor by consignee

Please see instructions for completion on back of form

Revision Date: November 22, 2004

CHAIN-OF-CUSTODY / TEST REQUEST FORM

1645

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

Client Name _____ Client Contact _____ Ship to _____

Address _____ Phone _____

_____ Fax _____

_____ Sampled by _____ Attn. _____ Shipping Date _____

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested					4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)

PO/Reference No. _____

Project Title _____

Results Needed By _____

Comments/Instructions _____

1) Released by: _____ Date: _____
Company: _____ Time: _____
Courier Name: _____

2) Released by: _____ Date: _____
Company: _____ Time: _____
Courier Name: _____

1) Received by: _____ Date: _____
Company: _____ Time: _____

1) Received by: _____ Date: _____
Company: _____ Time: _____

Shaded area to be completed by Golder Laboratory upon sample receipt.

Golder Project No. 04-1424-076

Golder Work Order No. 06X00234

Condition Upon Receipt _____

Receipt Sample Temp. (°C) _____

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Distribution of copies: White, Yellow — accompany the shipment
Pink — kept by consignor (e.g. shipper)
Yellow — kept by consignee (e.g. receiver)
White — returned to consignor by consignee

Please see instructions for completion on back of form

Revision Date: November 22, 2004

APPENDIX III

Chain-of-Custody Forms

Golder Laboratory Workorder

Golder Workorder Number: 600034 **Date:** 30-Jan-06

Golder Project Number: 04-1424-076 **Project Manager:** ECC

Golder Client Number: 613

Client Name: Seacor Environmental Engineering

Client Address: #6 - 40 Cadillac Avenue
Victoria BC
CANADA V8Z 1T2

Original Contact: Mr. Rob Chaisson **Current Contact:** M. McLeay

Phone Number: (250) 475-9595 **Extension:**

Fax Number: (250) 475-9596

Test Type: 48-h Bivalve Larval Development SPP **Test Code:** 309 **Number of Samples:** 3

Holding Time: 36h **Location:** Store at 4°C **Sample Type:** Marine Receiving water

Sample Name	Sample Number	Sample Date	Sample Time	Volume	Received Temp.	Date Received	Time Received	Received By	Notes
SW 37	20339	26-Jan-06	15:50	1x500mL, 1x1L	6.8 °C	28-Jan-06	10:50	JAP	
SW 9	20341	26-Jan-06	20:25	1x500mL, 1x1L	6.8 °C	28-Jan-06	10:50	JAP	
SW 11	20343	26-Jan-06	23:15	1x500mL, 1x1L	6.8 °C	28-Jan-06	10:50	JAP	

JGL March 13/06

CHAIN-OF-CUSTODY / TEST REQUEST FORM

1590

Client Name _____ Client Contact _____ Ship to _____

Address _____ Phone _____

_____ Fax _____

_____ Sampled by _____ Attn. _____ Shipping Date _____

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested					4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)

PO/Reference No. _____

Project Title _____

Results Needed By _____

Comments/Instructions _____

1) Released by:	Date:	2) Released by:	Date:
Company:	Time:	Company:	Time:
Courier Name:		Courier Name:	
1) Received by:	Date:	1) Received by:	Date:
Company:	Time:	Company:	Time:

Shaded area to be completed by Golder Laboratory upon sample receipt.

Golder Project No. _____

Golder Work Order No. _____

Condition Upon Receipt _____

Receipt Sample Temp. (°C) _____

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Distribution of copies:
White, Yellow – accompany the shipment
Pink – kept by consignor (e.g. shipper)
Yellow – kept by consignee (e.g. receiver)
White – returned to consignor by consignee

Please see instructions for completion on back of form

Revision Date: November 22, 2004

Golder Laboratory Workorder

Golder Workorder Number: 600049
Golder Project Number: 04-1424-076
Golder Client Number: 613

Date: 14-Feb-06
Project Manager: ECC

Client Name: Seacor Environmental Engineering
Client Address: #6 - 40 Cadillac Avenue
Victoria BC
CANADA V8Z 1T2
Original Contact: Mr. Rob Chaisson
Phone Number: (250) 475-9595 **Extension:**
Fax Number: (250) 475-9596

Current Contact: M. McLeay

Test Type: Echinoderm sperm cell fertilization **Test Code:** 320 **Number of Samples:** 6

Holding Time: 3 days **Location:** Store at 4°C **Sample Type:** Other Other

Sample Name	Sample Number	Sample Date	Sample Time	Volume	Received Temp.	Date Received	Time Received	Received By	Notes
SW9	20362	10-Feb-06		2x 1L	5.3 °C	13-Feb-06	12:15	JRS	
SW11	20363	10-Feb-06		2x 1L	5.3 °C	13-Feb-06	12:15	JRS	
SW37	20364	10-Feb-06		2x 1L	5.3 °C	13-Feb-06	12:15	JRS	
SW40	20365	10-Feb-06		2x 1L	5.3 °C	13-Feb-06	12:15	JRS	

JGL March 9/06

Golder Laboratory Workorder

SW38B	20366	10-Feb-06	2x 1L	5.3 °C	13-Feb-06	12:15	JRS
SW33	20367	10-Feb-06	2x 1L	5.3 °C	13-Feb-06	12:15	JRS

SEACOR ENVIRONMENTAL INC.

CHAIN-OF-CUSTODY

Client: SEACOR	SEACOR Project #: 201.01022.01	Turnaround:	☐ 1 week	Page
Site Name: Pole Box	Mail Final Report To:	☐ 24 hours	☑ Regular	1 of 1
Address: #5 -4C Cadillac Ave	Fax Interim Results To:	☐ 3 days	☐ Date: _____	
Sampled By: M. DeLeo	E-mail Interim Results To:			

Laboratory Use: Laboratory Name: Edmond Equilization Test

Line No.	Sample ID	Depth	Date	Matrix	HSVL									COMMENTS
1	SW9		2/13/06				✓							Test needs to
2	SW11		"				✓							Start today
3	SW37		"				✓							
4	SW40		"				✓							
5	SW38B		"				✓							
6	SW33		"				✓							
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

Relinquished by:	Date:	Received by:	Date:	Remarks: 0602049
		JPS	13 Feb 06	
			Time: 12:15	

White: File Copy Pink/Yellow: Laboratory

VIZON SCITEC

MARINE SEDIMENT TOXICITY TESTING OF FOUR SAMPLES SAMPLING PERIOD: APRIL 2004

Prepared for:

Seacor Environmental Inc.
#6 - 40 Cadillac Avenue
Victoria, BC
Canada V8Z 1T2

Prepared by:

Toxicology Group

Project No.: 2-11-0932

June 2004

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2

Tel:
(604) 224-4331

Fax:
(604) 224-0540

Email:
info@vizonscitec.com

Web:
www.vizonscitec.com

SUMMARY OF RESULTS AND WATER QUALITY MEASUREMENTS

Table 1-1: Pore Water Measurements for Seacor Sediment Samples

Sample ID	Salinity (‰)	Temperature (°C)	pH	Total Ammonia (mg N/L)	Un-Ionised Ammonia (mg N/L)
Control-1 & 2	29	14.8	7.9	0.040	0.0007
S-7[a, b]	16	14.8	7.9	-	-
S-10	27	14.6	7.9	3.3	0.0584
S-14[c]	29	-	-	-	-
S-15[d]	14	15.2	6.0	0.532	N/A[e]

[a] Pore water salinity at test initiation was 27‰.

[b] Sample did not have sufficient pore water to measure ammonia.

[c] Sample did not have sufficient pore water to measure temperature, pH and ammonia.

[d] Pore water salinity at test initiation was 25‰.

[e] Unionized ammonia concentration could not be calculated.

Table 1-2: Amphipod Overlying Water Temperature, DO, pH and Salinity Measurements (Range during Test)

Sample ID	Temperature (°C)	DO (mg/L)	pH	Salinity (‰)
Control-1	15.7 – 16.1	7.9 – 9.5	8.1 – 8.1	27 – 28
Control-2	15.7 – 16.1	7.9 – 9.5	8.1 – 8.1	27 – 28
S-7	15.6 – 16.0	7.9 – 8.4	8.1 – 8.1	27 – 28
S-10	15.5 – 16.2	7.8 – 8.4	8.1 – 8.1	28 – 28
S-14	15.5 – 16.1	7.8 – 8.3	8.1 – 8.1	28 – 28
S-15	15.6 – 16.5	7.8 – 8.4	6.2 – 7.3	27 – 27

Table 1-3: Amphipod Overlying Water Ammonia Concentrations

Sample ID	Initial Total NH_3 (mg N/L)	Initial Un-Ionised NH_3 (mg N/L)	Final Total NH_3 (mg N/L)	Final Un-Ionised NH_3 (mg N/L)
Control-1 & 2[a]	<0.01	<0.0003	0.022	0.00066
S-7	0.031	0.0009	0.022	0.00064
S-10	0.328	0.00958	0.023	0.00067
S-14	1.9	0.055	1.2	0.035
S-15	0.077	b	0.343	b

[a] A subsample from each of the controls was combined into one sample and analysed.

[b] Unionized ammonia concentration could not be calculated.

Table 1-4: 10-day Amphipod (*Eohaustorius estuarius*) Sediment Test Survival Results

Sample ID	Mean Survival (%)	SD (%)	Mean Reburial (%)	SD
Control-1	99	2.2	100	0
Control-2	98	4.5	100	0
Pooled Controls	99	3.4	100	0
S-7	93	5.7	99	0.4
S-10	91[a]	6.5	100	0
S-14	92	6.7	100	0
S-15	95	5.0	100	0

[a] Significantly different from the laboratory control.

Table 1-5: *Neanthes* Overlying Water Measurements (Range During Test)

Sample ID	Temperature (°C)	DO (mg/L)	pH	Salinity (‰)
Control-1	19.7 – 21.0	6.1 – 7.7	7.8 – 8.1	27 – 28
Control-2	19.9 – 20.7	6.6 – 7.6	7.7 – 8.1	27 – 28
S-7	19.9 – 20.5	6.9 – 7.7	7.6 – 8.1	27 – 28
S-10	19.7 – 20.7	6.5 – 7.8	7.0 – 8.0	27 – 28
S-14	19.7 – 20.7	6.1 – 7.6	7.8 – 8.1	27 – 28
S-15	19.9 – 20.6	6.1 – 7.7	5.9 – 7.6	26 – 28

Table 1-6: 20-day Polychaete (*Neanthes arenaceodentata*) Sediment Test Survival Results

Sample ID	Mean Survival (%)	SD (%)	Growth Rate (mg/individual/day)	SD
Control-1	88	27	0.38	0.14
Control-2	100	0	0.48	0.08
Pooled Controls	94	19	0.43	0.12
S-7	96	9	0.44	0.10
S-10	96	9	0.42	0.10
S-14	84	26	0.53	0.27
S-15	36[a]	22	0.13[b]	0.07

[a] Significantly different from the laboratory control.

[b] Significantly different from the laboratory control and the reference sediment (S-14).

Vizon SciTec Inc.
Vancouver BC

Marine Amphipod *(Eohaustorius estuarius)* Test Data Summary (2-11-0932A)

Client Name/Location	Seacor Environmental Inc. / Victoria, BC
Testing Lab/Location	Vizon SciTec Inc. / Vancouver, BC
Sample Information	
Sample Names	S-7, S-10, S-14, S-15
Type of Sample	Field collected sediments
Method of Collection	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Collector	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Volume	6 L
Sample Containers	6-L white food grade plastic buckets
Information on Labelling/Coding	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Collection Date (y/m/d)	04/04/08
Sample Temperature upon Arrival	3.8 – 4.4°C
Date (y/m/d) & Time of Sample Receipt at Lab	04/04/13 @ 12:21 PM
Date Test Started and Ended (y/m/d)	04/04/23 / 04/05/03
Storage Conditions	From receipt to test initiation, the samples were stored in a cold room that was at 4 ± 2°C
Sediment and Pore Water Characterisation	See "Sediment Sample Descriptions" and "Pore Water Measurements" sheets
Sample Preparation	
Homogenisation	Samples (including the separated liquid) were individually mixed until homogenised at ambient laboratory temperature; if necessary, debris and indigenous macro-organisms were removed during homogenisation (see "Sediment Sample Descriptions" sheet)
Date of Homogenisation	04/04/22
Characterisation	The following parameters were analysed on each sample: particle size distribution, moisture content; for pore water, pH, ammonia concentrations. Only salinity was obtained for S-14, due to lack of pore water. No pore water ammonia analysis for S-7, due to lack of pore water.
Test Organisms	
Species	*Eohaustorius estuarius*
Source	Mackenzie Beach, Tofino, BC from same population; as collected by Doug Swanston, Seacology, North Vancouver, BC.
Date of Collection (y/m/d)	04/04/21
Method of Organism Collection	All containers, sieves, pipettes and items that contacted the amphipods were cleaned by scrubbing with sand and rinsing with seawater prior to use. Seawater used in the sieving and storage of amphipods was collected adjacent to the amphipod collection site. The seawater was sieved to removed debris and unwanted organisms. A refractometer was used to determine the salinity of the seawater (28‰). Large debris and undesired amphipod species and other visible organisms were removed as observed during sieving. Approximately 100 mL of sieved seawater (28‰) was added to each container. Amphipods were drawn into a pipette and counted into clean containers (110/container) from the sieve. Each container was inspected for debris and unwanted organisms. Approximately 200 mL of clean sieved sand was then added to each container. A clean lid was loosely fitted and the container was placed in a cooler. Amphipods were stored in a locked vehicle or in the possession of a Seacology employee at

	all times prior to delivery at Vizon SciTec on April 21, 2004.
Age at Start of Test	3 to 5 mm juveniles
Date of Organism Arrival	April 21, 2004
Holding and Acclimation Conditions	See "Acclimation and Holding Conditions" sheets.
% Emerged during Holding Period	See "Acclimation and Holding Conditions" sheets.
Average Total Body Length (mean ± SD, sample size)	3.6 ± 0.6; 20 amphipods were measured. See "Length Measurements" sheet.
Test Conditions & Apparatus	
Personnel	Karen Kinnee, Juniper Ross, Robyn Wood
Description of Lighting and Temperature Regulation Systems	24 hour light with incandescent lighting; heating / air-conditioning units operating to provide appropriate temperature.
Test Vessels and Lids	1000 mL glass jars with ~ 8 cm inner diameter; covered.
Cleaning and Rinsing Procedures	All glassware was washed with detergent, rinsed with deionised water, soaked in an acid bath for a minimum of three hours and rinsed with deionised water prior to use.
Aeration System	Filtered air through 0.5 mm (ID) / 1.5 mm (OD) Tygon flexible microbore airline tubing
Control Sediment and Test Water	
Control Sediment Source	Mackenzie Beach, Tofino, BC; as collected by Doug Swanston, Seacology, North Vancouver, BC.
Control Sediment Collection Procedure	Sediment was sieved (1 mm) at collection site using site seawater.
Control Sediment Storage	From receipt to test initiation, the samples were stored in a cold room that was at 4 ± 2°C
Pre-treatment of Control Sediment	Overlying water was poured off prior to homogenisation.
Measured Quality of Control Sediment	See attached Tables and Appendix B
Overlying Water	Uncontaminated sand-filtered seawater obtained from the Vancouver Aquarium, Vancouver, BC. The seawater was pumped from Burrard Inlet from a depth of 40-45 feet and filtered through a gravity sand filter, with sand mesh size 22. After filtration, the seawater was held in a concrete reservoir (retention time approximately 4 h) before passing through a UV steriliser. The seawater was stored at 15°C prior to use in the tests.
Type and Quantity of Chemicals Added to Water	No chemicals were added to the water.
Pre-treatment of Overlying Water	The seawater was continuously aerated prior to use.
Measured Quality of Overlying Water	See attached tables and Appendix B and C, "Test Conditions and Survival Data" sheets.
Test Methods	
Test Method	Followed the EC Method for Marine Amphipods: Environment Canada (1992 and 1998 amendments) Biological Test Method: Acute Test for Sediment Toxicity Using Marine or Estuarine Amphipods, EPS 1/RM/26.
Test Type / Duration	10-d whole sediment toxicity test with no water renewal
Test Temperature	Water temperature ranged from 15.5°C to 16.5°C over the exposure period. See "Test Conditions and Survival Data" sheet.
Lighting	Overhead full spectrum (fluorescent or equivalent); 500 – 1000 lux, 24 h light
Aeration	Continuous and minimal in each test vessel; checked 2-3 times daily
Date/Time for Test Start	2004/04/23 @ 13:00
Date for Test Completion	2004/05/03

Volume / Depth of Wet Sediment	175 mL; 4 cm
Volume / Depth Test Water	775 mL; 9 cm
Water Renewal	None; there was no need to replace water due losses from evaporation.
Control/Dilution Water	Uncontaminated sand-filtered seawater obtained from the Vancouver Aquarium, Vancouver, BC. The seawater was pumped from Burrard Inlet from a depth of 40-45 feet and filtered through a gravity sand filter, with sand mesh size 22. After filtration, the seawater was held in a concrete reservoir (retention time approximately 4 h) before passing through an UV steriliser. The seawater was stored at 15°C prior to use in the tests.
Control Sediment	0.5 or 1 mm sieved sediment collected on April 21, 2004 from Mackenzie Beach, Tofino, BC.
# Organisms / Vessel	Twenty (20) amphipods were randomly assigned to each test chamber
Lab Replicates	There were five (5) laboratory replicates for each field replicate. There was also one (1) measurement beaker for each sediment sample.
Feeding Regime	None
Observations & Measurements	
Dissolved Oxygen Concentrations (DO) and Temperature	In overlying water, at the start of the test and 3 times/week (MWF) in the measurement beakers. See "Test Conditions and Survival Data" sheets.
pH, Conductivity, and Ammonia Concentrations	pH, conductivity, and ammonia concentrations were measured in sub-samples taken from all replicates at the start and end of the test. Probes were rinsed with clean water between sample measurements. See "Test Conditions and Survival Data" sheets.
Sediment Appearance and Observations During Test	See "Record of Aeration and Test Observations" and "Sediment Sample Descriptions" sheets.
Survival	All live amphipods recovered from the overlying water or sediment in a single test chamber were counted, and placed into 30 mL medicine cups prior to initiating the reburial endpoint.
Analytical Methods	**Ammonia:** American Public Health Association. 1998a. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Method 4500 – NH_3 Nitrogen (Ammonia) F Ammonia Selective Electrode Method. APHA, AWWA, WEF, Washington, DC. **Particle Size:** American Society for Testing and Materials. 1984. Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates American Society for Testing Materials. C136-01. American Society for Testing and Materials. Philadelphia, PA. **Total Organic Carbon (conducted at Cantest Ltd., Burnaby, BC):** The TOC samples were acid digested followed by Leco Induction Furnace combustion/volumetric analysis technique.
Sampling, Sample Preparation and Storage prior to Analysis	Ammonia samples were collected by removing 10 mL from each replicate and placing in a 125-mL plastic bottle; samples were stored at 4 ± 2°C prior to analysis. Particle size samples were placed into tared glass jars and stored at room temperature prior to analysis.
Frequency and Type of Observations Made During Test	DO and temperature measurements were taken on Monday, Wednesday and Fridays during the test; and number of emerged amphipods were observed on the same days.

Reburial Method	The live amphipods were placed into 1-L jars, each containing 175 mL negative control sediment and 200 mL overlying seawater. After 1 hour, the number of emerged amphipods was recorded.
Anything Unusual about the Test, Deviation from Test Method, Problems	There was nothing unusual about the test, no deviations from test method, and no problems with this test.
Results	
Endpoints	Mean (± SD) % of amphipods that survived the 10-day exposure. Mean (± SD) % amphipods that reburied after a 1-hour exposure to control sediment. See "Summary of Survival Results for *E. estuarius* Tests" sheet.
Endpoint Results	**Comparison with Laboratory Control** There was a difference in survival between the S-10 and the laboratory control ($p > 0.05$). **Comparison with Reference Sediment (S-14)** There were no significant differences in survival between the S-14 and the three other samples ($p > 0.05$). Statistical analyses were conducted using ToxCalc Version 5.0.
Sediment Total Organic Carbon	<0.5% dry weight
QA/QC	
Test Validity Criteria	Control survival was >90% (mean pooled control survival was 99%).
Ref Tox Test LC50 (95% CL) (mg Cd^{2+}/L) and Duration of Test	10.7 (9.3 – 12.3) Test duration was 96 hours.
Invalid Ref Tox Test? If YES state initiation and/or findings of a test system review	No; the control survival was 100%. For the test to be valid the control survival should be ≥90%. See "Control Chart" sheet.
Ref Tox Test Historic Geometric Mean (±SD) and 2SD Range (mg Cd^{2+}/L)	9.7 ± 2.6; 2SD range: (4.6 – 14.9)
Date of Ref Tox Test (y/m/d)	04/04/23
Organisms Batch and Condition of Ref Tox Test	Same batch of organisms used in the tests as for the reference toxicant; static, 96-h water-only test

Vizon SciTec Inc.
Vancouver, BC

Juvenile Polychaete (*Neanthes arenaceodentata*) Sediment Bioassay
Test Data Summary (2-11-0932B)

Client Name/Location	Seacor Environmental Inc. / Victoria, BC
Testing Lab/Location	Vizon SciTec Inc. / Vancouver, BC
Sediment Sample	
Sample collection date (y/m/d)	04/04/08
Sample Temperature upon Arrival	3.8 – 4.4°C
Storage Conditions	From receipt to test initiation, the samples were stored in a cold room that was at 4 ± 2°C
Sediment and Pore Water Characterisation	See "Sediment Sample Descriptions" and "Pore Water Measurements" sheets
Date (y/m/d)/time of sample receipt at lab	04/04/13 @ 12:21 PM
Sample Information	
Sample Names	S-7, S-10, S-14, S-15
Type of Sample	Field collected sediments
Method of Collection	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Collector	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Volume	6 L
Sample Containers	6-L white food grade plastic buckets
Information on Labelling/Coding	See "Toxicity Test Request" sheet or "Chain of Custody" form
Date Test Started and Ended (y/m/d)	04/04/23 / 04/05/13
Storage Conditions	From receipt to test initiation, the samples were stored in a cold room that was at 4 ± 2°C
Sediment Characterisation	See "Sediment Sample Descriptions" sheets
Test Organisms Imported from External Supplier	The EC document on the importation of test organisms was been followed (September 1999)
Species & Source	*Neanthes arenaceodentata* supplied by D. Reish, California State University, Long Beach, CA
Age at start of test	Emergent juveniles (2-3 weeks post-emergence)
Unusual appearance, behaviour, or treatment of organisms by supplier before shipping or by lab immediately preceding the test	See "Acclimation and Holding Conditions" sheets
Temp. & DO of shipping water immediately upon arrival	See "Acclimation and Holding Conditions" sheets
Acclimation rate & procedure	Fresh seawater was gradually added over the three day holding period. See "Acclimation and Holding Conditions" sheets for details.
Mortality upon arrival and 24 h preceding test	See "Acclimation and Holding Conditions" sheets
Test Conditions & Facilities	
Test method	Puget Sound Estuary Program. 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments. Juvenile Polychaete Sediment Bioassay.
Test type	Static-renewal, 3x weekly renewal, 20-day test
Test temperature	20 – 21 °C
Photo-period	24 hours light
Test vessels	1-L glass jars
Persons performing test	Karen Kinnee, Meg Lauder, Robyn Wood, Juniper Ross, Ann Lee, Rimo Yoo, Kerrie Serben, Pam Sinclair

Control/dilution water	Vancouver aquarium, from Burrard Inlet, 40-45' deep inlet, gravity sand filter w/sand mesh size 22, passed through UV steriliser
Type & quantity of chemicals added to control/dilution water	No chemicals were added
Control sediment	Mackenzie Beach, Tofino, BC sand, as collected by Doug Swanston, Seacology, North Vancouver, BC on April 21, 2004
Sediment volume and depth	175 mL & 4 cm
Overlying water volume and depth	775 mL & 9 cm depth
# of replicates per sample	5
# of organisms per test vessel	5
Manner & rate of renewal of overlying water	Three times weekly; ~30% (250 mL) of solution was removed with by pouring off water. The water was replaced with new seawater.
Water quality measurements	See "Test Conditions and Survival Data" sheets
Deviation from test method	There was nothing unusual about the test, no deviations from test method, and no problems with this test.
Results	
# & % mortality and SD in each sample	See "Test Conditions and Survival Data" and "Summary of Survival Results" sheets.
Initial total biomass based on dry weight (mean ± SD)	0.89 ± 0.69 mg / worm
Initial pore water salinity	See "Pore Water Measurements" sheet.
Endpoints	20-d survival (%) for each replicate and mean (± SD) for each treatment. 20-d total and individual biomass for each replicate and mean (± SD) for each treatment. 20-d individual growth rate for each replicate and mean (± SD) for each treatment. See "Summary of Survival Results for *N. arenaceodentata* Tests" and Dry Weights of Polychaete Worms" sheet.
Endpoint results	**Comparison with Laboratory Control** There was a significant difference in survival between S-15 and the control ($p < 0.05$). There was a significant difference in individual growth rate between S-15 and the control ($p < 0.05$). **Comparison with Reference Sediment (S-14)** No significant differences in survival between S-14 and the three other samples ($p > 0.05$). There was a significant difference in individual growth rate between S-14 and S-15 ($p < 0.05$). Statistical analyses were conducted using ToxCalc Version 5.0.
QA/QC	
Test Validity Criteria	Control survival was >90% (mean pooled control survival was 94%). Control growth rate was > 0.38 mg/individual/day (mean pooled control growth rate was 0.43 mg/individual/day).
Ref tox test LC50 (95% CL) (mg Cd^{2+}/L) and duration of test	8.7 (5.4, 12.7) Test duration was 96 hours.
Invalid Ref tox test?	No; the control survival was 100%. For the test to be valid the control survival should be ≥90%. See "Control Chart" sheet.
Ref tox test historic mean (± SD) & 2SD range (mgCd^{2+}/L)	9.1 ± 1.6; 2SD range: (5.9 – 12.4)
Date of ref tox test (y/m/d)	04/04/23
Organisms batch and conditions of ref tox test	Same batch of organisms used in the tests as for the reference toxicant; static, 96-h water-only test

APPENDIX A

SAMPLE INFORMATION

	Parameter	Description	Details	Activity Log
Seacor Environmental Inc. : Victoria				
Batch 040413C				
040413C-01				
Pending	**Marine amphipod**	SEDIMENT : S7 (0-15) Sample Date: Apr 08, 2004	ANALYST: JANET PICKARD Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
Pending	**Special Request 1: Neanthes**	SEDIMENT : S7 (0-15) Sample Date: Apr 08, 2004	ANALYST: KAREN KINNEE Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
040413C-02				
Pending	**Marine amphipod**	SEDIMENT : S10 (0-15) Sample Date: Apr 08, 2004	ANALYST: JANET PICKARD Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
Pending	**Special Request 1: Neanthes**	SEDIMENT : S10 (0-15) Sample Date: Apr 08, 2004	ANALYST: KAREN KINNEE Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
040413C-03				
Pending	**Marine amphipod**	SEDIMENT : S14 (0-15) Sample Date: Apr 08, 2004	ANALYST: JANET PICKARD Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
Pending	**Special Request 1: Neanthes**	SEDIMENT : S14 (0-15) Sample Date: Apr 08, 2004	ANALYST: KAREN KINNEE Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
040413C-04				
Pending	**Marine amphipod**	SEDIMENT : S15 (01-15) Sample Date: Apr 08, 2004	ANALYST: JANET PICKARD Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004
Pending	**Special Request 1: Neanthes**	SEDIMENT : S15 (01-15) Sample Date: Apr 08, 2004	ANALYST: KAREN KINNEE Project Manager: Karen Kinnee Project Number(s): 2-11-932	Received: Apr 13, 2004

SEACOR ENVIRONMENTAL INC.

6-40 Cadillac Avenue
Victoria, BC V8Z 3P6
Phone: (250) 475-9595
Fax: (250) 475-9596
www.seacorcanada.com

FAX

Date:	April 13, 2004	**Proj. No.:**	201.01022.01.0003
To:	Karen Kinnee	**From:**	Michael McLeay
Company:	Vizon Scitech (the artist formerly known as BC Research)	**Pages:**	5
Fax:	(604) 224 - 0540	**Phone No.:**	(604) 224 - 4331
Re:	**Toxicity Test Request Sheets**		

Hi Karen:

Attached are the toxicity test request sheets for the four pails of sediment which you likely received this morning.

You can skip the whole sediment TOC analysis as our chem. lab is doing this. Please do grain size, as well as any of the required porewater analyses or overlying water analyses.

None of the samples are that hazardous from a human health perspective. Contaminants are PAHs and metals.

Can't wait to see the results. I'll let you know which sediment is the reference sediment at test end.

Michael.

This message is intended only for the use of the individual or entity to which it is addressed and may contain confidential information. If you have received this information in error, please destroy it and notify us immediately at (250) 475-9595.

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER 040413(01)

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME: Michael Mc Leay		NAME: Tara Siemens	
COMPANY: Seacor Environmental Inc.		COMPANY: Seacor Environmental Inc.	
ADDRESS: #6 – 40 Cadillac Ave.		ADDRESS: Suite 200 – 1620 West 8th Ave.	
CITY: Victoria	PROVINCE: B.C.	CITY: Vancouver	PROVINCE: BC
COUNTRY: Canada	POSTAL CODE: V8Z 1T2	COUNTRY: Canada	POSTAL CODE: V6J 1V4
TELEPHONE: 250-475-9595	FAX: 250-475-9596	TELEPHONE: 604-738-2500	FAX: 604-738-2508

SAMPLE INFORMATION

SAMPLE NAME: S7 (0-15)

SAMPLING METHOD: grab

SPECIAL INSTRUCTIONS:

SAMPLED BY: M. McLeay

DATE: April 8, 04 TIME: 11:40

CONTAINER TYPE AND NUMBER: 6L pail

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	E. estuarius 10-d survival & reburial	✓	✓	Skip TOC, chem Lab is doing
	N. arenaceodentata 20-d survival & growth			Do grain size & PW chem (NH3, Sol.,

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
M. McLeay	April 12, 04	16:20	P. Sinclair	04/04/13	12:21

I:\QAU\Forms\Requisition- Chain of Custody Forms\Current\Templates\Toxicity Times Request Form v1.dot

VIZON SCITEC
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

VIZON SCITEC

TOXICITY TEST REQUEST SHEET

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER 040413[-02

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME: Michael Mc Leay		NAME: Tara Siemens	
COMPANY: Seacor Environmental Inc.		COMPANY: Seacor Environmental Inc.	
ADDRESS: #6 – 40 Cadillac Ave.		ADDRESS: Suite 200 - 1620 West 8th Ave.	
CITY: Victoria	PROVINCE: B.C.	CITY: Vancouver	PROVINCE: BC
COUNTRY: Canada	POSTAL CODE: V8Z 1T2	COUNTRY: Canada	POSTAL CODE: V6J 1V4
TELEPHONE: 250-475-9595	FAX: 250-475-9596	TELEPHONE: 604-738-2500	FAX: 604-738-2508

SAMPLE INFORMATION

SAMPLE NAME: S10 (0-15)

SAMPLING METHOD: grab

SPECIAL INSTRUCTIONS:

SAMPLED BY: M. McLeay

DATE: April 8, 04 TIME: 13:40

CONTAINER TYPE AND NUMBER: 6L pail

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	E. estuarius 10-d survival & reburial	✓	✓	Skip TOC, chem Lab is doing
	N. arenaceodentata 20-d survival & growth			Do grain size, & PW chem (NH_3, Sol.,

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
M. McLeay	April 12, 04	16:20	P. Sinclair	04/04/13	13:21

VIZON SCITEC
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER 040413C-04 03

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME: Michael Mc Leay		NAME: Tara Siemens	
COMPANY: Seacor Environmental Inc.		COMPANY: Seacor Environmental Inc.	
ADDRESS: #6 – 40 Cadillac Ave.		ADDRESS: Suite 200 - 1620 West 8th Ave.	
CITY: Victoria	PROVINCE: B.C.	CITY: Vancouver	PROVINCE: BC
COUNTRY: Canada	POSTAL CODE: V8Z 1T2	COUNTRY: Canada	POSTAL CODE: V6J 1V4
TELEPHONE: 250-475-9595	FAX: 250-475-9596	TELEPHONE: 604-738-2500	FAX: 604-738-2508

SAMPLE INFORMATION

SAMPLE NAME: S14(0-15)

SAMPLING METHOD: grab

SAMPLED BY: M. McLeay

DATE: April 8, 04 TIME: 16:00

CONTAINER TYPE AND NUMBER: 6L pail

SPECIAL INSTRUCTIONS:

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	E. estuarius 10-d survival & reburial	✓	✓	Skip TOC, chem lab is doing
	N. arenaceodentata 20-d survival & growth			Do grain size, & PW chem (NH3, Sal.,

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
M. McLeay	April 12, 04	16:20			
			P. Sinclair	04/04/13	12:21

I:\QAU\Forms\Requisition- Chain of Custody Forms\Current\Templates\Toxicity Test Request Form v4.dot

VIZON SCITEC
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER 040413[-03 04 ee

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME: Michael Mc Leay		NAME: Tara Siemens	
COMPANY: Seacor Environmental Inc.		COMPANY: Seacor Environmental Inc.	
ADDRESS: #6 – 40 Cadillac Ave.		ADDRESS: Suite 200 - 1620 West 8th Ave.	
CITY: Victoria	PROVINCE: B.C.	CITY: Vancouver	PROVINCE: BC
COUNTRY: Canada	POSTAL CODE: V8Z 1T2	COUNTRY: Canada	POSTAL CODE: V6J 1V4
TELEPHONE: 250-475-9595	FAX: 250-475-9596	TELEPHONE: 604-738-2500	FAX: 604-738-2508

SAMPLE INFORMATION

SAMPLE NAME: S15 (0-15)

SAMPLING METHOD: grab	SPECIAL INSTRUCTIONS
SAMPLED BY: M. McLeay	
DATE: April 8, 04 TIME: 16:30	
CONTAINER TYPE AND NUMBER: 6L pail	

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	E. estuarius 10-d survival & reburial N. arenaceodentata 20-d survival & growth	✓	✓	Skip TOC, chem Lab is doing Do grain size & PW chem (NH3, Sol., F

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
M. McLeay	April 12, 04	16:20	P. Sinclair	04/04/13	12:21

L:\QA\U\Forms\Requisition- Chain of Custody Forms\Current\Templates\Toxicity Tests Request Form v4.dot

VIZON SCITEC
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Sediment Sample Descriptions

Project # 2-11-0932

Sample Name	Vizon Sample # / Name	Date Homogenised / Subsampled	Grain Size	Type of Debris Removed	Endemic Animals Removed	Odor	N Applied & Stored in Cold Rm	Analyst
Control	KKEE 04/06/22 (60) ____	04/04/22	Sand	Poured off overlying H_2O	None	None	✓	KK
S7	040413C-01	04/04/22	Large/Coarse Black/Brown Small Pebbles/Some Gravel-Like	Rocks > 2.5 cm KK 04/04/22 EE	None	None	✓	KK
S10	040413C-02	04/04/22	Fine; dirt-like Black/Brown Some larger bits	Rocks > 2.5 cm	Barnacles	None	✓	KK
S14	040413C-03	04/04/22	Sand + pebbles, dark brown/ black	Rocks	None	Seaweed	✓	RW
S15	040413C-04	04/04/22	looks like S7 but with iron-rust colour	Large rocks, glass, pieces of drainage tile	None	Iodine-like	✓	KK

APPENDIX B

SEDIMENT CHARACTERISATION

Particle Size Analysis of Seacor Samples
(Received Apr. 21, 2004)

S 7 **BC Research Sample ID:040422D - 02**

Screen (mm)	Mass (g)	% Retained		% Passing
		Interval	Cumulative	
63	0	0.00	0.00	100.00
13.33	2.3	1.98	1.98	98.02
2	38.8	33.39	35.37	64.63
1	24.1	20.74	56.11	43.89
0.5	23.0	19.79	75.90	24.10
0.25	11.0	9.47	85.37	14.63
0.125	7.7	6.63	92.00	8.00
0.063	6.2	5.34	97.33	2.67
< 0.063	3.1	2.67	100.00	0.00
Total	116.2	100.00		

S 10 **BC Research Sample ID:040422D - 03**

Screen (mm)	Mass (g)	% Retained		% Passing
		Interval	Cumulative	
63	0	0.00	0.00	100.00
13.33	0	0.00	0.00	100.00
2	32.0	28.47	28.47	71.53
1	13.0	11.57	40.04	59.96
0.5	15.5	13.79	53.83	46.17
0.25	15.7	13.97	67.79	32.21
0.125	15.9	14.15	81.94	18.06
0.063	11.4	10.14	92.08	7.92
< 0.063	8.9	7.92	100.00	0.00
Total	112.4	100.00		

S 14 **BC Research Sample ID:040422D - 04**

Screen (mm)	Mass (g)	% Retained		% Passing
		Interval	Cumulative	
63	0	0.00	0.00	100.00
13.33	0	0.00	0.00	100.00
2	72.0	54.75	54.75	45.25
1	14.2	10.80	65.55	34.45
0.5	12.9	9.81	75.36	24.64
0.25	19.0	14.45	89.81	10.19
0.125	12.0	9.13	98.94	1.06
0.063	0.8	0.61	99.54	0.46
< 0.063	0.6	0.46	100.00	0.00
Total	131.5	100.00		

S 15 **BC Research Sample ID:040422D - 05**

Screen (mm)	Mass (g)	% Retained		% Passing
		Interval	Cumulative	
63	0	0.00	0.00	100.00
13.33	23.4	17.58	17.58	82.42
2	45.7	34.34	51.92	48.08
1	18.2	13.67	65.59	34.41
0.5	14.6	10.97	76.56	23.44
0.25	14.3	10.74	87.30	12.70
0.125	12.7	9.54	96.84	3.16
0.063	2.1	1.58	98.42	1.58
< 0.063	2.1	1.58	100.00	0.00
Total	133.1	100.00		

Contol **BC Research Sample ID:040422D - 01**

Screen (mm)	Mass (g)	% Retained		% Passing
		Interval	Cumulative	
63	0	0.00	0.00	100.00
13.33	0	0.00	0.00	100.00
2	0	0.00	0.00	100.00
1	0.6	0.48	0.48	99.52
0.5	1.1	0.88	1.37	98.63
0.25	3.6	2.89	4.26	95.74
0.125	107.9	86.67	90.92	9.08
0.063	10.9	8.76	99.68	0.32
< 0.063	0.4	0.32	100.00	0.00
Total	124.5	100.00		

Marina Radojevic
May 31, 04

Moisture Analysis of Seacor Samples
(Received Apr. 21, 2004)

Sample	tare (g)	Wet Sample & jar (g)	Wet Sample (g)	Dry Sample & jar (g)	Moisture %
Control	226	381.2	155.2	350.90	**19.5%**
S7	225	378.4	153.4	341	**24.4%**
S10	224	376.1	152.1	336.8	**25.8%**
S14	225	376.7	151.7	357.7	**12.5%**
S15	225	384.4	159.4	358.4	**16.3%**

Maurice Podoyak
May 31, 04

APPENDIX C

10-DAY MARINE AMPHIPOD SURVIVAL AND REBURIAL TEST DATA

Marine Amphipods-10 Day Survival

Start Date:	4/23/2004	Test ID:	MA076-0104	Sample ID:	076-Seacor
End Date:	5/3/2004	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	076-Sediments
Sample Date:	4/8/2004	Protocol:	EPS1/RM/26-Amphipods	Test Species:	EE-Eohaustorius estuarius

Comments:

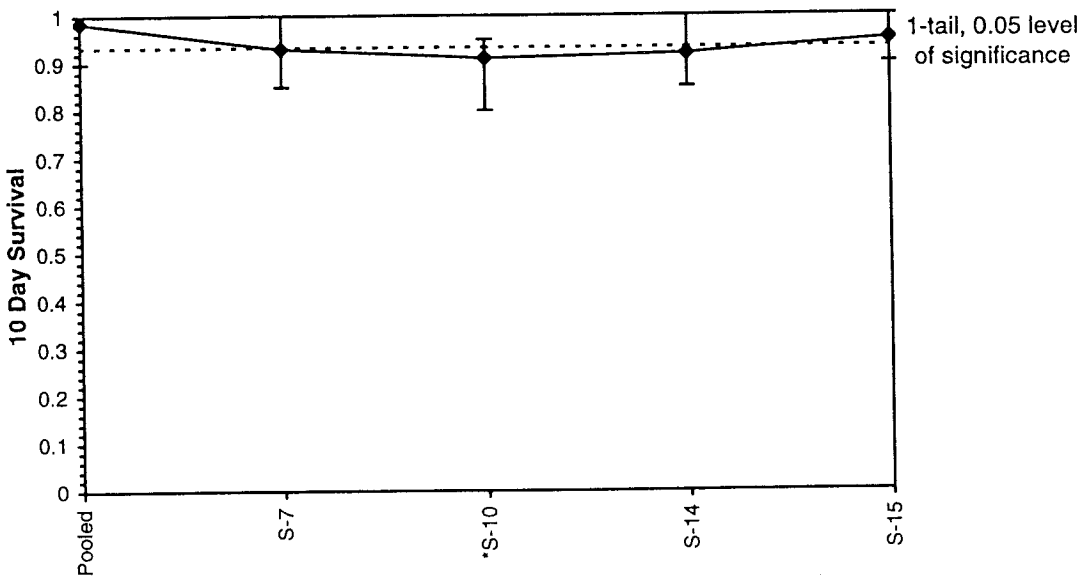
Conc-%	1	2	3	4	5
Control-1	1.0000	1.0000	0.9500	1.0000	1.0000
Control-2	1.0000	1.0000	1.0000	1.0000	0.9000
S-7	0.9500	0.9000	0.9500	0.8500	1.0000
S-10	0.9500	0.9000	0.9500	0.9500	0.8000
S-14	0.8500	0.8500	0.9500	0.9500	1.0000
S-15	0.9500	0.9000	1.0000	0.9000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Pooled	0.9850	1.0000	1.4264	1.2490	1.4588	5.034	10			
S-7	0.9300	0.9442	1.3143	1.1731	1.4588	8.246	5	2.079	2.385	0.1287
*S-10	0.9100	0.9239	1.2784	1.1071	1.3453	8.167	5	2.744	2.385	0.1287
S-14	0.9200	0.9340	1.2991	1.1731	1.4588	9.546	5	2.360	2.385	0.1287
S-15	0.9500	0.9645	1.3522	1.2490	1.4588	7.760	5	1.376	2.385	0.1287

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91455	0.9	-0.46	-0.6306
Bartlett's Test indicates equal variances (p = 0.75)	1.93629	13.2767		
The control means are not significantly different (p = 0.70)	0.4036	2.30601		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test indicates significant differences	0.05201	0.0531	0.02585	0.0097	0.05595	4, 25

Dose-Response Plot



Reviewed by: KSarkar
04/05/05

Marine Amphipods-10 Day Survival

Start Date:	4/23/2004	Test ID:	MA076-0204	Sample ID:	076-Seacor
End Date:	5/3/2004	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	076-Sediments
Sample Date:	4/8/2004	Protocol:	EPS1/RM/26-Amphipods	Test Species:	EE-Eohaustorius estuarius

Comments:

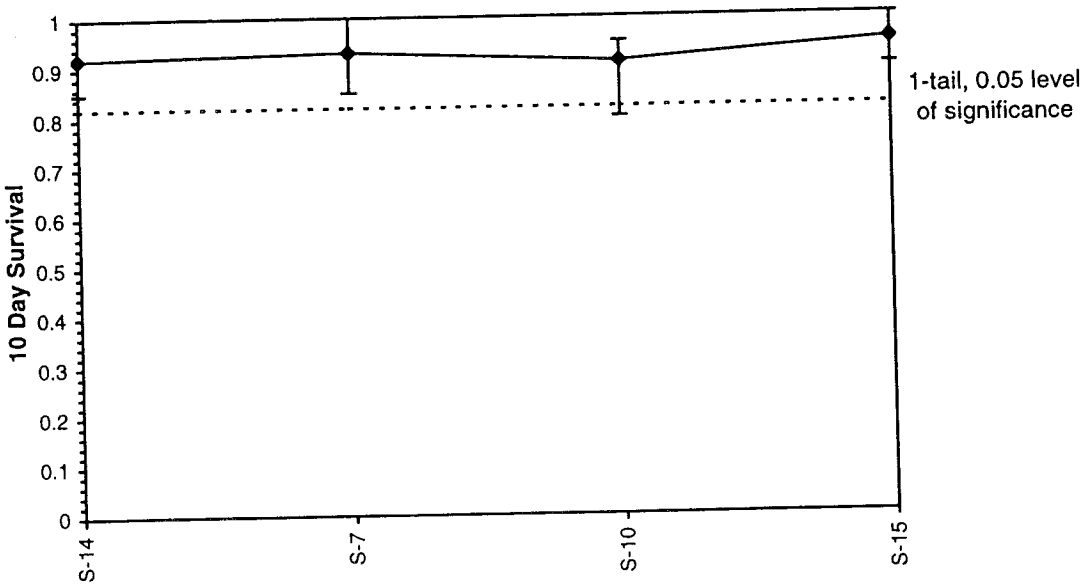
Conc-%	1	2	3	4	5
S-14	0.8500	0.8500	0.9500	0.9500	1.0000
S-7	0.9500	0.9000	0.9500	0.8500	1.0000
S-10	0.9500	0.9000	0.9500	0.9500	0.8000
S-15	0.9500	0.9000	1.0000	0.9000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
S-14	0.9200	1.0000	1.2991	1.1731	1.4588	9.546	5			
S-7	0.9300	1.0109	1.3143	1.1731	1.4588	8.246	5	-0.217	2.230	0.1562
S-10	0.9100	0.9891	1.2784	1.1071	1.3453	8.167	5	0.296	2.230	0.1562
S-15	0.9500	1.0326	1.3522	1.2490	1.4588	7.760	5	-0.758	2.230	0.1562

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93774	0.868	-0.205	-1.22
Bartlett's Test indicates equal variances (p = 0.99)	0.14792	11.3449		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test indicates no significant differences	0.10014	0.10791	0.00485	0.01226	0.75788	3, 16

Dose-Response Plot



ToxCalc v5.0

Reviewed by: KSather 04105/30

Summary of Survival Results for *E.estuarius* Tests on Seacor Sediments (2-11-0932)

Sample ID	# Alive	Sample Survival (%)	Mean Survival (%)	SD	Mean Pooled Control Survival
Control-1 A	20	100	99	2.2	99
Control-1 B	20	100			SD
Control-1 C	19	95			3.4
Control-1 D	20	100			
Control-1 E	20	100			
Control-2 A	20	100	98	4.5	
Control-2 B	20	100			
Control-2 C	20	100			
Control-2 D	20	100			
Control-2 E	18	90			
S-7 A	19	95	93	5.7	
S-7 B	18	90			
S-7 C	19	95			
S-7 D	17	85			
S-7 E	20	100			
S-10 A	19	95	91	6.5	
S-10 B	18	90			
S-10 C	19	95			
S-10 D	19	95			
S-10 E	16	80			
S-14 A	17	85	92	6.7	
S-14 B	17	85			
S-14 C	19	95			
S-14 D	19	95			
S-14 E	20	100			
S-15 A	19	95	95	5.0	
S-15 B	18	90			
S-15 C	20	100			
S-15 D	18	90			
S-15 E	20	100			

K Seiben
04/05/30

Vizon SciTec **Marine Amphipod 10 Day Acute Survival Sediment Test**
Test Conditions and Survival Data

Client # & Name: #76-Seacor Start Date & Time: 04/04/13 @13:00

Sample Date: 04/04/08 End Date: 04/05/03

Sample Received: 04/04/13 Species: E. estuarius

Vizon Project #: 2-11-0932A Organism Lot #: SE040421

Analyst(s): K. Kinnee, Robyn Wood, J. Ross TOXCALC: MA076-0104 MA076-0204

Sample ID: Control-1 Vizon #: N/A

	Day 1 *	3	5	7	10
Day	Friday	Monday	Wednesday	Friday	Monday
Date	04/04/23	04/04/26	04/04/28	04/04/30	04/05/03
Temperature(°C)	16.0	16.1	15.7	15.7	15.7
D.O. (mg/L)	7.9	8.3	8.2	8.4	9.5
pH	8.1				8.1
Salinity (‰)	28				27
Analyst	RW	KK	RW	RW	JR

	# Alive				
Replicate	A	B	C	D	E
	20	20	19	20	20
Analyst	RW	RW	RW	RW	RW

Ammonia Sample Taken

Initial	Final
RW	JR

Sample ID: Control-2 Vizon #: N/A

	Day 1 *	3	5	7	10
Day	Friday	Monday	Wednesday	Friday	Monday
Date	04/04/23	04/04/26	04/04/28	04/04/30	04/05/03
Temperature(°C)	16.0	16.1	15.8	15.8	15.7
D.O. (mg/L)	7.9	8.3	8.2	8.4	9.5
pH	8.1				8.1
Salinity (‰)	28				27
Analyst	RW	KK	RW	RW	JR

	# Alive				
Replicate	A	B	C	D	E
	20	20	20	20	~~19~~ 18*
Analyst	RW	RW	RW	RW	RW

Ammonia Sample Taken

Initial	Final
RW	JR

* 1 was a different species of amphiped.

* Day 1 measurements and ammonia subsample was done on a sample pooled from all CTRL replicates RW

Vizon SciTec

Marine Amphipod 10 Day Acute Survival Sediment Test
Test Conditions and Survival Data

PCEC 04/05/31

Client # & Name: Seacor

Start Date & Time: 04/04/23 @ 13:00

Sample Date: 04/04/08

End Date: 04/05/03

Sample Received: 04/04/13

Species: E. estuarius

Vizon Project #: 2-11-0932A

Organism Lot #: SE040421

Analyst(s): K. Kinnee, Robyn Wood, J. Ross

TOXCALC: MA076-0104
MA076-0204

Sample ID: S-7

Vizon #: 040413C-01

	Day 1	3 04/04/26	5	7	10
Day	Friday	Monday	Wednesday	Friday	Monday
Date	04/04/23	04/04/26	04/04/28	04/04/30	04/05/03
Temperature(°C)	15.9	16.0	15.8	15.7	15.6 JR
D.O. (mg/L)	7.9	8.2	8.1	8.4	8.0
pH	8.1				8.1
Salinity (‰)	27				28
Analyst	RW	KK	RW	RW	JR

	# Alive				
Replicate	A	B	C	D	E
	~~18~~ 19	18	19	~~18~~ 17	20
Analyst	RW	RW	RW	RW	RW

Counted 19 prior to reburial KK.

1 amphipod was a different species KK

Ammonia Sample Taken

Initial	Final
RW	JR

Sample ID: S-10

Vizon #: 040413C-02

	Day 1	3	5	7	10
Day	Friday	Monday	Wednesday	Friday	Monday
Date	04/04/23	04/04/26	04/04/28	04/04/30	04/05/03
Temperature(°C)	15.9	16.2	15.7	15.7	15.5
D.O. (mg/L)	7.8	8.2	8.2	8.4	8.0
pH	8.1				8.2 JR
Salinity (‰)	28				28
Analyst	RW	KK	RW	RW	JR

	# Alive				
Replicate	A	B	C	D	E
	19	18	19	19	16
Analyst	KK	KK	KK	KK	KK

Ammonia Sample Taken

Initial	Final
RW	JR

Vizon SciTec **Marine Amphipod 10 Day Acute Survival Sediment Test**
Test Conditions and Survival Data

Client # & Name: Seacor Start Date & Time: 04/04/23 @ 13:00

Sample Date: 04/04/08 End Date: 04/05/03

Sample Received: 04/04/13 Species: E. estuarius

Vizon Project #: 2-11-0932 Organism Lot #: SE040421

Analyst(s): K. Kinnee, Robyn Wood, J. Ross TOXCALC: MA076-0104 MA076-0204

Sample ID: S-14 Vizon #: 040413C-03

	Day 1	3	5	7	10
Day	Friday	Monday	Wednesday	Friday	Monday
Date	04/04/23	04/04/26	04/04/28	04/04/30	04/05/03
Temperature(°C)	15.8	16.1	15.9	15.8	15.5
D.O. (mg/L)	7.8	8.1	8.1	8.3	8.0
pH	8.1				8.1
Salinity (‰)	28				28
Analyst	RW	KK	RW	RW	JR

	# Alive				
Replicate	A	B	C	D	E
	17	17	19	19	~~19~~ ~~20~~ 20
Analyst	JR	JR	JR	JR	JR

Entry Error KL 04/05/03 (Recounted prior to reporting KK)

Ammonia Sample Taken

Initial	Final
RW	JR

Sample ID: S-15 Vizon #: 040413C-04

	Day 1	3	5	7	10
Day	Friday	Monday	Wednesday	Friday	Monday
Date	04/04/23	04/04/26	04/04/28	04/04/30	04/05/03
Temperature(°C)	15.8	16.15 KK 04/04/26	16.0	15.7	15.6
D.O. (mg/L)	7.8	8.1	8.0	8.4	8.0
pH	7.3				6.2
Salinity (‰)	27				27
Analyst	RW	KK	RW	RW	JR

	# Alive				
Replicate	A	B	C	D	E
	19	18	20	19	20
Analyst	KK	KK	KK	KK	KK

Ammonia Sample Taken

Initial	Final
RW	JR

Vizon SciTec

Marine Amphipod 10 Day Acute Survival Sediment Test
Reburial/Emerged Data at Test Termination

Client # & Name: #76 Seacor Start Date & Time: 04/04/23@ 13:00

Sample Date: 04/04/08 End Date: 04/05/03

Sample Received: 04/04/13 Species: E. estuarius

Vizon Project #: 2-11-0932A Organism Lot #: SE040421

Analyst(s): K. Kinnee

Sample ID: Control 1 Vizon #: N/A

	# Emerged after 1 hour in Control Sediment				
Replicate	A	B	C	D	E
Control 1	0	0	0	0	0
Analyst	KK	KK	KK	KK	KK

Sample ID: Control 2 Vizon #: N/A

	# Emerged after 1 hour in Control Sediment				
Replicate	A	B	C	D	E
Control 2	0	0	0	0	0
Analyst	KK	KK	KK	KK	KK

Sample ID: 57 Vizon #: 040413C-01

	# Emerged after 1 hour in Control Sediment				
Replicate	A	B	C	D	E
57	0	0	0	1 *	0
Analyst	KK	KK	KK	KK	KK

* on surface of sediment - not swimming KK

Sample ID: 510 Vizon #: 040413C-02

	# Emerged after 1 hour in Control Sediment				
Replicate	A	B	C	D	E
510	0	0	0	0	0
Analyst	KK	KK	KK	KK	KK

Sample ID: 514 Vizon #: 040413C-03

	# Emerged after 1 hour in Control Sediment				
Replicate	A	B	C	D	E
514	0	0	0	0	0
Analyst	KK	KK	KK	KK	KK

Sample ID: 515 Vizon #: 040413C-04

	# Emerged after 1 hour in Control Sediment				
Replicate	A	B	C	D	E
515	0	0	0	0	0
Analyst	KK	KK	KK	KK	KK

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Record of Aeration and Test Observations

Client # & Name: 76 Seacor

Start Date and Time: 04/04/23@ 13:00

Sample ID: Control 1

Vizon #: N/A

Sediment Description
(e.g. colour, texture, homogeneity, presence of plants, animals & tracks or burrows of animals):

Sandy; grey; homogeneous;

Date	Rep.	Comments (e.g. not aerating, DO levels (if not aerating), daily airline checks etc.)	Analyst
04/04/26	A to E	No emerged	KK
04/04/27	A to E	No emerged	KK
04/04/28	A to E	No emerged	[illegible]
04/04/30	A to E	No emerged	[illegible]
04/05/02	A to E	None emerged	JR
04/05/03	A to E	15:21 to 15:24 into clean sediment for reburied	KK

N:/Biology/Bioassay/Forms/Marine Amphipods/Test Observations.xls

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Record of Aeration and Test Observations

Client # & Name: 76 Seacor

Start Date and Time: 04/04/23 13:00

Sample ID: Control 2

Vizon #: N/A

Sediment Description
(e.g. colour, texture, homogeneity, presence of plants, animals & tracks or burrows of animals):

Sandy; grey; homogenous

Date	Rep.	Comments (e.g. not aerating, DO levels (if not aerating), daily airline checks etc.)	Analyst
04/04/26	A to E	No emerged	KK
04/04/27	A to E	No emerged	KK
04/04/28	A to E	No emerged	KK
↓	A to E	~~No emerged~~ 15	KK
04/04/30	A to E	No emerged	KK
04/05/02	A to E	No emerged	JR
04/05/03	A to E	15:24 to 15:27 Into clean sediment for reburial	KK

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Record of Aeration and Test Observations

Client # & Name: 76 Seacor

Start Date and Time: 04/04/23 @ 13:00

Sample ID: S7

Vizon #: 040413C-01

Sediment Description
(e.g. colour, texture, homogeneity, presence of plants, animals & tracks or burrows of animals):

Sediment → in jar, rocky, dk brown w/a lighter brown/tan layer settled on the surface once sediment dumped from jar → it is dark brown, rocky w/ ~~lots of~~ some shells pl

Date	Rep.	Comments (e.g. not aerating, DO levels (if not aerating), daily airline checks etc.)	Analyst
04/04/26	A to E	No emerged	KK
04/04/27	A to E	No emerged	KK
04/04/28	A to E	No emerged	RW
04/04/30	A to E	No emerged	RW
04/05/02	A to E	No emerged	JR
04/05/03	A to E	15:29 to 15:34 into clean sediment for retarial	KK

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Record of Aeration and Test Observations

Client # & Name: 76 Seacor

Start Date and Time: 04/04/23 @ 13:00

Sample ID: S10

Vizon #: 040413C-02

Sediment Description
(e.g. colour, texture, homogeneity, presence of plants, animals & tracks or burrows of animals):
brown, heterogeneous, some shells + rocks + material >1.0mm
brown, fine sediment on top ~1; rocky/wood/shells underneath

Date	Rep.	Comments (e.g. not aerating, DO levels (if not aerating), daily airline checks etc.)	Analyst
04/04/23	C	1 emerged @ 14:00 but buried at 14:30 h	KK
		is not replaced	
04/04/26	A to E	No emerged	KL
04/04/27	A to E	No emerged	KK
04/04/28	A to E	No emerged	RW
04/04/30	A to E	No emerged	RW
04/05/02	A to E	No emerged	JR
04/05/03	A to E	15:35 - 15:38 Into clean sediment for reburial	KK

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Record of Aeration and Test Observations

Client # & Name: 76 Seacor

Start Date and Time: 04/04/23@13:00

Sample ID: S14

Vizon #: 040413C-043

KLEE 04/04/23

Sediment Description
(e.g. colour, texture, homogeneity, presence of plants, animals & tracks or burrows of animals):

Dark sand with rocks ~ 2 cm²; crabs, shell bits, slight rotten egg odor brown algae-like gunk on sand surface; many baby amphipods 1 barnacle

Date	Rep.	Comments (e.g. not aerating, DO levels (if not aerating), daily airline checks etc.)	Analyst
04/04/26	A to E	No emerged	KK
04/04/27	A to E	No emerged	KK
04/04/28	S14-A	one dead, removed	RW
↓	C	" " "	RW
↓	A → E	No emerged	RW
04/04/30	A → E	No emerged	RW
04/05/02	A to E	No emerged	JR
04/05/03	A to E	15:30 - 15:43 Into clean sediment for reburial	KK

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Record of Aeration and Test Observations

Client # & Name: 76 Seacor

Start Date and Time: 04/04/23 @13:00

Sample ID: S15

Vizon #: 040413C-04

Sediment Description
(e.g. colour, texture, homogeneity, presence of plants, animals & tracks or burrows of animals):
rusty, heterogenous, rocky, amphipods have rusty residue on their body parts, some fine material on top

Date	Rep.	Comments (e.g. not aerating, DO levels (if not aerating), daily airline checks etc.)	Analyst
04/04/23	A	1 emerged @ 14:00 but buried @ 14:30	KL
04/04/23	D	5 emerged @ 14:00, still @ 14:30 but not replaced as probably avoiding sediment Amphipods have 'rust' on their body parts	KK
04/04/26	A to E	No emerged.	KL
04/04/26	A to E	No emerged	KK
04/04/28	A to E	No emerged	Rw
04/04/30	A to E	No emerged	Rw
04/05/02	A to E	No emerged	JR
04/05/03	A to E	15:43 - 15:47 into Clean sediment for retrieval	KK

Vizon SciTec
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Porewater Measurements

Client # & Name: #76 - Seacor

Start Date: 04/04/23 @ 13:00

Date Measured: 04/04/22

Start Time: 13:00

Sample ID	Salinity (‰)	Temperature (°C)	pH	NH_3 Sample Taken	Analyst
Control	29	14.8	7.9	✓	KK
S-7	16*	14.8	7.9	✓	Pw
S-10	27	14.6	7.9	✓	Pw
S-15	14*	15.2	6.0	✓	Pw
S-7 (Test initiation)	27	—	—	—	Pw
S-15 (Test initiation)	25	—	—	—	Pw

Comments

Control - Removed 175mL overlying H_2O from sediment for pore water measurements prior to homogenisation; removed all overlying H2O prior to

S7 - Salinity difficult to determine accurately B/c porewater is very dirty Pw for pairing

+ S15 → " " " " " " " LE 04/04/22

S-14 = no porewater obtained Pw

S-14 - porewater salinity measured on 04/04/21 - 29‰ KK

ANALYSIS REPORT

DATE: May 25/04
PROJECT No: 2-11-0932
APPROVED BY:

CLIENT: Seacor Environmental Inc
#6 - 40 Cadillac Avenue
Victoria, BC
Canada V8Z 1T2
CONTACT: Michael McLeay

VIZON SCITEC
Vancouver, B.C.
3650 Wesbrook Mall
Vancouver, B.C.
Canada
TEL: (604) 224-4331
FAX: (604) 224-0540

COMMENTS: Ammonia Analysis Results

Sample Description	Sample Date	Ammonia mgN/L		Log#
Control-Porewater	Apr.22/04	0.040		040422C-01
S 10 Porewater	Apr.22/04	3.3		040422C-02
S 15 Porewater	Apr.22/04	0.532		040422C-03
Control -Initial	Apr.22/04	<0.01		040423C-01
S 7 Initial	Apr.22/04	0.031		040423C-02
S 10 Initial	Apr.22/04	0.328		040423C-03
S 14 Initial	Apr.22/04	1.9		040423C-04
S 15 Initial	Apr.22/04	0.077		040423C-05
Control 1&2 Final	May 3/04	0.022		040503D-01
S 7 Final	May 3/04	0.022		040503D-02
S 10 final	May 3/04	0.023		040503D-03
S 14 Final	May 3/04	1.2		040503D-04
S 15 Final	May 3/04	0.343		040503D-05
QC Sample True	040422C	0.069		
		0.070		
QC sample Found				
	040423C	0.069		
		0.069		
	040503D	0.069		
		0.076		

Vizon SciTec, Inc.
Vancouver, BC

Total and Unionized Ammonia Results for Seacor Amphipod Tests - April 2004

	Porewater Ammonia Initial (mg/L)			Overlying Ammonia Day 0 (mg/L)			Overlying Ammonia Day 10 (mg/L)		
Seacor Sample Name	Total	% Unionized Ammonia[a]	Unionized	Total	% Unionized Ammonia	Unionized	Total	% Unionized Ammonia	Unionized
Control	0.040	1.73	0.0007	<0.01	2.92	<0.0003	0.022	2.99	0.00066
S-7	-	-	-	0.031	2.99	0.0009	0.022	2.92	0.00064
S-10	3.3	1.77	0.058	0.328	2.92	0.00958	0.023	2.92	0.00067
S-14	-	-	-	1.9	2.92	0.055	1.2	2.92	0.035
S-15	0.532	b	-	0.077	c	-	0.343	d	-

[a] Values from Bower CE and Bidwell, JP. 1978. Ionization of Ammonia in Seawater: Effects of Temperature, pH and Salinity. Journal of Fisheries Research Board of Canada 35:1012-1016.

[b] No values were given in Bower and Bidwell (1978) for measured pH value of 6 and salinity of 14.

[c] No value was given in Bower and Bidwell (1978) for the measured pH value of 7.3.

[d] No value was given in Bower and Bidwell (1978) for the measured pH value of 6.2.

K Seaton
04105130

Randomization Chart for Amphipod Tests

Use the coloured dots to find appropriate concentrations

Position Map

Back Wall

6	12	18	24	30	36
5	11	17	23	29	35
4	10	16	22	28	34
3	9	15	21	27	33
2	8	14	20	26	32
1	7	13	19	25	31

Front of Counter

Client #	76			Client #	Ref Tox		
Position #	Treatment	Replicate	Colour	Position #	Treatment	Replicate	Colour
29	Control-1	A	Blue	8	Control	A	White
7	Control-1	B	Blue	9	Control	B	White
16	Control-1	C	Blue	5	1	A	White
32	Control-1	D	Blue	10	1	B	White
2	Control-1	E	Blue	7	2.2	A	White
31	Control-1	Measure	Blue	4	2.2	B	White
9	Control-2	A	Red	2	4.6	A	White
5	Control-2	B	Red	1	4.6	B	White
10	Control-2	C	Red	3	10	A	White
13	Control-2	D	Red	12	10	B	White
4	Control-2	E	Red	6	22	A	White
27	Control-2	Measure	Red	11	22	B	White
36	S7	A	Green				
12	S7	B	Green				
33	S7	C	Green				
6	S7	D	Green				
15	S7	E	Green				
30	S7	Measure	Green				
8	S10	A	Orange				
14	S10	B	Orange				
23	S10	C	Orange				
1	S10	D	Orange				
3	S10	E	Orange				
28	S10	Measure	Orange				
25	S14	A	White				
17	S14	B	White				
34	S14	C	White				
11	S14	D	White				
18	S14	E	White				
24	S14	Measure	White				
26	S15	A	Yellow				
20	S15	B	Yellow				
19	S15	C	Yellow				
35	S15	D	Yellow				
21	S15	E	Yellow				
22	S15	Measure	Yellow				

Vizon SciTec

Marine Amphipod 10 Day Acute Survival Sediment Test
Aeration Checks

Client # & Name: #76 Seacor

Start Date & Time: 04/04/23 @ 13:00

Initial when aeration is checked. If air is off record DO and note which replicate(s) in comments section.

	Day 0	1.0	2.1	3.2	4.3	5.4	6.5	7.6	8.7	9.8	KKCC 10.9	10
Date	—	04/04/23	04/04/24	04/04/25	04/04/26	04/04/27	04/04/28	04/04/29	04/04/30	04/05/01	04/05/02	04/05/6
Early AM	—	—	CL	JR	KK	KK	KK	RW	RW	CL	JR	JR
Mid-day	—	KK	CL	JR	KK	KK	RW		RW	RM	JR	JR
Late PM	—	CL	CL	JR	KK	CL	KK	KK	RW	RM	JR	—

Comments:

04/04/22 Water quality of overlying water before added to sediment: (Vancouver aquarium H2O) Salinity 28ppt; pH: 8.3; DO. 8.5 mg/L Temp 14.9°C

04/04/25 Rx 1 mg/L B - 1 floating, Rx 2.2 A/B mg/L - 4 floating, Rx 4.6 A/B mg/L - 3 floating, Rx 10 A mg/L - 3 floating

~~04/04~~/04/05/01 No visible organisms out of sediment

Vizon SciTec Inc.
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Length Measurements

Client # & Name: #76 - Seacor

Vizon #: 040413C-01 to 04

Sample ID: S-7, S-10, S-14, S-15

Species: *E. estuarius*

Start Date and Time: 04/04/23 @ 13:00

Organism Lot #: SE040421

End Date: 04/05/03

Lengths at Beginning of Test

Marine Amphipod #	Length (mm)
1	3
2	3
3	4
4	3
5	4
6	4
7	4
8	3
9	3
10	3
11	4
12	3
13	5
14	3
15	3
16	3
17	4
18	4
19	4
20	4
Average	3.6
SD	0.6
Analyst	KK

Average must be 3-5 mm (Environment Canada 1992, ASTM 1993, PSEP 1995)

Vizon SciTec Inc.
Vancouver, BC

Marine Amphipod 10 Day Acute Survival Sediment Test
Length Measurements

Client # & Name: #76-Seacor

Vizon #: 040413C

Sample ID: S7, S10, S14, S15

Species: E. estuarius

Start Date and Time: 04/04/23 @ 13:00

Organism Lot #: SE040421

End Date: 04/09/03

Lengths at Beginning of Test

Marine Amphipod #	Length (mm)
1	3
2	3
3	4
4	3
5	4
6	4
7	4
8	3
9	3
10	3
11	4
12	3
13	5
14	3
15	3
16	3
17	4
18	4
19	4
20	4
Average	3.6
SD	0.6
Analyst	KK

Average must be 3-5 mm (Environment Canada 1992, ASTM 1993, PSEP 1995)

Vizon SciTec

Marine Amphipod 10 Day Acute Survival Sediment Test
Acclimation and Holding Conditions

Tank #1

Species: E. estuarius

Organism Lot #: SE040421

Date Collected: 04/04/20 + 21 (KK EE 04/09/21)

Total Number of Organisms: 880 (440/tank) (110 in 8 containers, split between 2 tanks)

	Large	Small	Inactive or Dead
Container #1 -	117	0	1/0
Container #2 -	113	1	0/1
Container #3 -	115	1	1/3
Container #4 -	122	4	0/1
	467		

Total = 474

Date Arrived: 04/04/21 @ 08:15 PM

Upon Arrival: Temperature: 16.1°C D.O.: 8.3 mg/L pH: 7.8 Salinity: 25 ‰

Acclimation/Holding Conditions

Parameter	Units	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Date		04/04/21	04/04/22	04/04/23								
pH	-	8.1	8.1 @ SE	8.1								
Temperature	(°C)	15.2	16.1	16.1								
D.O.	(mg/L)	8.3	7.7	7.7								
Salinity	(‰)	28	28	28								
Analyst		KK	RW	RW								

Health Data

Parameter	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Total	% Effected
Date	04/04/21	04/04/22	04/04/23										KK EE 04/05/25
Dead	1	4	4									5	~~0.8~~ 1.0
Inactive	0	2	2									2	0.4
Emerged	0	0	0									0	0
Analyst	KK	RW KK 04/04/23 EE	KK									KK	KK

50% H_2O Change

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Date	04/04/22	04/04/23								
Analyst	N/A	N/A								

Comments: WQ on tank H_2O 04/04/21 KK ~ Approximately 110 amphipods/container
Salinity 28‰ (added 250-350mL Type II DI to ↓ salinity from 30 to 28‰)
DO & Temp: 8.3 @ 15.2°C

Vizon SciTec

Marine Amphipod 10 Day Acute Survival Sediment Test
Acclimation and Holding Conditions

Species: E. estuarius 04/05/22 EE KK

Organism Lot #: SE040421 Tank #2

Date Collected: 04/04/2021

Total Number of Organisms: 880 (~440/tank) (110 in 8 containers, split between 2 tanks).

	Large	Small	Inactive or Dead
Container #1	120	0	0/0
Container #2	101	1	0/2
Container #3	111	4	0/2
Container #4			

Date Arrived: 04/04/21 @ 20:15

Upon Arrival: Temperature: 16.1 °C D.O.: 8.3 mg/L pH: 7.8 Salinity: 25 ‰

Acclimation/Holding Conditions

Parameter	Units	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Date		04/04/21	04/04/22	04/04/23								
pH	-	8.1	8.1 KK	8.1								
Temperature	(°C)	15.2	16.3	16.3								
D.O.	(mg/L)	8.3	7.6	7.6								
Salinity	(‰)	28	28	28								
Analyst		KK	KK	KK								

Health Data

Parameter	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Total	% Effected
Date	04/04/21	04/04/22	04/04/23										
Dead	0	—	0									0	0
Inactive	0	—	0									0	0
Emerged	0	—	0									0	0
Analyst	KK	KK	KK									KK	KK

50% H_2O Change

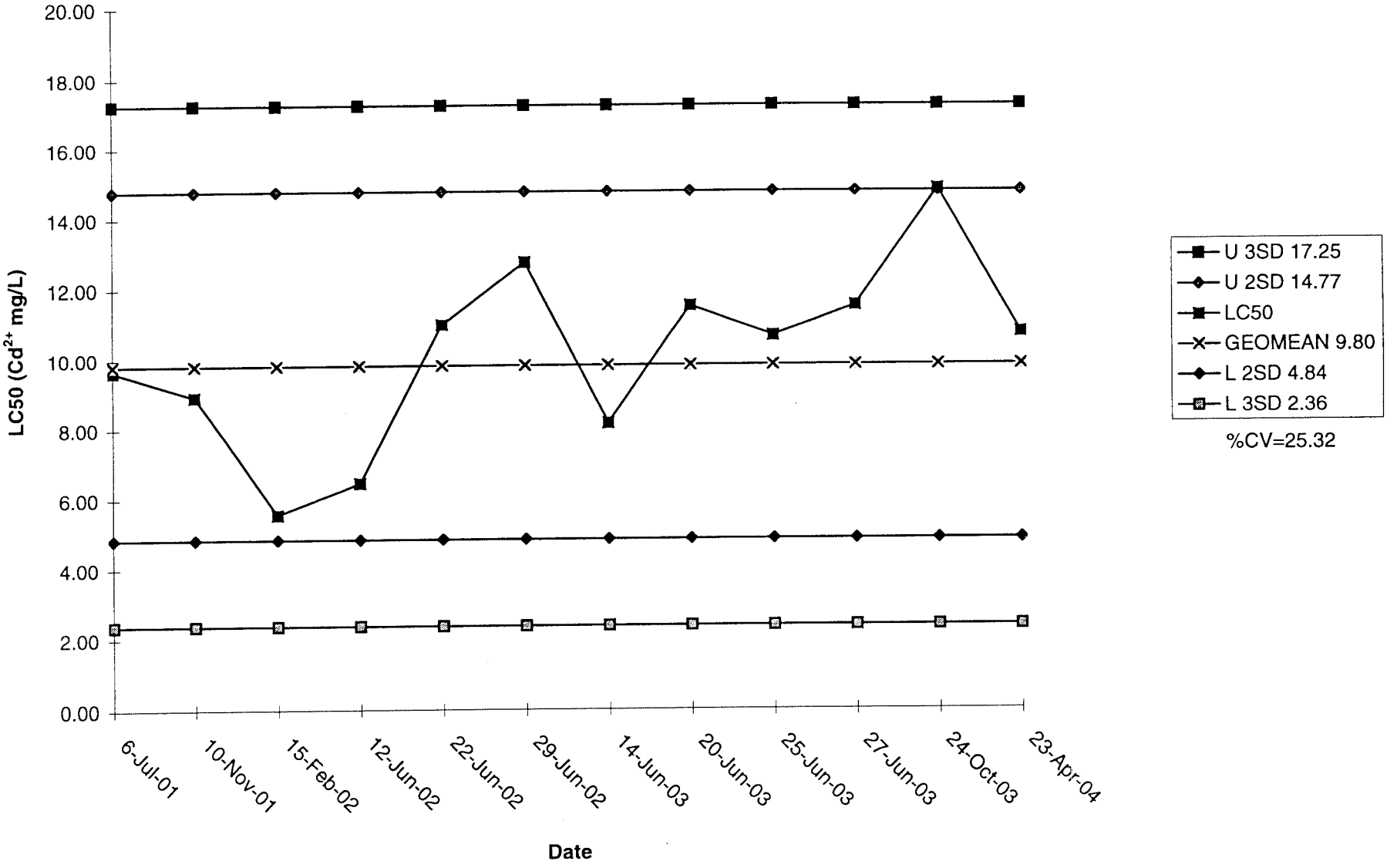
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Date	04/04/22	04/04/23	—	—	—	—	—	—	—	—
Analyst	N/A	N/A	—	—	—	—	—	—	—	—

Comments: See Tank #1.

VIZON SCITEC INC.
Vancouver, BC

Eohaustorius estuarius

96-hr Water-Only Reference Toxicant Control Chart using Cadmium (2^+)



APPENDIX D

20-DAY JUVENILE POLYCHAETE TEST DATA

Neanthes arenaceodentata Survival and Growth Test-20-d Survival

Start Date:	4/23/2004	Test ID:	NA076-0104	Sample ID:	076-Seacor
End Date:	5/13/2004	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	076-Sediments
Sample Date:	4/8/2004	Protocol:	PSEP-95/07-Polychaetes	Test Species:	NA-Neanthes arenaceodentata

Comments:

Conc-%	1	2	3	4	5
Control-1	1.0000	1.0000	1.0000	0.4000	1.0000
Control-2	1.0000	1.0000	1.0000	1.0000	1.0000
S-7	1.0000	0.8000	1.0000	1.0000	1.0000
S-10	0.8000	1.0000	1.0000	1.0000	1.0000
S-14	0.8000	1.0000	1.0000	0.4000	1.0000
S-15	0.4000	0.0000	0.4000	0.6000	0.4000

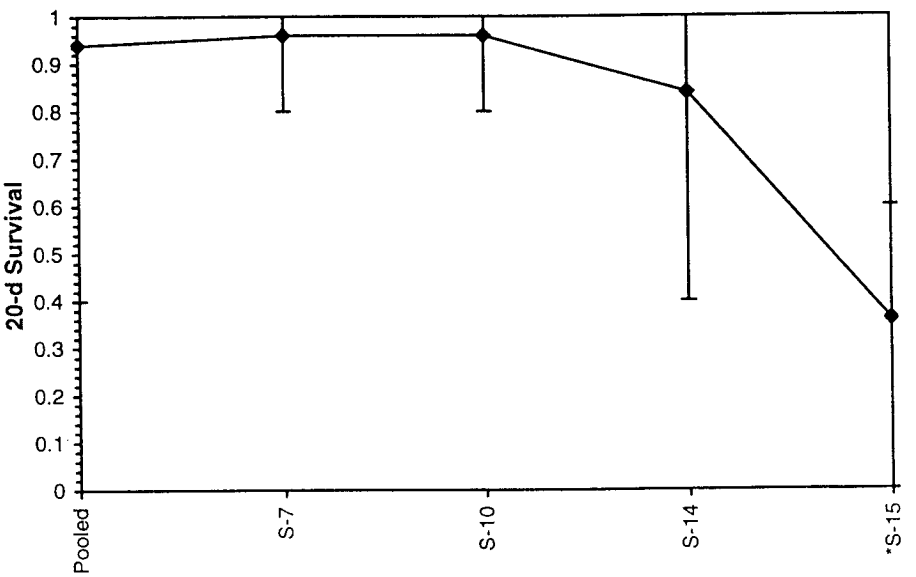
			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Pooled	0.9400	1.0000	1.2792	0.6847	1.3453	16.329	10		
S-7	0.9600	1.0213	1.2977	1.1071	1.3453	8.207	5	38.00	21.00
S-10	0.9600	1.0213	1.2977	1.1071	1.3453	8.207	5	38.00	21.00
S-14	0.8400	0.8936	1.1655	0.6847	1.3453	24.700	5	33.00	21.00
*S-15	0.3600	0.3830	0.6331	0.2255	0.8861	38.535	5	17.50	21.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.70274	0.9	-1.9519	3.61386
Bartlett's Test indicates equal variances (p = 0.23)	5.59013	13.2767		
The control means are not significantly different (p = 0.35)	1	2.30601		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Rank Sum Test indicates significant differences

Dose-Response Plot



Reviewed by: 04/05/17

Neanthes arenaceodentata Survival and Growth Test-20-d Survival

Start Date:	4/23/2004	Test ID:	NA076-0204	Sample ID:	076-Seacor
End Date:	5/13/2004	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	076-Sediments
Sample Date:	4/8/2004	Protocol:	PSEP-95/07-Polychaetes	Test Species:	NA-Neanthes arenaceodentata
Comments:					

Conc-%	1	2	3	4	5
S-14	0.8000	1.0000	1.0000	0.4000	1.0000
S-7	1.0000	0.8000	1.0000	1.0000	1.0000
S-10	0.8000	1.0000	1.0000	1.0000	1.0000
S-15	0.4000	0.0000	0.4000	0.6000	0.4000

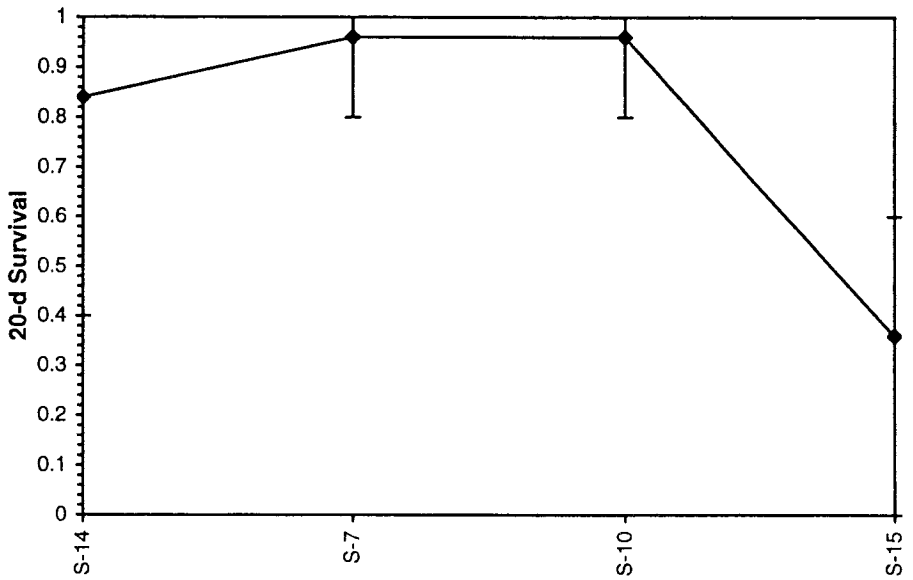
			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
S-14	0.8400	1.0000	1.1655	0.6847	1.3453	24.700	5		
S-7	0.9600	1.1429	1.2977	1.1071	1.3453	8.207	5	30.50	17.00
S-10	0.9600	1.1429	1.2977	1.1071	1.3453	8.207	5	30.50	17.00
S-15	0.3600	0.4286	0.6331	0.2255	0.8861	38.535	5	17.50	17.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.80166	0.868	-1.4264	1.90223
Bartlett's Test indicates equal variances (p = 0.14)	5.50654	11.3449		

Hypothesis Test (1-tail, 0.05)

Steel's Many-One Rank Test indicates no significant differences

Dose-Response Plot



Reviewed by: KSuben

04/05/30

Neanthes arenaceodentata Survival and Growth Test-Growth Rate

Start Date:	4/23/2004	Test ID:	NA076-0104	Sample ID:	076-Seacor
End Date:	5/13/2004	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	076-Sediments
Sample Date:	4/8/2004	Protocol:	PSEP-95/07-Polychaetes	Test Species:	NA-Neanthes arenaceodentata
Comments:					

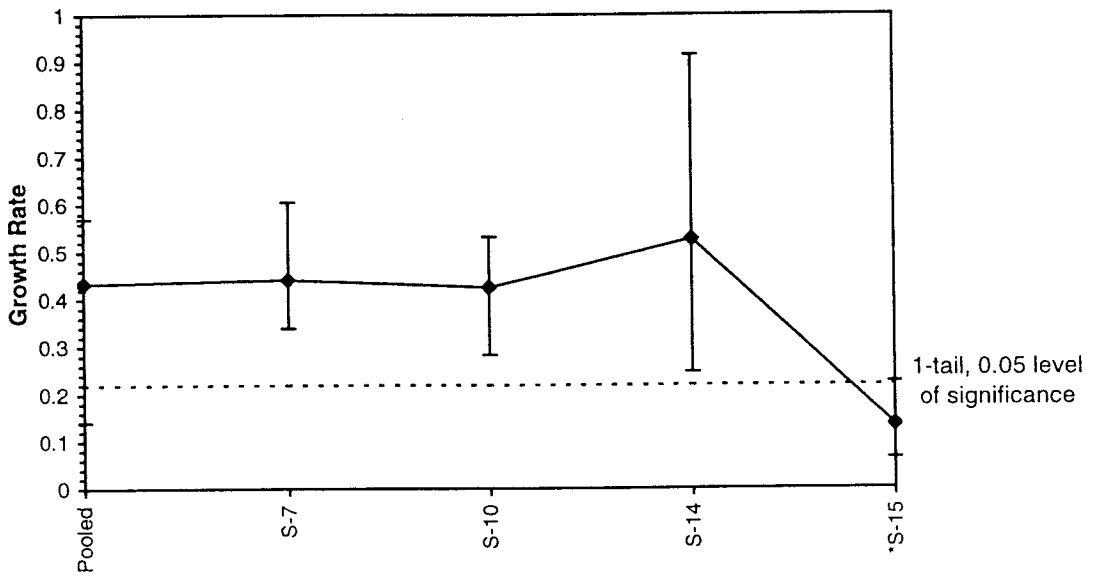
Conc-%	1	2	3	4	5
Control-1	0.4833	0.4226	0.4825	0.1415	0.3913
Control-2	0.5635	0.3995	0.5700	0.4328	0.4436
S-7	0.6050	0.3864	0.4427	0.3386	0.4316
S-10	0.5318	0.3518	0.2827	0.4901	0.4669
S-14	0.6928	0.4389	0.3400	0.9150	0.2460
S-15	0.2252	0.1215	0.0630	0.1298	

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Pooled	0.4331	1.0000	0.7142	0.3857	0.8556	18.354	10			
S-7	0.4409	1.0180	0.7256	0.6211	0.8912	14.028	5	-0.127	2.391	0.2144
S-10	0.4247	0.9806	0.7081	0.5606	0.8172	15.062	5	0.068	2.391	0.2144
S-14	0.5265	1.2158	0.8248	0.5190	1.2750	36.991	5	-1.234	2.391	0.2144
*S-15	0.1349	0.3114	0.3682	0.2537	0.4945	26.800	4	3.572	2.391	0.2315

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94922	0.898	0.32226	2.2371
Bartlett's Test indicates equal variances (p = 0.08)	8.47111	13.2767		
The control means are not significantly different (p = 0.22)	1.3327	2.30601		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test indicates significant differences	0.21362	0.49795	0.12962	0.0268	0.00527	4, 24

Dose-Response Plot



Reviewed by: K Seiber
04/05/17

Neanthes arenaceodentata Survival and Growth Test-Growth Rate

Start Date:	4/23/2004	Test ID:	NA076-0204	Sample ID:	076-Seacor
End Date:	5/13/2004	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	076-Sediments
Sample Date:	4/8/2004	Protocol:	PSEP-95/07-Polychaetes	Test Species:	NA-Neanthes arenaceodentata
Comments:					

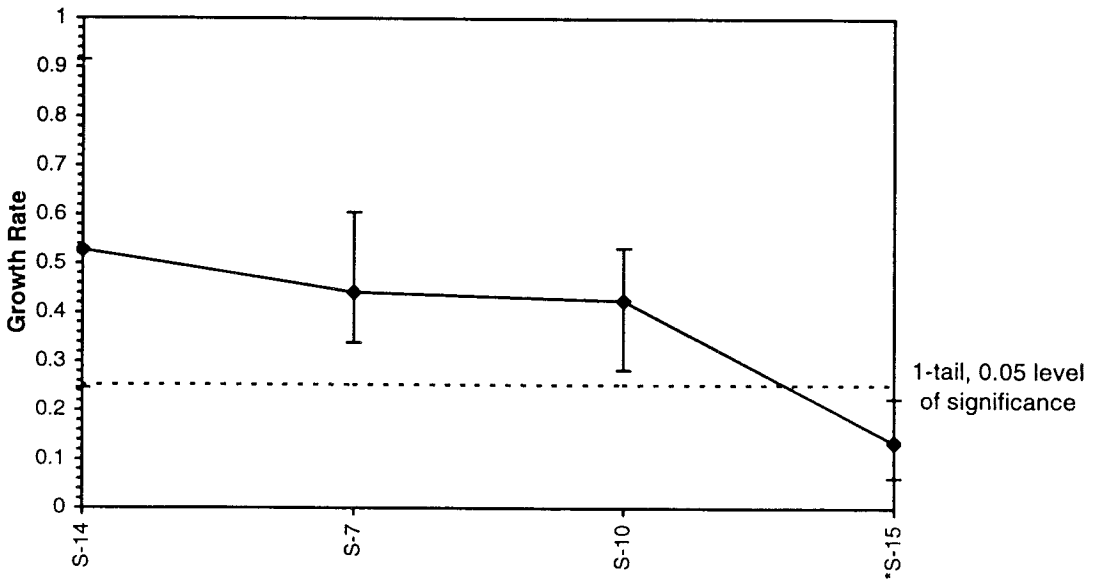
Conc-%	1	2	3	4	5
S-14	0.6928	0.4389	0.3400	0.9150	0.2460
S-7	0.6050	0.3864	0.4427	0.3386	0.4316
S-10	0.5318	0.3518	0.2827	0.4901	0.4669
S-15	0.2252	0.1215	0.0630	0.1298	

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
S-14	0.5265	1.0000	0.8248	0.5190	1.2750	36.991	5			
S-7	0.4409	0.8373	0.7256	0.6211	0.8912	14.028	5	0.869	2.343	0.2674
S-10	0.4247	0.8065	0.7081	0.5606	0.8172	15.062	5	1.022	2.343	0.2674
*S-15	0.1349	0.2562	0.3682	0.2537	0.4945	26.800	4	3.772	2.343	0.2836

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95091	0.863	0.82178	2.13849
Bartlett's Test indicates equal variances (p = 0.06)	7.37643	11.3449		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test indicates significant differences	0.27398	0.508	0.16892	0.03256	0.01172	3, 15

Dose-Response Plot



Reviewed by: KSalen
04/05/30

Summary of Survival Results for *N. arenaceodentata* Tests on Seacor Sediments (2-11-0932)

Sample ID	Log In ID	# Surviving	Sample Survival (%)	Mean Survival (%)	SD
Control-1	-	5	100	88	27
Control-1	-	5	100	**Pooled**	**Pooled**
Control-1	-	5	100	94	19
Control-1	-	2	40		
Control-1	-	5	100		
Control-2	-	5	100	100	0
Control-2	-	5	100		
Control-2	-	5	100		
Control-2	-	5	100		
Control-2	-	5	100		
S-7	040413C-01	5	100	96	9
S-7	040413C-01	4	80		
S-7	040413C-01	5	100		
S-7	040413C-01	5	100		
S-7	040413C-01	5	100		
S-10	040413C-02	4	80	96	9
S-10	040413C-02	5	100		
S-10	040413C-02	5	100		
S-10	040413C-02	5	100		
S-10	040413C-02	5	100		
S-14	040413C-03	4	80	84	26
S-14	040413C-03	5	100		
S-14	040413C-03	5	100		
S-14	040413C-03	2	40		
S-14	040413C-03	5	100		
S-15	040413C-04	2	40	36	22
S-15	040413C-04	0	0		
S-15	040413C-04	2	40		
S-15	040413C-04	3	60		
S-15	040413C-04	2	40		

KSeiben
04105128

Vizon SciTec, Inc.
Vancouver, BC

***Neanthes arenaceodentata* 20-d Test**
Dry Weights of Polychaete Worms

Client # & Name: #076 - Seacor
Start Date and Time: 23-Apr-04 @ 10:45
Sample Date: 8-Apr-04
End Date: 13-May-04
Sample Received: 13-Apr-04
Weighing Dates: 12-May-04 and 14-May-04
Organism Lot #: DR040420
Vizon ID # 040413C-01, 02, 03, 04
Sample ID: S-7, S-10, S-14, S-15
Toxcalc. File ID: NA076-0104
Analyst(s): Karen Kinnee, Robyn Wood, Rimo Yoo, Juniper Ross, Ann Lee, Pam Sinclair, Kerrie Serben

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)	Wt. of Worms (mg)	Mean Wt./Worm (mg)	Mean Wt./ Treatment (mg)	SD	Estimated Individual Growth Rate (mg/day)	Estimated Individual Growth Rate (mg/day)	SD
1	Control-1	A	5	1.14974	1.19807	48.33	9.67	7.68	2.83	0.48	0.38	0.14
2	Control-1	B	5	1.14341	1.18567	42.26	8.45			0.42	**Pooled**	**Pooled**
3	Control-1	C	5	1.15873	1.20698	48.25	9.65			0.48	0.43	0.12
4	Control-1	D	2	1.12694	1.13260	5.66	2.83			0.14		
5	Control-1	E	5	1.13646	1.17559	39.13	7.83			0.39		
6	Control-2	A	5	1.14038	1.19673	56.35	11.27	9.64	1.58	0.56	0.48	0.08
7	Control-2	B	5	1.12927	1.16922	39.95	7.99			0.40		
8	Control-2	C	5	1.13018	1.18718	57.00	11.40			0.57		
9	Control-2	D	5	1.15572	1.19900	43.28	8.66			0.43		
10	Control-2	E	5	1.13036	1.17472	44.36	8.87			0.44		
11	S-7	A	5	1.12438	1.18488	60.50	12.10	8.82	2.01	0.61	0.44	0.10
12	S-7	B	4	1.14600	1.17691	30.91	7.73			0.39		
13	S-7	C	5	1.14889	1.19316	44.27	8.85			0.44		
14	S-7	D	5	1.14910	1.18296	33.86	6.77			0.34		
15	S-7	E	5	1.13687	1.18003	43.16	8.63			0.43		
16	S-10	A	4	1.14608	1.18862	42.54	10.64	8.49	2.07	0.53	0.42	0.10
17	S-10	B	5	1.15267	1.18785	35.18	7.04			0.35		
18	S-10	C	5	1.14450	1.17277	28.27	5.65			0.28		
19	S-10	D	5	1.16675	1.21576	49.01	9.80			0.49		
20	S-10	E	5	1.13002	1.17671	46.69	9.34			0.47		

Vizon SciTec, Inc.
Vancouver, BC

***Neanthes arenaceodentata* 20-d Test**
Dry Weights of Polychaete Worms

Client # & Name: #076 - Seacor
Sample Date: 8-Apr-04
Sample Received: 13-Apr-04
Organism Lot #: DR040420
Sample ID: S-7, S-10, S-14, S-15

Start Date and Time: 23-Apr-04 @ 10:45
End Date: 13-May-04
Weighing Dates: 12-May-04 and 14-May-04
Vizon ID # 040413C-01, 02, 03, 04
Toxcalc. File ID: NA076-0104

Analyst(s): Karen Kinnee, Robyn Wood, Rimo Yoo, Juniper Ross, Ann Lee, Pam Sinclair, Kerrie Serben

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)	Wt. of Worms (mg)	Mean Wt./Worm (mg)	Mean Wt./ Treatment (mg)	SD	Estimated Individual Growth Rate (mg/day)	Estimated Individual Growth Rate (mg/day)	SD
21	S-14	A	4	1.15489	1.21031	55.42	13.86	10.53	5.47	0.69	0.53	0.27
22	S-14	B	5	1.15554	1.19943	43.89	8.78			0.44		
23	S-14	C	5	1.15155	1.18555	34.00	6.80			0.34		
24	S-14	D	2	1.15085	1.18745	36.60	18.30			0.91		
25	S-14	E	5	1.14794	1.17254	24.60	4.92			0.25		
26	S-15	A	2	1.14543	1.15444	9.01	4.50	2.70	1.34	0.23	0.13	0.07
27	S-15	B	0	1.14344	-	-	-			-		
28	S-15	C	2	1.13530	1.14016	4.86	2.43			0.12		
29	S-15	D	3	1.13039	1.13417	3.78	1.26			0.06		
30	S-15	E	2	1.12651	1.13170	5.19	2.60			0.13		
31	QA/QC	QA/QC	-	1.14996	1.14999	-	-	-	-	-	-	-
32	QA/QC	QA/QC	-	1.14854	1.14850	-	-	-	-	-	-	-
1		A	5	1.14977	1.19806	-	-	-	-	-	-	-
Analyst			PS RW KS	PS	RY							

K Serben (p1-2)
04/05/17

Vizon SciTec, Inc.
Vancouver, BC

Neanthes arenaceodentata 20-d Test
Initial Dry Weights of Polychaete Worms

Client # & Name: #076 - Seacor

Start Date and Time: 23-Apr-04 @ 10:45

Sample Date: 8-Apr-04

End Date: 13-May-04

Sample Received: 13-Apr-04

Weighing Dates: 12-May-04 and 14-May-04

Organism Lot #: DR040420

Vizon ID # 040413C-01, 02, 03, 04

Sample ID: S-7, S-10, S-14, S-15

Toxcalc. File ID: NA076-0104

Analyst(s): Kerrie Serben, Ann Lee

Boat #	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)	Wt. of Worms (mg)	Mean Wt./Worm (mg)	Mean Wt. (mg)	SD
1	A	5	1.14461	1.14653	1.92	0.38	0.89	0.69
2	B	5	1.13675	1.13986	3.11	0.62		
3	C	5	1.13962	1.14801	8.39	1.68		
Analyst		KS	KS	AL				

KSerben
04/05/30

Vizon SciTec *Neanthes arenaceodentata* Survival and Change in Biomass Test
Test Conditions and Survival Data

Client # & Name: #076 - Seacor
Start Date and Time: 04/04/23 @ 10:45
Client Project #: ~~2-11-09328~~ KK 04/04/23 EE
End Date: 04/05/13
Vizon Project #: 2-11-09328
Age at Start of Test: 2-3 wks post-emergence
Organism Lot #: ~~SDR040420~~ KK EE 04/04/23
Statistics File: NA076-0204 NA076-0104
Analyst(s): K. Kinnee, Robyn Wood, R. Yoo, J. Ross, P. Sind
Salinity must be 28±2‰ KSaber
Temperature must be 20±1°C

Sample ID: control 1
Vizon #: N/A
Sample Date: 04/04/21
Sample Received: 04/04/21

Date	04/04/23	04/04/26	04/04/29	04/05/02 JR	04/05/05	04/05/08	04/05/11	04/05/13
Replicate	A	B	C	D	E	A	B	C
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20
Temp. (°C)	20.4	19.9	20.0	21.0	20.4	19.8	19.7	19.9°C
D.O. (mg/L)	~~7.6~~ 7.6	7.5	7.7	6.7	6.1	7.3	7.2	KS EE ~~8.5~~ 7.4
pH	8.1	7.9	8.0	7.9	7.8	8.1	7.9	8.0
Salinity (‰)	28	27	28	28	27	28	28	KS 19 28
Analyst	RW	KK	RY	RW	JR	CL	PS	KS

Replicate	A	B	C	D	E	Ammonia & Sulphide Samples Taken	
# Surviving	5	5	5	2	5	Initial	Final
Analyst	RW	RW	JR	RW	MEL	—	—

Sample ID: Control 2
Vizon #: N/A
Sample Date: 04/04/21
Sample Received: 04/04/21

Date	04/04/23	04/04/26	04/04/29	04/05/02 JR	04/04/05	04/05/08	04/05/11	04/05/13
Replicate	A	B	C	D	E	A	B	C
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20
Temp. (°C)	20.4	19.9	20.0	20.7	20.3	19.9	19.9	20.2°C
D.O. (mg/L)	7.6	7.3	7.5	7.1	6.6	KS 7.83	6.8	EE ~~8.6~~ 7.3
pH	8.1	7.8	8.0	8.0	8.0	8.1	7.7	8.0
Salinity (‰)	28	27	28	28	28	28	28	28
Analyst	RW	KK	RY	RW	JR ~~28~~ JR	CL	PS	KS

Replicate	A	B	C	D	E	Ammonia & Sulphide Samples Taken	
# Surviving	5	5	5	5	5	Initial	Final
Analyst	JR	JR	JR	JR	MEL	—	—

Feeding Regime: 5 mL per Replicate of 8.0 g/L Seawater TetraMarine Slurry (1 shot @ 5, using 50 mL Eppendorf attachment)

Vizon SciTec — *Neanthes arenaceodentata* Survival and Change in Biomass Test
Test Conditions and Survival Data

Client # & Name: #076 - Seacor
Start Date and Time: 04/04/23@10:45
Client Project #: ——
End Date: ~~04~~ KSee 05 04/05/13
Vizon Project #: 2-11-0932
Age at Start of Test: 2-3wks Postemergence
Organism Lot #: DR040420
Statistics File: NA076-0204 NA076-0104
Analyst(s): K. Kinnee, Robyn Wood, R Yoo, J. Ross A. Lee P. Sinclair K Seiben
Salinity must be 28±2‰
Temperature must be 20±1°C

Sample ID: S-7
Vizon #: 040413C-01
Sample Date: 04/04/08
Sample Received: 04/04/13

Date	04/04/23	04/04/26	04/04/29	04/04/02 05 JR	04/05/05	04/05/08	04/05/11	04/05/13
Replicate	A	B	C	D	E	A	B	C
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20
Temp. (°C)	20.5	20.0	20.0	20.5	20.3	19.9	20.0	20.2
D.O. (mg/L)	7.6	7.7	7.4	7.0	6.9	6.9	6.9	~~8.5~~ 7.2 KSee
pH	8.1	8.0	7.9	7.8	7.9	7.8	7.6	7.9
Salinity (‰)	27	27	27	28	28	28	28	28
Analyst	RW	KK	RY	RW	JR	AL	PS	KS

Replicate	A	B	C	D	E	Ammonia & Sulphide Samples Taken	
# Surviving	5	4	5	5	5	Initial	Final
Analyst	MEL	JR	MEL	KS	MEL	——	——

Sample ID: S-10
Vizon #: 040413C-02
Sample Date: 04/04/08
Sample Received: 04/04/13

Date	04/04/23	04/04/28 b KSee 04/04/26	04/04/29	04/04/02 05 JR	04/05/05	04/05/08	04/05/11	04/05/13
Replicate	A	B	C	D	E	A	B	C
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20
Temp. (°C)	20.7	20.1	20.0	20.5	20.3	19.7	~~20.0~~ 19.9	20.2
D.O. (mg/L)	7.3	7.8	7.8	7.3	7.0	6.5	~~6.9~~ 7.4	~~8.5~~ 7.1 KSee
pH	8.0	7.6	8.1	8.0	7.9	7.7	7.8	7.9
Salinity (‰)	28	27	28	28	28	28	28	28
Analyst	RW	KK	RY	RW	JR	AL	PS	KS

Replicate	A	B	C	D	E	Ammonia & Sulphide Samples Taken	
# Surviving	4	5	5	5	5	Initial	Final
Analyst	MEL	JR	KS	MEL	MEL	——	——

Feeding Regime: 5 mL per Replicate of 8.0 g/L Seawater TetraMarine Slurry (1 shot @ 5, using 50 mL Eppendorf attachment)

Vizon SciTec — *Neanthes arenaceodentata* Survival and Change in Biomass Test
Test Conditions and Survival Data

Client # & Name: #076 - Seacor
Start Date and Time: 04/04/23 @ 10:45
Client Project #: —
End Date: 04/05/13
Vizon Project #: 2-11-0932B
Age at Start of Test: 2-3 wks post-emergence
NA076-0204
Organism Lot #: D040420
Statistics File: NA076-0104
Analyst(s): K. Kinner, Robyn Wood, R Yoo, J. Ross, A-Lee, P. Sinclair
K Seber
Salinity must be 28±2‰ Temperature must be 20±1°C

Sample ID: S-14
Vizon #: 040413C-03
Sample Date: 04/04/08
Sample Received: 04/04/13

Date	04/04/23	04/04/26	04/04/29	04/05/02 (KS JR)	04/05/05	04/05/08	04/05/11	04/05/13
Replicate	A	B	C	D	E	A	B	C
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20
Temp. (°C)	20.7	20.1	20.1	20.6	20.3	19.7	20.0	20.2
D.O. (mg/L)	7.2	6.6	7.6	6.7	6.1	6.5	7.2	8.5 7.3 (KS 04/05/13)
pH	8.1	7.8	8.0	7.8	8.0	7.8	7.9	8.1
Salinity (‰)	28	27	28	28	28	28	28	28
Analyst	[illegible]	KK	RY	[illegible]	JR	QL	PS	KS

Replicate	A	B	C	D	E	Ammonia & Sulphide Samples Taken	
# Surviving	4	5	5	2	5	Initial	Final
Analyst	[illegible]	KS	[illegible]	JR	[illegible]	—	—

Sample ID: S-15
Vizon #: 040413C-04
Sample Date: 04/04/08
Sample Received: 04/04/13

Date	04/04/23	04/04/26	04/04/29	04/05/02 (KS JR)	04/05/05	04/05/08	04/05/11	04/05/13
Replicate	A	B	C	D	E	A	B	C
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20
Temp. (°C)	20.6	20.0	20.1	20.4	20.3	19.9	20.1	20.3
D.O. (mg/L)	7.2	7.7	7.1	6.2 6.4	6.3	7.3	7.2	8.5 6.1 (KS 04/05/13)
pH	6.9	5.9	7.0	7.1	7.1	7.6	7.3	8.1 7.3 (KS 04/05/13)
Salinity (‰)	27	26	27	27	28	28	28	28
Analyst	[illegible]	KK	RY	[illegible]	JR	QL	PS	KS

pH a factor in sediment related?

Replicate	A	B	C	D	E	Ammonia & Sulphide Samples Taken	
# Surviving	2	Ø	2	3	2	Initial	Final
Analyst	KS	KS/ML	[illegible]	[illegible]	JR	—	—

Feeding Regime: 5 mL per Replicate of 8.0 g/L Seawater TetraMarine Slurry (1 shot @ 5, using 50 mL Eppendorf attachment)

Vizon SciTec
Vancouver, BC

***Neanthes arenaceodentata* Survival and Change in Biomass Test**
Test ~~Termination~~ Observations
KL 04/04/23

Client # & Name: **#076 - Seacor**

Start Date and Time: 04/04/23 @10:45
End Date: 04/05/13

Date	Sample	Replicate	Comments (e.g. floating, emerged, swimming, and/or apparently dead polychaetes, sizes of polychaetes, native organisms, food or sediment in digestive tract, inactive polychaetes)	Analyst
~~04/04/23~~ Test Initiated				
04/04/23	S-10	A	Removed 2 small crabs (3-6mm) during feeding @ NOON. Also	
			checked other beakers → but no other crabs found	KS
04/04/23	S-14	C	Observed one dead white Chironomid-like worm on surface	KS
04/04/26	C1+C2	A to E	Can see worm tracks on top of sediment; some leftover	KK
			feed and/or fecal pigmentation on sediment surface	
04/04/26	C2	D	2 "worms" emerged - may not be alive or may not be worms	KK
04/04/26	S14	A/B	Disturbed sediments during H_2O Δ - while pouring off H_2O -	KK
			sediments moved.	
04/04/26	S14	A to E	Some materials was resuspended during addition of new H_2O	KK
			but settled out quite quickly (~ 1 to 2 min)	
04/04/26	All	A	Measurements from Replicate A	KK
04/04/26	S15	B	2 "worms" dead on surface	KK
04/04/26	S15	A to E	See comment for A to E of S14; however settled out	KK
			slower than S14	
04/04/26	All	All	Removed 250mL of H_2O + replaced with 250mL	KK
			new H_2O using diffuser plate	
04/04/29	All	~~A~~ C	Measurements	RM
04/04/29	S14	A-E	sediments disturbed during H_2O Δ	RM
04/04/29	All	All	Removed 250 mL of H_2O, replaced using diffuser plate	RM
04/04/29	All	All	Fed 5 mL of Tetra Marine slurry @ 16:30	RM
04/05/02	All	D	Measurements	RM
04/05/02	All	A → E	did a water Δ, removed 250mL of H_2O + replaced w/	RM
			250mL new H_2O using diffuser plate	
↓	S14	A → E	Sediments moved during pouring off RM	RM
↓	All	A → E	No dead/emerged animals found RM	RM
04/05/05	All	E	Measurements	JR
04/05/05	All	A-E	water Δ, removed 250mL of H_2O and replaced w/ new H_2O	JR
			using diffuser plate	
04/05/05	S7	A-E	Sediment disturbed during H_2O Δ	JR
04/05/05	S14	A	Sediment disturbed during H_2O Δ	JR
04/05/05	S15	D+C	Sediment disturbed during H_2O Δ	JR
04/05/08	All	A	Measurement	CA
	All	A-E	Water Δ, remove 250ml of H2O + place w/ new H2O using	CA

diffuser plate

Vizon SciTec ***Neanthes arenaceodentata*** **Survival and Change in Biomass Test Observations**

Vancouver, BC

Client # & Name: # 76 - Seacor

Start Date and Time: 04/04/23@10:45

End Date: 04/05/13

Date	Sample	Replicate	Comments (e.g. floating, emerged, swimming, and/or apparently dead polychaetes, sizes of polychaetes, native organisms, food or sediment in digestive tract, inactive polychaetes)	Analyst
04/05/08	S-7	B, C	Sediment disturbed during H_2O Δ	CL
04/05/08	S-14	All	Sediment disturbed during H_2O Δ	CL
04/05/08	S-15	C, D, E	Sediment disturbed during H_2O Δ	CL
04/05/11	S-14	All	Sediment disturbed during H_2O ▷	PS
04/05/11	S-15	c, d, e	Sediment disturbed during H_2O ▷	PS
04/05/11	All	All	Final Measurements	PS
04/05/11	All	A-E	H_2O ▷, 250ml of H_2O removed and replaced using	PS
"	"	"	diffuser plate	PS
04/05/11	All	All	Fed 5ml of Tera Marine Slurry @ 15:20	PS

~~BC Research~~, Inc.
Vancouver, BC

Neanthes arenaceodentata 20-d Test
Dry Weights of Polychaete Worms

Client # & Name: #76 - Seacor
Sample Date: 04/04/08
Sample Received: 04/04/13
Organism Lot #: DR040420
Sample ID: S-7, S-10, S-14, S-15
Analyst(s): P. Sinclair, R Yoo, K Salven

Start Date and Time: 04/04/23 @ 10:45
End Date: 04/05/13
Weighing Dates: 04/05/12 & 14
Vizon SciTec# 040413C-01 to 04
Toxcalc. File ID: NA076-0104, 0204

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)
1	Control-1	A	5	1.14974	1.19807
2		B	5	1.14341	1.18567
3		C	5	1.15873	1.20698
4		D	4	1.12694	1.13260
5		E	5	1.13646	1.17559
6	control-2	A	5	1.14038	1.19673
7		B	5	1.12927	1.16922
8		C	5	1.13018	1.18718
9		D	5	1.15572	1.19900
10		E	5	1.13036	1.17472
11	S-7	A	5	1.13438	1.18488
12		B	4	1.14600	1.17691
13		C	5	1.14889	1.19316
14		D	5	1.14910	1.18296
15		E	5	1.13687	1.18003
16	S-10	A	4	1.14608	1.18862
17		B	5	1.15267	1.18785
18		C	5	1.14450	1.17277
19		D	5	1.16675	1.21576
20		E	5	1.13002	1.17671
21	S-14	A	4	1.15489	1.21031
22		B	5	1.15554	1.19943
23		C	5	1.15155	1.18555
24		D	2	1.15085	1.18745
25		E	5	1.14794	1.17254
26	S-15	A	2	1.14543	1.15444
27		B	0	1.14344	—
28		C	2	1.13530	1.14016
29		D	3	1.13039	1.13417
30		E	2	1.12651	1.13170
31		A			
32		B			
33		C			
34		D			
35		E			
36		A			
37		B			
38		C			
39		D			
40		E			
Analyst			PS RY KS	PS	RY

~~BC Research~~ Inc.
VIZONSCITEC
Vancouver, BC

Neanthes arenaceodentata 20-d Test
Dry Weights of Polychaete Worms

Client # & Name: #76 - Seacor
Start Date and Time: 04/04/23 @ 10:45
Sample Date: 04/04/08
End Date: 04/05/13
Sample Received: 04/04/13
Weighing Dates: 04/05/12 + 14
Organism Lot #: DR040420
VIZON ~~BCR~~ # 040413C-01 to 04
Sample ID: S-7, S-10, S-14, S-15
Toxcalc. File ID: NA076-0104, 0204
Analyst(s): P. Sinclair, RYoo

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)
41		A			
42		B			
43		C			
44		D			
45		E			
46		A			
47		B			
48		C			
49		D			
50		E			
51		A			
52		B			
53		C			
54		D			
55		E			
56		A			
57		B			
58		C			
59		D			
60		E			
61		A			
62		B			
63		C			
64		D			
65		E			
66		A			
67		B			
68		C			
69		D			
70		E			
71	QA/QC	-		1.14996	1.14999
72	QA/QC	-		1.14854	1.14850
1		A		1.14977	1.19806
Analyst				PS	RY

Vizon SciTec

Neanthes 20 Day Survival and Change in Biomass Test
Aeration and Feeding Checks

Client # & Name: **#076 - Seacor**

Start Date & Time: Apr 23/04 @ 10:45 AM

Initial when aeration is checked. If air is off record DO and note which replicate(s) in comments section.

	Day 0	1	2	3	4	5	6	7	8	9	10
Date	04/04/23	04/04/24	04/04/25	04/04/26	04/04/27	04/04/28	04/04/29	04/04/30	04/05/01	04/05/02	04/05/03
Early AM	—	CL	JR	KK	KK	KK	KK	RW	CL	RW	JR
Mid-day	KS	CL	JR	KK	KK	RW		RW	CL	RW	JR
Late PM	CL	CL	JR	KK	KK	RW	RY	RW	CL	RW	

	Day 11	12	13	14	15	16	17	18	19	20
Date	04/05/04	04/05/05	04/05/06	04/05/07	04/05/08	04/05/09	04/05/10	04/05/11	04/05/12	04/05/13
Early AM	KK	JR	JR	JR	TK	JR	JR	PS	PS	
Mid-day		JR	CL	PS	CL	JR	JR	PS	PS	KS
Late PM	KK	JR	CL	PS	CL	JR		PS	PS	

Comments:

04/04/24 9:10 am. #76-N S15-C was not aerating. CL

04/04/25 All airlines clear throughout day JR.

04/04/26 See 04/05/13 #76-N S-14-A not aerating @ 1:45pm check KS. DO = 2mg/L @ 20°C.

Feeding Check		
Day	Date	Analyst
Day 0	04/04/23	KS
Day 2	04/04/25	JR
Day 4	04/04/27	KK
Day 6	04/04/29	RY
Day 8	04/05/01	CL

Feeding Check		
Day	Date	Analyst
Day 10	04/05/03	JR
Day 12	04/05/05	JR
Day 14	04/05/07	JR
Day 16	04/05/09	JR
Day 18	04/05/11	PS

Vizon SciTec
Vancouver, BC

Neanthes Survival and Growth Test
Overlying Water Measurements

Client # & Name: #076 - Seacor **Test Initiation Date:** 04/04/23

Seawater Arrival Date: 04/04/14

Date	Day	Temperature (°C)	D.O. (mg/L)	pH	Salinity (‰)	Analyst
04/04/22	-1 (KS ice)	21.3	7.3	8.2	28	RW
04/04/26	3	19.2	7.9	8.1	28	KK
04/04/29	6	19.5	7.9	8.0	28	RM
04/05/02	9	20.4	7.7	8.0	28	RM
04/05/05	12	19.7	7.8	8.0	27	JR
04/05/08	15	20.2	7.7	8.1	28	CR
04/05/11	18	18.8 (19.4)	7.9 (7.7)	8.0	28	PS

Randomization Chart for Neanthes Tests

Use the coloured dots to find appropriate concentrations

Position Map

Back Wall

6	12	18	24	30	36
5	11	17	23	29	35
4	10	16	22	28	34
3	9	15	21	27	33
2	8	14	20	26	32
1	7	13	19	25	31

Front of Counter

Client #	76			Client #	Ref Tox		
Position #	Treatment	Replicate	Colour	Position #	Treatment	Replicate	Colour
16	Control-1	A	Blue	3	Control	A	White
20	Control-1	B	Blue	2	Control	B	White
24	Control-1	C	Blue	8	3.2	A	White
12	Control-1	D	Blue	9	3.2	B	White
8	Control-1	E	Blue	10	5.6	A	White
18	Control-2	A	Red	5	5.6	B	White
26	Control-2	B	Red	7	10	A	White
13	Control-2	C	Red	4	10	B	White
17	Control-2	D	Red	6	18	A	White
2	Control-2	E	Red	11	18	B	White
7	S7	A	Green	12	32	A	White
30	S7	B	Green	1	32	B	White
1	S7	C	Green				
10	S7	D	Green				
22	S7	E	Green				
19	S10	A	Orange				
23	S10	B	Orange				
3	S10	C	Orange				
14	S10	D	Orange				
27	S10	E	Orange				
28	S14	A	White				
11	S14	B	White				
4	S14	C	White				
25	S14	D	White				
5	S14	E	White				
6	S15	A	Yellow				
15	S15	B	Yellow				
29	S15	C	Yellow				
9	S15	D	Yellow				
21	S15	E	Yellow				

Vizon SciTec Inc.
Vancouver, BC

***Neanthes arenaceodentata* 20-d Test**
Dry Weights of Polychaete Worms

Client # & Name: 76 Seacor

Start Date and Time: Apl 23/04 @ 10:45

Sample Date: 04/04/08

End Date: 04/05/13

Sample Received: 04/04/13

Weighing Dates: 04104123 04/04/24

Organism Lot #: DR040420

Vizon # 040413C

Sample ID: S7, S10, S14, S15

Toxcalc. File ID: NA076-0104

Analyst(s): KSeaborn / A. Lee

Boat #	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)
1	A	5	1.14461	1.14653
2	B	5	1.13675	1.13986
3	C	5	1.13962	1.14801
Analyst		KS	KS	AL

KS 20 ie-weigh 1st boat weighed: Boat #1A 1.14463 KS

DR040420

CALIFORNIA STATE UNIVERSITY
Department of Biological Sciences
Long Beach, CA
United States 90840
Tel: (562) 985-4846
Fax: (562) 985-8878
DJReish@aol.com

ORGANISM HISTORY

DATE SHIPPED:_April 19, 2004_____

SPECIES:_____Neanthes arenaceodentata_____

AGE:_____2-3 weeks post-emergence_____

LIFE STAGE: _____young_____

FOOD: ____Enteromorpha and rabbit food_____

WATER QUALITY RECORD

TEMPERATURE:_____19-20 C_____

SALINITY:_____34-36 ppt_____

pH:_____not taken_____

D.O.: _____not taken_____

COMMENTS:_____
_____
_____
_____

_____Donald J. Reish_____
Name and Signature of Supplier

Vizon SciTec *Neanthes arenaceodentata* **Juvenile Survival and Growth Test**
Arrival Conditions

Client #: 76 Seacor
Date & Time of Arrival: 04/04/20 @ 10:30
Vizon #: 040413C
Age upon Arrival: juvenile
Organism Lot #: DR040420
Number of *Neanthes* Ordered: 300 (+10%)
Water (ml) per Bag: ~40 ml
Number of Shipping Bags: 15

Arrival Conditions

Bag ID	# Dead	% Dead	Salinity (‰)	Temp. (°C)	pH	DO (mg/L)	Feeding	Analyst
Combined	—	—	34	18.5	7.5	7.8	✓	JP
Total								

Comments — Analyst

04/04/20 Pans 1-3 have 3 bags of ~~20~~ 22 organisms each. JP
Pans 4-6 have 2 bags " " " "
~~50%~~ 100% Vizon Seawater added while extracting animals from bags. Vizon seawater = Van. Aquarium water (29 ppt) w/ DFO Brine to adjust salinity to 32 ppt. @ 12:50. Airlines in.
15:30 added 40ml ~~to~~ seawater (32 ppt) to each pan
17:00 added 150 ml ~~re~~seawater to each pan.
finished feeding 0.3ml/worm, 19.8 ml to pans 1-3 5 JP
13.5 JP ml to pans 4-6 JP
04/04/21 @ 7:30 · Aeration off, airline from supply popped off. DO in pans 1-3 was 4.7-4.8, DO in pans 4-6 was 6.5-7.2 mg/L. Turned on 2nd air supply (DO meter calibrated in FW)
* Salinities on all pans: 1-35 ppt, 2-36, 3-40, 4-37, 5-37 6-40. Pans not covered: evaporation occurred. Added 400 ml Seawater (29 ppt) to each pan. Covered pans. Increased temp. in room since the temps on the side where animals were placed was ~4.5 °C lower than the other side where room thermometer was. Moved room thermometer.

Vizon SciTec *Neanthes arenaceoaentata* Juvenile Survival and Growth Test
Arrival Conditions

Page 2

Client # : 76 Seacor

Date & Time of Arrival: _____

Vizon #: _____

Age upon Arrival: _____

Organism Lot #: DR040420

Number of *Neanthes* Ordered: _____

Water (ml) per Bag: _____

Number of Shipping Bags: _____

Arrival Conditions

Bag ID	# Dead	% Dead	Salinity (‰)	Temp. (°C)	pH	DO (mg/L)	Feeding	Analyst
Total								

Comments

Analyst

04/04/22

Removed ½ water from each pan & replaced & almost filled pans. All pans are @ 28 ppt salinity. Fed pans 1-3 19.5 ml food & pans 4-6 13.5 ml. Moved pans & seawater from Incubator 2 to BL 4. Neanthes have had 24h of light since arriving.

04/04/23 Sexed Test 10:45 Am - 11:20 Am (5 each)

11:30 Am - 11:48 Sexed Leftovers (8 each) mm

Vizon SciTec

Neanthes Acclimation and Holding Conditions

Species: Neanthes

Organism Lot #: DR040420 **Tank ID:** 3

Arrival Conditions

Date	Total Number	Salinity (‰)	Temperature (°C)	pH	DO (mg/L)	Comments	Analyst
04/04/20	300	34	18.5	7.5	7.8	Look good, but small	JP

Holding Conditions

	Before Water Addition				After Water Addition				
Date & Time	Salinity (‰)	Temperature (°C)	pH	DO (mg/L)	Salinity (‰)	Temperature (°C)	pH	DO (mg/L)	Analyst
04/04/21	39	15.5	7.3	5.6	33	19.3	7.7	6.2	JP
04/04/22	32	21.0	7.9	6.8	28	21.5	7.9	6.8	JP
* 04/04/23	28	19.8	7.4	6.0					JP

Feeding

Date	04/04/20								
Analyst	JP								

Culture Health

Date	Total Number	Deaths	Removed	% Mortality (Previous 7 days)	Comments (e.g appearance)	Analyst
04/04/21		—	—		No Morts seen	JP

* measurements taken after Neanthes removed

28-D *NEANTHES* TOXICITY TESTING OF FIVE SEDIMENT SAMPLES SAMPLING PERIOD: FEBRUARY 2005

Prepared for:

Seacor Environmental Inc.
#6 - 40 Cadillac Avenue
Victoria, BC
Canada V8Z 1T2

Prepared by:

Toxicology Group

Project No.: 2-11-0932C

March 2005

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SUMMARY OF RESULTS AND WATER QUALITY MEASUREMENTS

Table 1 Pore Water Measurements for Seacor Sediment Samples

Sample ID	Salinity (‰)	Temperature (°C)	pH	Total Ammonia (mg N/L)	Un-Ionised Ammonia (mg N/L)
Control 1	20	14.5	7.7	0.046	0.0006
S17	[a]	[a]	[a]	[a]	-
S18	[a]	[a]	[a]	[a]	-
S23	17	19.3	6.5	2.19	[b]
S24	8	21.0	7.6	[a]	-
S26	[a]	[a]	[a]	[a]	-

[a] Insufficient porewater to conduct measurements.
[b] No values listed in Bower and Bidwell (1978) for salinity of 17‰ and pH 6.5

Table 2 *Neanthes* Overlying Water Measurements (Range During Test)

Sample ID	Temperature (°C)	DO (mg/L)	pH	Salinity (‰)
Control 1	19.1 – 21.7	6.6 – 7.8	7.6 – 8.1	27 – 28
Control 2	19.1 – 21.9	6.5 – 8.0	7.6 – 8.1	27 – 29
S17	19.1 – 21.8	6.8 – 8.1	7.5 – 8.1	27 – 28
S18	19.2 – 22.0	6.8 – 8.0	7.5 – 8.0	27 – 28
S23	19.1 – 21.9	6.3 – 8.0	7.3 – 7.8	27 – 28
S24	19.0 – 22.0	6.6 – 7.9	7.4 – 8.0	27 – 28
S26	19.1 – 22.1	6.6 – 8.0	7.6 – 8.1	27 – 28

Table 3 *Neanthes* Overlying Water Ammonia Concentrations

Sample ID	Initial Total NH_3 (mg N/L)	Initial Un-Ionised NH_3 (mg N/L)	Final Total NH_3 (mg N/L)	Final Un-Ionised NH_3 (mg N/L)
Pooled Controls [a]	0.020	0.0005	0.403	0.0055
S17	0.142	0.0036	0.253	0.0028
S18	0.053	0.0014	0.540	0.0059
S23	0.205	0.0033	0.267	[b]
S24	0.646	0.0067	0.353	0.0038
S26	0.363	0.0091	0.187	0.0025

[a] A subsample from each of the controls was combined into one sample and analysed.
[b] Unionized ammonia concentration could not be calculated.

Table 4 28-day Polychaete (*Neanthes arenaceodentata*) Sediment Test Survival Results

Sample ID	Mean Survival (%)	SD (%)	Growth Rate (mg/individual/day)	SD
Control-1	96	5.5	0.68	0.02
Control-2	90	10.0	0.66	0.06
Pooled Controls	93	8.0	0.67	0.04
S17	85	12.9	0.65	0.08
S18	94	5.5	0.67	0.03
S23	98	4.5	0.68	0.05
S24	96	5.5	0.68	0.09
S26	100	0.0	0.89	0.13

Vizon SciTec Inc.
Vancouver, BC

Juvenile Polychaete (*Neanthes arenaceodentata*) Sediment Bioassay Test Data Summary (2-11-0932C)

Client Name/Location	Seacor Environmental Inc. / Victoria, BC
Testing Lab/Location	Vizon SciTec Inc. / Vancouver, BC
Sample Information	
Sample collection date (y/m/d)	05/02/03
Sample Temperature upon Arrival	-0.8°C (samples were not frozen)
Storage Conditions	From receipt to test initiation, the samples were stored in a cold room that was at 4 ± 2°C
Sediment and Pore Water Characterisation	See "Sediment Sample Descriptions" and "Pore Water Measurements" sheets
Date (y/m/d)/time of sample receipt at lab	05/02/05 @ N/A
Sample Names	S17, S18, S23, S24, S26
Type of Sample	Field collected sediments
Method of Collection	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Collector	See "Toxicity Test Request" sheet or "Chain of Custody" form
Sample Volume	4 L
Sample Containers	4-L white food grade plastic buckets
Information on Labelling/Coding	See "Toxicity Test Request" sheet or "Chain of Custody" form
Date Test Started and Ended (y/m/d)	05/02/24 / 05/03/24
Sediment Characterisation	See "Sediment Sample Descriptions" sheets
Test Organisms Imported from External Supplier	The EC document on the importation of test organisms was been followed (September 1999)
Species & Source	*Neanthes arenaceodentata* supplied by D. Reish, California State University, Long Beach, CA
Age at start of test	Emergent juveniles (2-3 weeks post-emergence)
Unusual appearance, behaviour, or treatment of organisms by supplier before shipping or by lab immediately preceding the test	See "Acclimation and Holding Conditions" sheets
Temp. & DO of shipping water immediately upon arrival	See "Acclimation and Holding Conditions" sheets
Acclimation rate & procedure	Fresh seawater was gradually added over the three day holding period. See "Acclimation and Holding Conditions" sheets for details.
Mortality upon arrival and 24 h preceding test	See "Acclimation and Holding Conditions" sheets
Test Conditions & Facilities	
Test method	Puget Sound Estuary Program. 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments. Juvenile Polychaete Sediment Bioassay and ASTM. 2000. Standard Guide for Conducting Sediment Toxicity Tests with Polycaetous Annelids.
Test type	Static-renewal, every 3rd day, 28-day test
Test temperature	19 – 22 °C
Photo-period	24 hours light
Test vessels	1-L glass jars
Persons performing test	Karen Kinnee, Meg Lauder, Juniper Ross, Christina Hagberg, Pam Sinclair, Melissa Kozma
Control/dilution water	Vancouver aquarium, from Burrard Inlet, 40-45' deep inlet, gravity sand filter w/sand mesh size 22, passed through UV steriliser

Type & quantity of chemicals added to control/dilution water	No chemicals were added
Control sediment	Mackenzie Beach, Tofino, BC sand, as collected by Doug Swanston, Seacology, North Vancouver, BC on February 19, 2005
Sediment volume and depth	175 mL & 4 cm
Overlying water volume and depth	775 mL & 9 cm depth
# of replicates per sample	5
# of organisms per test vessel	10
Manner & rate of renewal of overlying water	Every third day; ~30% (250 mL) of solution was removed with by pouring off water. The water was replaced with new seawater.
Water quality measurements	See "Test Conditions and Survival Data" sheets
Deviation from test method	Ten *Neanthes* were added to each test vessel, rather than 5. Therefore, the feeding was increased to 10 mL (from 5 mL) of an 8 g/L TertraMarine slurry, every second day. The test temperature was >21.0°C on a few days during the test. Control 1 Replicate B had 15 *Neanthes* in it, rather than 10. This replicate was excluded from the growth rate calculations. One or more crabs were found in S17, replicates C, D and E. As the survival in S17 replicate D was significantly lower than the other replicates, this replicate was excluded from the survival and growth rate calculations, as the crabs may have eaten some of the *Neanthes*. There was nothing else unusual about the test, no other deviations from test method, and no other problems with this test.
Analytical Methods	**Ammonia:** Vizon SOP 5330, which is based on American Public Health Association. 1998a. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Method 4500 – NH_3 Nitrogen (Ammonia) F Ammonia Selective Electrode Method. APHA, AWWA, WEF, Washington, DC.
Results	
# & % mortality and SD in each sample	See "Test Conditions and Survival Data" and "Summary of Survival Results" sheets.
Initial total biomass based on dry weight (mean ± SD)	0.54 ± 0.22 mg / worm
Initial pore water salinity	See "Pore Water Measurements" sheet.
Endpoints	28-d survival (%) for each replicate and mean (± SD) for each treatment. 28-d total and individual biomass for each replicate and mean (± SD) for each treatment. 28-d individual growth rate for each replicate and mean (± SD) for each treatment. See "Summary of Survival Results for *N. arenaceodentata* Tests" and Dry Weights of Polychaete Worms" sheet.
Endpoint results	**Comparison with Laboratory Control** No significant differences in survival and growth rate between the lab control and the samples ($p > 0.05$). **Comparison with Reference Sediment (S-26)** No significant differences in survival between S-26 and the other samples ($p > 0.05$). There was a significant difference in individual growth rate between S-26 and the four other samples ($p < 0.05$). Statistical analyses were conducted using ToxCalc Version 5.0.18

QA/QC	
Test Validity Criteria	Control survival was ≥90% (mean pooled control survival was 93%). Control growth rate was > 0.38 mg/individual/day (mean pooled control growth rate was 0.67 mg/individual/day).
Ref tox test LC50 (95% CL) (mg Cd^{2+}/L) and duration of test	6.0 (5.9, 6.1) Test duration was 96 hours.
Invalid Ref tox test?	No; the control survival was 94%. For the test to be valid the control survival should be ≥90%. See "Control Chart" sheet.
Ref tox test historic mean (± SD) & 2SD range (mgCd^{2+}/L)	9.1 ± 1.5; 2SD range: (6.0 – 12.1)
Date of ref tox test (y/m/d)	05/02/24
Organisms batch and conditions of ref tox test	Same batch of organisms used in the tests as for the reference toxicant; static, 96-h water-only test

APPENDIX A

SAMPLE INFORMATION

	Parameter	Description	Details	Activity Log
Seacor Environmental Inc. : Victoria				
Batch 050207F				
050207F-01				
Completed	**Special Request 1: 28 Day Neanthes Test**	SEDIMENT : S17 Sample Date: Feb 03, 2005	ANALYST: KAREN KINNEE Project Manager: Karen Kinnee Project Number(s): 2-11-0932C	Received: Feb 07, 2005 Completed: Mar 24, 2005
050207F-02				
Completed	**Special Request 1: 28 Day Neanthes Test**	SEDIMENT : S-18 Sample Date: Feb 03, 2005	ANALYST: KAREN KINNEE Project Manager: Janet Pickard Project Number(s): 2-11-0932C	Received: Feb 07, 2005 Completed: Mar 24, 2005
050207F-03				
Completed	**Special Request 1: 28 Day Neanthes Test**	SEDIMENT : S-23 Sample Date: Feb 03, 2005	ANALYST: KAREN KINNEE Project Manager: Janet Pickard Project Number(s): 2-11-0932C	Received: Feb 07, 2005 Completed: Mar 24, 2005
050207F-04				
Completed	**Special Request 1: 28 Day Neanthes Test**	SEDIMENT : S-24 Sample Date: Feb 03, 2005	ANALYST: KAREN KINNEE Project Manager: Janet Pickard Project Number(s): 2-11-0932C	Received: Feb 07, 2005 Completed: Mar 24, 2005
050207F-05				
Completed	**Special Request 1: 28 Day Neanthes Test**	SEDIMENT : S-26 Sample Date: Feb 03, 2005	ANALYST: KAREN KINNEE Project Manager: Janet Pickard Project Number(s): 2-11-0932C	Received: Feb 07, 2005 Completed: Mar 24, 2005

SEACOR
ENVIRONMENTAL INC.

6-40 Cadillac Avenue
Victoria, BC V8Z 1T2
Phone: (250) 475-9595
Fax: (250) 475-9596
www.seacorcanada.com

FAX

Date:	February 7, 2005	**Proj. No.:**	201.01022.01
To:	Karen Kinnee	**From:**	Michael McLeay
Company:	Vizon Scitech	**Pages:**	6
Fax:	(604) 224 - 0540	**Phone No.:**	(604) 224 - 4331
Re:	**Chain of Custodies**		

Hi Karen:

Here are faxed copies of the chain of custodies for our Union Bay samples. I have mailed you the original hard copies.

Michael.

NO TNT on 522/25

This message is intended only for the use of the individual or entity to which it is addressed and may contain confidential information. If you have received this information in error, please destroy it and notify us immediately at (250) 475-9595.

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE Feb 7/05
	CLIENT	SAMPLE NUMBER 050207 F-01

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME	Michael McLeay	NAME	Tara Siemens
COMPANY	SEACOR Environmental	COMPANY	SEACOR Environmental
ADDRESS	#6-40 Cadillac Ave	ADDRESS	#200 - 1620 W. 8th Ave.
CITY	Victoria	CITY	Vancouver
PROVINCE	BC	PROVINCE	BC
COUNTRY	Canada	COUNTRY	Canada
POSTAL CODE	V8Z 1T2	POSTAL CODE	V6J 1Y4
TELEPHONE	(250)475-7595	TELEPHONE	(604) 738-2500
FAX	(250)475-7596	FAX	(604) 738-2508

SAMPLE INFORMATION

SAMPLE NAME	S17	
SAMPLING METHOD	composite scoops using SS spoon	SPECIAL INSTRUCTIONS
SAMPLED BY	Michael McLeay	subsample for chem, post homog.
DATE	02/03/05	TIME 17:20
CONTAINER TYPE AND NUMBER	plastic bucket (1)	using provided jars

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	Neanthes 28-day ASTM Method	✓		with PSEP method water changes and feeding

-0.8

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
Michael McLeay	02/03/05	22:00	CCh	Feb 7/05	15:29

Vizon SciTec Inc.
3650 Westbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE Feb 7/05
	CLIENT	SAMPLE NUMBER 050207F -02

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME	Michael McLeay	NAME	Tara Siemens
COMPANY	SEACOR Environmental	COMPANY	SEACOR Environmental
ADDRESS	#6 - 40 Cadillac Ave.	ADDRESS	#200 - 1620 W. 8th Ave
CITY	Victoria	CITY	Vancouver
PROVINCE	BC	PROVINCE	BC
COUNTRY	Canada	COUNTRY	Canada
POSTAL CODE	V8Z 1T2	POSTAL CODE	V6J 1V4
TELEPHONE	(250) 475-9595	TELEPHONE	(604) 738-2500
FAX	(250) 475-9596	FAX	(604) 738-2508

SAMPLE INFORMATION

SAMPLE NAME	S18
SAMPLING METHOD	composite scoops using SS spoon
SAMPLED BY	Michael McLeay
DATE	02/03/05
TIME	18:00
CONTAINER TYPE AND NUMBER	plastic bucket (1)
SPECIAL INSTRUCTIONS	Subsample for chem, post homog. using provided jars

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	Neanthes 28-day ASTM Method	✓		with PSEP method water changes and feeding

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
Michael McLeay	02/03/05	22:00	CCr	Feb 7/05	15:29

Vizon SciTec Inc.
3650 Westbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Rec'd Feb 5/05

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE Feb 7/05
	CLIENT	SAMPLE NUMBER 050207 F-03

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME	Michael McLeay	NAME	Tara Siemens
COMPANY	SEACOR Environmental	COMPANY	SEACOR
ADDRESS	#6-40 Cadillac Ave.	ADDRESS	# 200-1620 W. 8th Ave.
CITY	Victoria	CITY	Vancouver
PROVINCE	BC	PROVINCE	BC
COUNTRY	Canada	COUNTRY	Canada
POSTAL CODE	V8Z 1T2	POSTAL CODE	V6J 1V4
TELEPHONE	(250) 475-9595	TELEPHONE	(604) 738-2500
FAX	(250) 475-9596	FAX	(604) 738-2508

SAMPLE INFORMATION

SAMPLE NAME	S23	
SAMPLING METHOD	composite scoops using SS spoon	SPECIAL INSTRUCTIONS
SAMPLED BY	Michael McLeay	Subsample for chem, post homog.
DATE	02/03/05	TIME 19:55
CONTAINER TYPE AND NUMBER	plastic bucket (1)	using provided jars

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPEMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	Neanthes 28-day ASTM Method	✓		with PSEP method water changes and feeding

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
Michael McLeay	02/03/05	22:00	C Chan	Feb 7/05	15:29

I:\QA\Forms\Requisitions Chain of Custody Forms\Current\Complete\Toxicity Tests Required Form v1.doc

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Rec'd Feb 5/05

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE Feb 7/05
	CLIENT	SAMPLE NUMBER 050207F -04

REPORTING AND BILLING INFORMATION

RESULTS TO:	INVOICE TO (IF DIFFERENT):
NAME Michael McLeay	NAME Tara Siemens
COMPANY SEACOR Environmental	COMPANY SEACOR Environmental
ADDRESS #6-40 Cadillac Ave	ADDRESS #200-1620 W. 8th
CITY Victoria PROVINCE BC	CITY Vancouver PROVINCE BC
COUNTRY Canada POSTAL CODE V8Z 1T2	COUNTRY Canada POSTAL CODE V6J 1V4
TELEPHONE (250)475-9595 FAX (250)475-9596	TELEPHONE (604) 738-2500 FAX (604) 738-2508

SAMPLE INFORMATION

SAMPLE NAME S24

SAMPLING METHOD composite scoops using SS spoon	SPECIAL INSTRUCTIONS
SAMPLED BY Michael McLeay	Subsample for chem, post homog.
DATE 02/03/05 TIME 20:20	using provided jars
CONTAINER TYPE AND NUMBER	

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINE/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER Neanthes 28-day ASTM Method		✓		with PSEP method water changes and feeding

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
Michael McLeay	02/03/05	22:00		Feb 7/05	15:27

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Rec'd Feb 5/05

TOXICITY TEST REQUEST SHEET

VIZON SCITEC

FOR LAB USE ONLY	PROJECT NUMBER	DATE Feb 7
	CLIENT	SAMPLE NUMBER 050207F -05

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME	Michael McLeay	NAME	Tara Siemens
COMPANY	SEACOR Environmental	COMPANY	SEACOR Environmental
ADDRESS	#6 -40 Cadillac Ave	ADDRESS	#200 - 1620 W. 8th Ave
CITY	Victoria	PROVINCE	BC
COUNTRY	Canada	POSTAL CODE	V8Z 1T2
TELEPHONE	(250) 475-4595	FAX	(250) 475-4596
CITY	Vancouver	PROVINCE	BC
COUNTRY	Canada	POSTAL CODE	V6J 1Y4
TELEPHONE	(604) 738-2500	FAX	(604) 738-2508

SAMPLE INFORMATION

SAMPLE NAME: S26

SAMPLING METHOD: Composite scoops using SS spoon	SPECIAL INSTRUCTIONS
SAMPLED BY: Michael McLeay	Subsample for chem, post homog. using provided jars
DATE: 02/03/05 TIME: 21:40	
CONTAINER TYPE AND NUMBER	

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN (PASS/FAIL)	CONCENTRATION RANGE	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URCHINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER	Neanthes 28-day ASTM Method	✓		with PSEP method water changes and feeding

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: NAME	DATE	TIME	RECEIVED BY: NAME	DATE	TIME
Michael McLeay	02/03/05	22:00		Feb 4/05	15:29

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0510
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Rec'd Feb 5/05

APPENDIX B

SEDIMENT CHARACTERISATION

Sediment Sample Descriptions

Project # 2-11-09320

Sample Name	Vizon Sample # / Name	Date Homogenised / Subsampled	Grain Size	Type of Debris Removed	Endemic Animals Removed	Colour / Odor	N Applied & Stored in Cold Rm	Analyst
Union Bay S17	050207F-01	05/02/23	↑ >2.0mm very rocky	n/a	none	faint coal black	✓	mk
S18	050207F-02	05/02/23	72.0mm	rocks, 2-5 cm	none	dark brown / none	✓	kq
S23	050207F-03	05/02/23	clay & sand & rocks	rocks 74cm	none	dark brown -dirt	✓	kq
S24	050207F-04	05/02/23	sand & big rocks	big rocks 710cm	worm like creatures	reddish brown / iron+iodine	✓	kq
S26	050207F-05	05/02/23	0-2.0m - full of ground shells coarse sand	big seashells & rocks	2 worms	gray / organic smell	✓	mk.

APPENDIX C

28-DAY JUVENILE POLYCHAETE TEST DATA

Neanthes arenaceodentata Survival and Growth Test-28-d Survival

Start Date:	2/24/2005	Test ID:	NA076-0105	Sample ID:	076-Seacor
End Date:	3/24/2005	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	SM-Sediment
Sample Date:	2/3/2005	Protocol:	PSEP-95/07-Polychaetes	Test Species:	NA-Neanthes arenaceodentata

Comments:

Conc-%	1	2	3	4	5
Control 1	0.9000	1.0000	1.0000	0.9000	1.0000
Control 2	1.0000	0.8000	1.0000	0.9000	0.8000
S17	0.9000	1.0000	0.7000	0.8000	
S18	1.0000	1.0000	0.9000	0.9000	0.9000
S23	1.0000	0.9000	1.0000	1.0000	1.0000
S24	0.9000	1.0000	0.9000	1.0000	1.0000
S26	1.0000	1.0000	1.0000	1.0000	1.0000

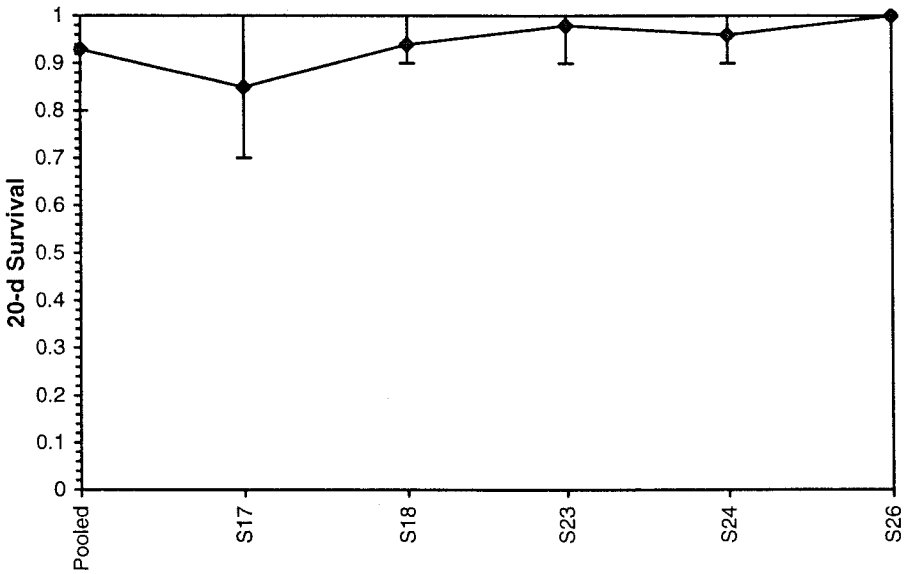
			Transform: Untransformed					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Pooled	0.9300	1.0000	0.9300	0.8000	1.0000	8.852	10		
S17	0.8500	0.9140	0.8500	0.7000	1.0000	15.188	4	22.00	13.00
S18	0.9400	1.0108	0.9400	0.9000	1.0000	5.827	5	40.50	21.00
S23	0.9800	1.0538	0.9800	0.9000	1.0000	4.563	5	48.50	21.00
S24	0.9600	1.0323	0.9600	0.9000	1.0000	5.705	5	44.50	21.00
S26	1.0000	1.0753	1.0000	1.0000	1.0000	0.000	5	52.50	21.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96138	0.908	-0.3657	0.24446
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.27)	1.1767	2.30601		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Rank Sum Test indicates no significant differences

Dose-Response Plot



Neanthes arenaceodentata Survival and Growth Test-28-d Survival

Start Date:	2/24/2005	Test ID:	NA076-0205	Sample ID:	076-Seacor
End Date:	3/24/2005	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	SM-Sediment
Sample Date:	2/3/2005	Protocol:	PSEP-95/07-Polychaetes	Test Species:	NA-Neanthes arenaceodentata

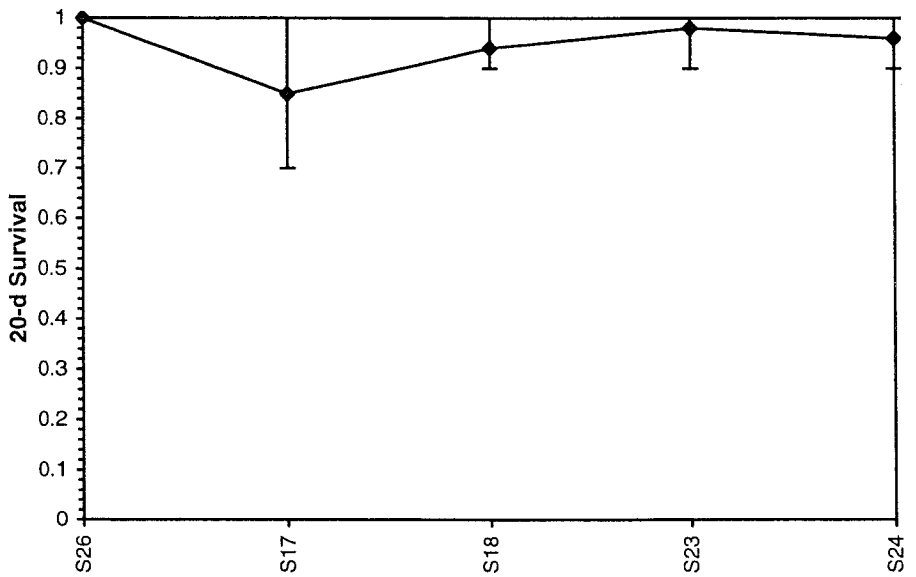
Comments:

Conc-%	1	2	3	4	5
S26	1.0000	1.0000	1.0000	1.0000	1.0000
S17	0.9000	1.0000	0.7000	0.8000	
S18	1.0000	1.0000	0.9000	0.9000	0.9000
S23	1.0000	0.9000	1.0000	1.0000	1.0000
S24	0.9000	1.0000	0.9000	1.0000	1.0000

			Transform: Untransformed					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
S26	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	5		
S17	0.8500	0.8500	0.8500	0.7000	1.0000	15.188	4	12.50	10.00
S18	0.9400	0.9400	0.9400	0.9000	1.0000	5.827	5	20.00	16.00
S23	0.9800	0.9800	0.9800	0.9000	1.0000	4.563	5	25.00	16.00
S24	0.9600	0.9600	0.9600	0.9000	1.0000	5.705	5	22.50	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95578	0.884	-0.1069	1.60163
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Rank Sum Test indicates no significant differences				

Dose-Response Plot



Neanthes arenaceodentata Survival and Growth Test-Growth Rate

Start Date:	2/24/2005	Test ID:	NA076-0105	Sample ID:	076-Seacor
End Date:	3/24/2005	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	SM-Sediment
Sample Date:	2/3/2005	Protocol:	PSEP 1991-Polychaetes	Test Species:	NA-Neanthes arenaceodentata
Comments:					

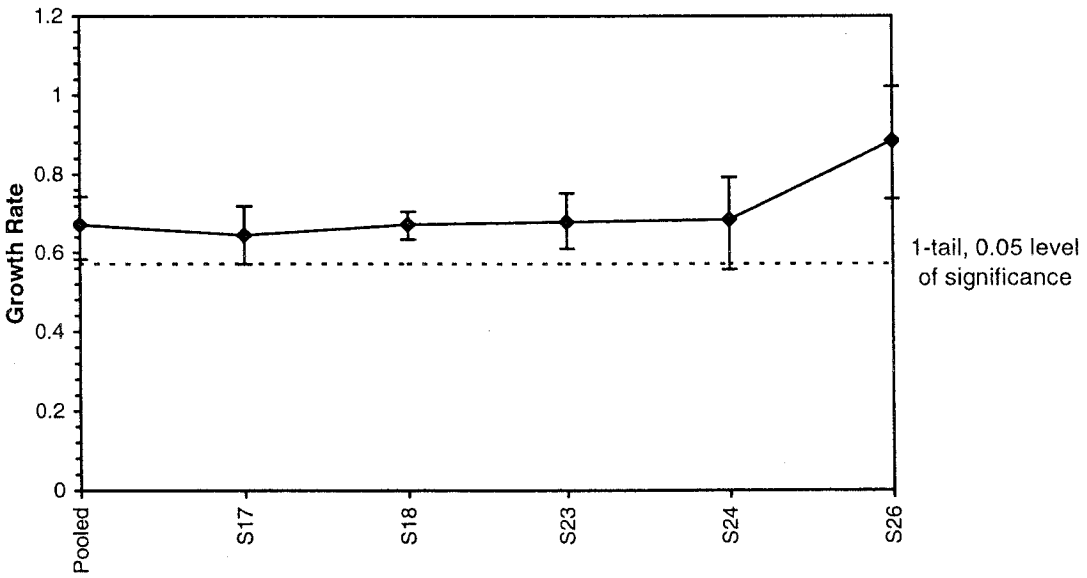
Conc-%	1	2	3	4	5
Control 1	0.6570	0.6832	0.6971	0.6902	
Control 2	0.6834	0.6611	0.6472	0.5828	0.7434
S17	0.7132	0.5708	0.7190	0.5780	
S18	0.6858	0.6696	0.6692	0.6336	0.7053
S23	0.6598	0.6784	0.7526	0.6104	0.6942
S24	0.7932	0.6783	0.5571	0.7288	0.6662
S26	0.7678	0.9398	0.7377	0.9585	1.0220

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Pooled	0.6717	1.0000	0.6717	0.5828	0.7434	6.496	9			
S17	0.6452	0.9606	0.6452	0.5708	0.7190	12.692	4	0.608	2.473	0.1077
S18	0.6727	1.0015	0.6727	0.6336	0.7053	3.922	5	-0.025	2.473	0.1000
S23	0.6791	1.0110	0.6791	0.6104	0.7526	7.622	5	-0.182	2.473	0.1000
S24	0.6847	1.0194	0.6847	0.5571	0.7932	12.730	5	-0.322	2.473	0.1000
S26	0.8852	1.3177	0.8852	0.7377	1.0220	14.136	5	-5.279	2.473	0.1000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97387	0.906	-0.3058	-0.03
Bartlett's Test indicates equal variances (p = 0.05)	11.2602	15.0863		
The control means are not significantly different (p = 0.57)	0.59965	2.36462		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test indicates no significant differences	0.09997	0.14883	0.03942	0.00525	1.6E-04	5, 27

Dose-Response Plot



Neanthes arenaceodentata Survival and Growth Test-Growth Rate

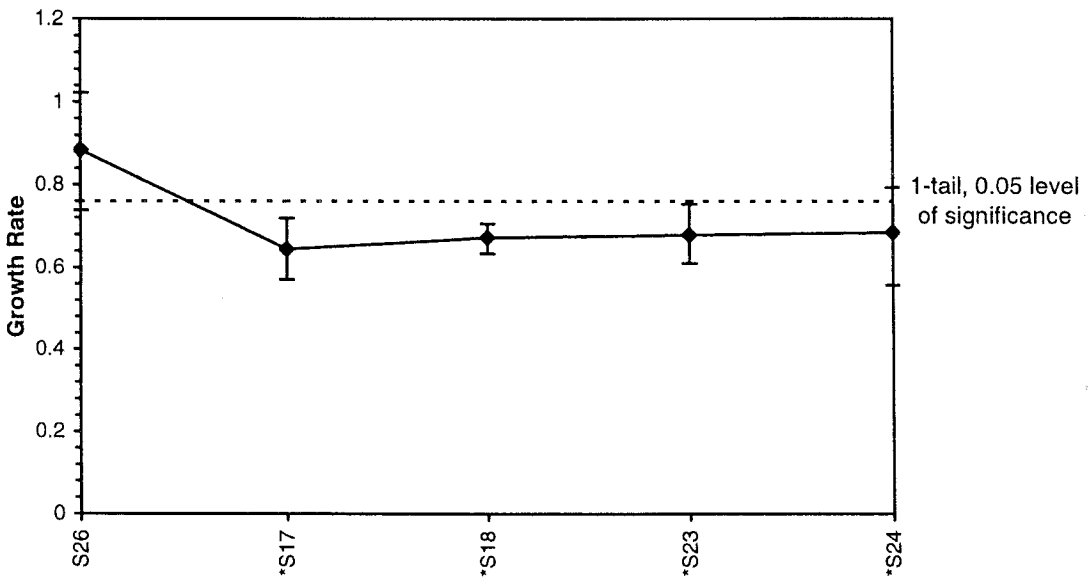
Start Date:	2/24/2005	Test ID:	NA076-0205	Sample ID:	076-Seacor
End Date:	3/24/2005	Lab ID:	VIZ-Vizon SciTec Toxicology	Sample Type:	SM-Sediment
Sample Date:	2/3/2005	Protocol:	PSEP 1991-Polychaetes	Test Species:	NA-Neanthes arenaceodentata
Comments:					

Conc-%	1	2	3	4	5
S26	0.7678	0.9398	0.7377	0.9585	1.0220
S17	0.7132	0.5708	0.7190	0.5780	
S18	0.6858	0.6696	0.6692	0.6336	0.7053
S23	0.6598	0.6784	0.7526	0.6104	0.6942
S24	0.7932	0.6783	0.5571	0.7288	0.6662

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
S26	0.8852	1.0000	0.8852	0.7377	1.0220	14.136	5			
*S17	0.6452	0.7290	0.6452	0.5708	0.7190	12.692	4	4.381	2.433	0.1333
*S18	0.6727	0.7600	0.6727	0.6336	0.7053	3.922	5	4.114	2.433	0.1256
*S23	0.6791	0.7672	0.6791	0.6104	0.7526	7.622	5	3.991	2.433	0.1256
*S24	0.6847	0.7736	0.6847	0.5571	0.7932	12.730	5	3.881	2.433	0.1256

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97378		0.884		-0.2771	-0.424
Bartlett's Test indicates equal variances (p = 0.10)	7.88281		13.2767			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Bonferroni t Test indicates significant differences	0.12565	0.14195	0.04604	0.00667	0.00131	4, 19

Dose-Response Plot



Summary of Survival Results for *N. arenaceodentata* Tests on Seacor Sediments (2-11-0932C)

Sample ID	Log In ID	# Surviving	Sample Survival (%)	Mean Survival (%)	SD
Control-1	-	9	90	96.0	5.5
Control-1	-	15	100	**Pooled**	**Pooled**
Control-1	-	10	100	93.0	8.2
Control-1	-	9	90		
Control-1	-	10	100		
Control-2	-	10	100	90.0	10.0
Control-2	-	8	80		
Control-2	-	10	100		
Control-2	-	9	90		
Control-2	-	8	80		
S17	050207F-01	9	90	85.0	12.9
S17	050207F-01	10	100		
S17	050207F-01	7	70		
S17	050207F-01	4	40		
S17	050207F-01	8	80		
S18	050207F-02	10	100	94.0	5.5
S18	050207F-02	10	100		
S18	050207F-02	9	90		
S18	050207F-02	9	90		
S18	050207F-02	9	90		
S23	050207F-03	10	100	98.0	4.5
S23	050207F-03	9	90		
S23	050207F-03	10	100		
S23	050207F-03	10	100		
S23	050207F-03	10	100		
S24	050207F-04	9	90	96.0	5.5
S24	050207F-04	10	100		
S24	050207F-04	9	90		
S24	050207F-04	10	100		
S24	050207F-04	10	100		
S26	050207F-05	10	100	100.0	0.0
S26	050207F-05	10	100		
S26	050207F-05	10	100		
S26	050207F-05	10	100		
S26	050207F-05	10	100		

Two large crabs were found in S17 Replicate C and this replicate was excluded from the calculations

Vizon SciTec Inc.
Vancouver, BC

***Neanthes arenaceodentata* 28-d Test**
Dry Weights of Polychaete Worms

Client # & Name: #76 Seacor
Vizon # 050207F-01 to 050207F-05
Start Date & Time: 05/02/24 @ 11:15
Sample Date: 05/02/03
Toxcalc. File ID: NA076-0105
End Date: 02/03/24
Sample Received: 05/02/05
Organism Lot #: DR050221
Weighing Dates: 23-Mar-05 / 25-Mar-05
Sample ID: S17, 18, 23, 24, 26
Analyst(s): Melissa Kozma, Karen Kinnee, Meg Lauder

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)	Wt. of Worms (mg)	Mean Wt./Worm (mg)	Mean Wt./Conc. (mg)	SD	Estimated Individual Growth Rate (mg/day)	Estimated Individual Growth Rate (mg/day)	SD
1	Control 1	A	9	1.15152	1.32192	170.40	18.93	19.63	0.49	0.66	0.68	0.02
2	Control 1*	B	15	1.14229	1.32291	180.62	12.04	**Pooled**	**Pooled**	0.41	**Pooled**	**Pooled**
3	Control 1	C	10	1.15188	1.34856	196.68	19.67	19.35	1.22	0.68	0.67	0.04
4	Control 1	D	9	1.14328	1.32380	180.52	20.06			0.70		
5	Control 1	E	10	1.15265	1.35130	198.65	19.87			0.69		
6	Control 2	A	10	1.15357	1.35031	196.74	19.67	19.12	1.63	0.68	0.66	0.06
7	Control 2	B	8	1.14704	1.29943	152.39	19.05			0.66		
8	Control 2	C	10	1.16004	1.34663	186.59	18.66			0.65		
9	Control 2	D	9	1.15824	1.30996	151.72	16.86			0.58		
10	Control 2	E	8	1.15050	1.32133	170.83	21.35			0.74		
11	S17	A	9	1.16311	1.34767	184.56	20.51	20.79	5.27	0.71	0.65	0.08
12	S17	B	10	1.14538	1.31060	165.22	16.52			0.57		
13	S17	C	7	1.14431	1.28901	144.70	20.67			0.72		
14	S17 **	D	4	1.13378	1.25185	118.07	29.52			1.03		
15	S17	E	8	1.13014	1.26391	133.77	16.72			0.58		
16	S18	A	10	1.15001	1.34741	197.40	19.74	19.37	0.74	0.69	0.67	0.03
17	S18	B	10	1.13625	1.32913	192.88	19.29			0.67		
18	S18	C	9	1.14923	1.32272	173.49	19.28			0.67		
19	S18	D	9	1.15193	1.31645	164.52	18.28			0.63		
20	S18	E	9	1.16001	1.34260	182.59	20.29			0.71		
21	S23	A	10	1.14995	1.34009	190.14	19.01	19.55	1.45	0.66	0.68	0.05
22	S23	B	9	1.14460	1.32041	175.81	19.53			0.68		
23	S23	C	10	1.14724	1.36334	216.10	21.61			0.75		
24	S23	D	10	1.14209	1.31838	176.29	17.63			0.61		
25	S23	E	10	1.15415	1.35390	199.75	19.98			0.69		

Vizon SciTec Inc.
Vancouver, BC

***Neanthes arenaceodentata* 28-d Test**
Dry Weights of Polychaete Worms

Client # & Name: #76 Seacor
Vizon # 050207F-01 to 050207F-05
Start Date & Time: 05/02/24 @ 11:15
Sample Date: 05/02/03
Toxcalc. File ID: NA076-0105
End Date: 02/03/24
Sample Received: 05/02/05
Organism Lot #: DR050221
Weighing Dates: 23-Mar-05 / 25-Mar-05
Sample ID: S17, 18, 23, 24, 26
Analyst(s): Melissa Kozma, Karen Kinnee, Meg Lauder

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)	Wt. of Worms (mg)	Mean Wt./Worm (mg)	Mean Wt./Conc. (mg)	SD	Estimated Individual Growth Rate (mg/day)	Estimated Individual Growth Rate (mg/day)	SD
26	S24	A	9	1.15232	1.35705	204.73	22.75	19.71	2.44	0.79	0.68	0.09
27	S24	B	10	1.14940	1.34472	195.32	19.53			0.68		
28	S24	C	9	1.14220	1.28743	145.23	16.14			0.56		
29	S24	D	10	1.15614	1.36560	209.46	20.95			0.73		
30	S24	E	10	1.14537	1.33730	191.93	19.19			0.67		
31	S26	A	10	1.14327	1.36363	220.36	22.04	25.32	3.50	0.77	0.89	0.13
32	S26	B	10	1.14360	1.41213	268.53	26.85			0.94		
33	S26	C	10	1.15161	1.36354	211.93	21.19			0.74		
34	S26	D	10	1.14351	1.41728	273.77	27.38			0.96		
35	S26	E	10	1.14972	1.44126	291.54	29.15			1.02		
36	QA/QC	A	-	1.13910	1.13912	0.02	-	-	-	-	-	-
37	QA/QC	B	-	1.14332	1.14330	-0.02	-			-	-	-
38	Control 1	C	9	1.15154	1.32190	170.36	18.93			-	-	-
Analyst			KK	MK	ML							

* Control 1 B exlcluded from calculations as 15 *Neanthes* were recovered at test termination and growth was less than the other control replicates.
** Two large crabs were found in S17 Replicate C and this replicate was excluded from the calculations

Vizon SciTec, Inc.
Vancouver, BC

***Neanthes arenaceodentata* 28-d Test**
Dry Weights of Polychaete Worms

Client # & Name: #76 Seacor

Start Date and Time: 05/02/24 @ 11:15

Sample Date: 05/02/03

End Date: 02/03/24

Sample Received: 05/02/05

Weighing Dates: 24-Feb-05 & 27-Feb-05

Organism Lot #: DR050221

Vizon # 050207F-01 to 050207F-05

Sample ID: S17, 18, 23, 24, 26

Toxcalc. File ID: NA076-0105

Analyst(s): Melissa Kozma, Juniper Ross

Boat #	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)	Wt. of Worms (mg)	Mean Wt./Worm (mg)	Mean Wt. Per Worm (mg)	SD
1	A	5	1.14775	1.15179	4.04	0.81	0.54	0.22
2	B	5	1.14759	1.14908	1.49	0.30		
3	C	5	1.14260	1.14449	1.89	0.38		
4	D	5	1.15738	1.16101	3.63	0.73		
5	E	5	1.14880	1.15121	2.41	0.48		
Analyst		MK	MK	JR				

Vizon SciTec *Neanthes arenaceodentata* Survival and Change in Biomass Test
Test Conditions and Survival Data

Client # & Name: #076 - Seacor
Start Date and Time: 05/02/24 @ 11:15
Vizon Project #: 2-11-932C
End Date: 05/03/24
Organism Lot #: DR050Z22 RK
Age at Start of Test: 2-3 wks post emergence
Statistics File: NA076-0105
Samples Received: 05/02/05
Analyst(s): J. Ross, CHaegberg, P. Sinclair K. Kinnee MKomita

Feeding Regime: ~~5~~ 10 mL per Replicate of 8.0 g/L SeaWater TetraMarine Slurry ~~(1 shot @ 5, using 50 mL Eppendorf attachment)~~

Salinity should be 28 ± 2‰ Temperature should be 20 ± 1°C

Sample ID: CTRL-1 Vizon #: N/A Sample Date: 05/02/19

Date	05/02/24	05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/20 CH	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20 1	Day 22 5+	Day 24 8
Temp. (ºC)	20.0	21.5	19.1	21.6	21.7	20.8	21.8 RKE	20.7	20.3	21.0
D.O. (mg/L)	7.8	6.9	7.9	6.7	7.0	7.2	7.81 RKE	6.7	6.6	7.8
pH	7.9	7.8	8.0	7.8	8.1	8.0	8.0	7.9	7.6	7.6
Salinity (‰)	27	27	27	27	27	27	27	27	27	28
Analyst	SB	JR	mk	SB	CH	CH	PS	SB	CH	mk

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	~~8~~ 9 MK	~~10~~ 10 MK	10	9	10	Initial	Final
Analyst	MK	MK	MK	MK	MK	SB	KK

Sample ID: S17 Vizon #: 050207F-01 Sample Date: 05/02/03

Date	05/02/24	05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/20 CH	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20 1	Day 22 5+	Day 24 8
Temp. (ºC)	19.8	21.4	19.1	21.7	21.8	21.0	21.0	21.0	20.5	~~21.1~~ 21.1 mk
D.O. (mg/L)	7.8	7.1	8.1	7.2	7.1	7.1	7.3	6.8	6.9	7.7
pH	7.9	~~7.89~~ JR	7.9	8.0	8.1	7.9	8.0	7.8	7.5	7.5
Salinity (‰)	27	27	27	27	27	27	28	27	27	28
Analyst	SB	JR	mk	SB	CH	CH	PS	SB	CH	mk

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	9	10	7	4	~~8~~ 8	Initial	Final
Analyst	MK	MK	MK	MK	MK	SB	KK

Vizon SciTec *Neanthes arenaceodentata* Survival and Change in Biomass Test
Test Conditions and Survival Data

Client # & Name: #076 - Seacor
Start Date and Time: 05/02/24 @ 11:15
Vizon Project #: 2-11-0932C
End Date: 05/03/24
Organism Lot #: DR050222A (2 KK EE 05/03 KK) NA076-0205
Age at Start of Test: 2-3 wks post-emergence
Statistics File: NA076-0105
Samples Received: 05/02/05
Analyst(s): J. Ross, CHagberg, P. Sinclair K. Kinnee M. Kraus

Feeding Regime: 5/10 mL per Replicate of 8.0 g/L Seawater TetraMarine Slurry ~~(1 shot @ 5, using 50 mL Eppendorf attachment)~~

Salinity should be 28 ± 2‰ Temperature should be 20 ± 1°C

Sample ID: S18 Vizon #: 050207F-02 Sample Date: 05/02/03

Date	05/02/24	05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/20 (CH)	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20 (1)	Day 22 (5H)	Day 24 (E)
Temp. (ºC)	19.8	21.4	19.2	21.6	22.0	21.2	21.0	20.8	20.5	21.2
D.O. (mg/L)	7.9	7.2	8.0	7.4	6.9	7.2	7.3	6.8	7.0	7.6
pH	7.9	7.9	8.0	8.0	7.8	7.9	7.9	7.7	7.6	7.5
Salinity (‰)	27	27	27	27	27	27	~~28~~ 27	27	27	28
Analyst	SB	JR	MK	SB	CH	CH	PS	SB	CH	MK

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	10	10	9	9	9	Initial	Final
Analyst	~	~	~	~	~	SB	KK

Sample ID: S23 Vizon #: 050207F-03 Sample Date: 05/02/03

Date	05/02/24	05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/20 (CH)	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20 (1)	Day 22 (5H)	Day 24 (E)
Temp. (ºC)	19.8	21.6	19.1	21.7	21.9	21.2	21.1	20.8	20.6	21.2
D.O. (mg/L)	7.9	7.0	8.0	7.2	7.0	7.2	7.2	6.8	6.3	7.9
pH	7.7	7.7	7.8	7.8	7.8	7.8	7.7	7.5	7.3	7.4
Salinity (‰)	27	27	27	27	27	27	27	27	27	28
Analyst	SB	JR	MK	SB	CH	CH	PS	SB	CH	MK

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	10	9	10	10	10	Initial	Final
Analyst	~	~	~	~	~	SB	KK

Vizon SciTec *Neanthes arenaceodentata* Survival and Change in Biomass Test

Test Conditions and Survival Data

Client # & Name: #076 - Seacor

Start Date and Time: 05/02/24@11:15

Vizon Project #: 2-11-0932C

End Date: 05/03/24

Organism Lot #: DR050222
NA076-0205

Age at Start of Test: 2-3 wks post-emergence

Statistics File: NA076-0105

Samples Received: 05/02/05

Analyst(s): J. Ross, C Haagberg, P. Sinclair K. Kinnee M. Kozma

Feeding Regime: ~~8~~ 10 mL per Replicate of 8.0 g/L Seawater TetraMarine Slurry ~~(1 shot @ 5, using 50 mL Eppendorf attachment)~~

Salinity should be 28 ± 2‰ Temperature should be 20 ± 1°C

Sample ID: S24 Vizon #: 050207F-04 Sample Date: 05/02/03

Date	05/02/24	05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/CH	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	Day 22 5A	Day 24 8
Temp. (ºC)	19.9	21.6	19.0	21.7	22.0	21.2	21.2	20.8	20.5	21.1
D.O. (mg/L)	7.4	6.7	7.9	6.8	6.9	7.1	7.1	6.8	6.6	7.7
pH	7.5	7.7	7.9	7.8	8.0	7.8	7.9	7.8	7.4	7.5
Salinity (‰)	27	27	27	27	27	27	27	27	27	28
Analyst	SB	JR	mk	SB	CH	CH	PS	SB	CH	mk

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	9	10	9	10	10	Initial	Final
Analyst	~	~	~	~	~	SB	KK

Sample ID: S26 Vizon #: 050207F-05 Sample Date: 05/02/03

Date	05/02/24	05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/CH	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	Day 22 5A	Day 24 8
Temp. (ºC)	19.9	21.6	19.1	21.7	22.1	21.2	21.2	20.8	20.~~5~~7	~~7.4~~ 21.1
D.O. (mg/L)	7.9	7.0	8.0	7.1	6.6	7.1	7.1	6.7	6.69	7.4 ee mk
pH	7.9	7.9	8.1 ~~7.80~~ EE mk	8.1	8.0	7.9	8.0	7.9	7.7	7.6
Salinity (‰)	28	27	27	27	27	27	27	27	27	28
Analyst	SB	JR	mk	SB	CH	CH	PS	SB	CH	mk

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	10	10	10	10	10	Initial	Final
Analyst	~	~	~	~	KK	SB	KK

Vizon SciTec *Neanthes arenaceodentata* Survival and Change in Biomass Test
Test Conditions and Survival Data

Client # & Name: #076 - Seacor
Start Date and Time: 05/02/24 @ 11:15
Vizon Project #: 2-11-0932C
End Date: 05/03/24
Organism Lot #: DR050223 NA076-0205
Age at Start of Test: 2-3 wks post-emergence
Statistics File: NA076-0105
Samples Received: 05/02/05
Analyst(s): J. Ross, CHagberg P. Sinclair K. Kinnee H. Kozma

Feeding Regime: ~~8~~ mL per Replicate of 8.0 g/L Seawater Tetramarine Slurry (1 shot @ 5, using 50 mL Eppendorf attachment)

Salinity should be 28 ± 2‰ Temperature should be 20 ± 1°C

Sample ID: CTR1 - 2 Vizon #: N/A Sample Date: 05/02/19

Date		05/02/27	05/03/02	05/03/05	05/03/08	05/03/11	05/03/14	05/03/17	05/03/20	05/03/24
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	Day 22	Day 24
Temp. (ºC)	20.0	21.5	19.1	21.7	21.9	21.1	21.0	20.9	20.6	21.2
D.O. (mg/L)	7.8	6.9	8.0	7.3	7.0	7.2	7.1	6.5	6.9	7.7
pH	7.9	7.8	8.1	8.1	8.1	8.0	8.0	7.8	7.6	7.7
Salinity (‰)	27	27	27	27	27	27	27	27	27	29
Analyst	KK	JR	MK	SB	CH	CH	PS	SB	CH	MK

EE KK 05/03/24 KK 05/03/24 EE

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving	10	~~8~~ 9	10	9	8	Initial	Final
Analyst		MK / MK		MK	MK	KK	KK

Sample ID: Vizon #: Sample Date:

Date										
Replicate	A	B	C	D	E	A	B	C	D	E
	Day 0	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 20	Day 22	Day 24
Temp. (ºC)										
D.O. (mg/L)										
pH										
Salinity (‰)										
Analyst										

Replicate	A	B	C	D	E	Ammonia Samples Taken	
# Surviving						Initial	Final
Analyst							

Vizon SciTec, Inc.
Vancouver, BC

***Neanthes arenaceodentata* 28-d Test**
Dry Weights of Polychaete Worms

Client # & Name: #76 - Seacor
Start Date and Time: 05/02/24 @ 11:15
Sample Date: 05/02/03
End Date: 05/03/24
Sample Received: 05/02/05
Weighing Dates: 23-Mar-05 | 25-Mar-05
Organism Lot #: DR050224 2 gp EE
Vizon # 050207F-01 to 05
Sample ID: S17, 18, 23, 24, 26
Toxcalc. File ID: NA076-0105/0205
Analyst(s): mk Karen Kinnee M. Powell

Boat #	Sample ID	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)
1	Control 1	A	9	1.15152	1.32192
2	Control 1	B	15	1.14229	1.32291
3	Control 1	C	10	1.15188	1.34856
4	Control 1	D	9	1.14328	1.32380
5	Control 1	E	10	1.15265	1.35130
6	Control 2	A	10	1.15357	1.35031
7	Control 2	B	~~8~~	1.14704	1.29943
8	Control 2	C	10 KK	1.16004	1.34663
9	Control 2	D	~~5~~ 9 05/03/24	1.15824	1.30996
10	Control 2	E	8	1.15050	1.32193
11	S17	A	9	1.16311	1.34767
12	S17	B	10	1.14538	1.31060
13	S17	C	7	1.14431	1.28901
14	S17	D	4	1.13278	1.25185
15	S17	E	8	1.13014	1.26391
16	S18	A	10	1.15001	1.34741
17	S18	B	10	1.13625	1.32913
18	S18	C	9	1.14923	1.32272
19	S18	D	9	1.15193	1.31645
20	S18	E	9	1.16001	1.34260
21	S23	A	10	1.14995	1.34009
22	S23	B	9	1.14460	1.32041
23	S23	C	10	1.14724	1.36354
24	S23	D	10	1.14209	1.31838
25	S23	E	10	1.15415	1.35390
26	S24	A	9	1.15232	1.35705
27	S24	B	10	1.14940	1.34472
28	S24	C	9	1.14220	1.28427
29	S24	D	10	1.15614	1.36560
30	S24	E	10	1.14537	1.33730
31	S26	A	10	1.14327	1.36363
32	S26	B	10	1.14360	1.41213
33	S26	C	10	1.15161	1.36354
34	S26	D	10	1.14351	1.41728
35	S26	E	10	1.14972	1.44126
36	QA/QC	-		1.13910	1.13912
37	QA/QC	-		1.14332	1.14330
1	Control 1	A		1.15158 4 mk	1.32190
Analyst			KK	mk	mk

* 05/03/22 - Empty weigh boats put in 60°C drying oven @ 13:10 SB

1.41213 ~ 1.35390

Propped after 2 wt

Vizon SciTec

Neanthes 28 Day Survival and Change in Biomass Test
Aeration and Feeding Checks

Client # & Name: 76 Seacor

Start Date & Time: 05/02/24 @ 11:15

Initial when aeration is checked. If air is off record DO and note which replicate(s) in comments section.

	Day 0	1	0	1	2	3	4	5	6	7	8	9
Date	05/02/23	05/02/24		05/02/25	05/02/26	05/02/27	05/02/28	05/03/01	05/03/02	05/03/03	05/03/04	05/03/05
Early AM	—	LH ✓		✓ SB	✓	✓ JR	✓ CH	✓ mk	✓ mk	✓ mk	✓ SB	✓ SB
Mid-day	✓	—		✓ SB	✓	✓ JR	✓ CH	✓ mk	✓ mk	✓ mk	✓ SB	✓ SB
Late PM	KK	CH ✓		✓ SB	✓ SB	✓ JR	✓ CH	✓ mk	✓ mk	✓ mk	✓ SB	✓ SB

	Day 10	11	12	13	14	15	16	17	18	19
Date	05/03/06	05/03/07	05/03/08	05/03/09	05/03/10	05/03/11	05/03/12	05/03/13	05/03/14	05/03/15
Early AM	✓ JR	✓ CH	✓ CH	✓ SB	✓ CH	✓ CH	✓ SB	✓ JR	✓ PS	✓ SB
Mid-day	✓ JR	✓ CH	✓ CH	✓ SB	✓ CH	✓ CH	✓ CH	✓ JR	✓ PS	✓ SB
Late PM	✓ JR	✓ CH	✓ CH	✓ SB	✓ CH	✓ CH	✓ SB		✓ CH	✓ SB

	Day 20	21	Day 22	23	24	25	26	27	28
Date	05/03/16	05/03/17	05/03/18	05/03/19	05/03/20	05/03/21	05/03/22	05/03/23	05/03/24
Early AM	✓ CH	✓ SB	✓ CH	✓ SB	✓ JR	✓ CH	✓ CH	✓ KK	✓ KK
Mid-day	✓ CH	✓ SB	✓ CH	✓ SB	✓ JR	✓ CH	✓ CH	✓ mk	
Late PM	✓ CH	✓ SB	✓ CH	✓ SB	✓ JR	✓ CH	✓ CH		

Comments:

05/02/24 - 08:45 AM - Airline feeding S24-C, S18-E, Ctrl 1-D, S24-B, S17-D & S24-A not connected. - Restarted airline @ 08:50 Am SB

05/03/02 -

05/03/05 - turned room temp. down slightly SB

05/03/08 - S17 rep D - 2 large crabs removed.

05/03/11 - S17 rep C - 1 crab removed.

05/03/14 - S17 rep E - 1 crab removed PS

05/03/18 - S26 rep C - airline blocked, clipped + restarted CH

05/03/20 - none flag or emerged

Feeding Check			
Day	Date	Analyst	
Day 0	05/02/24	CH	10mL
Day 2	05/02/26	SB	
Day 4	05/03/28	CH	5mL
Day 6	05/02/03	mk	10mL
Day 8	05/03/04	SB	10ml

Feeding Check			
Day	Date	Analyst	
Day 10	05/03/06	JR	10mL
Day 12	05/03/08	CH	10mL
Day 14	05/03/10	CH	10mL
Day 16	05/03/12	SB	10mL
Day 18	05/03/14	PS	10ml

Feeding Check			
Day	Date	Analyst	
Day 20	05/03/16	CH	10mL
Day 22	05/03/18	CH	10mL
Day 24	05/03/20	JR	10mL
Day 26	05/03/22	CH	10ml

Vizon SciTec
Vancouver, BC

***Neanthes* Survival and Growth Test**
Overlying Water Measurements (prior to H_2O Δ)

Client # & Name: 76 Seacor (KEE 05/03/28) **Test Initiation Date:** 05/02/24 @ 11:15

Seawater Arrival Date: 05/02/15 4

Date	Day	Temperature (°C)	D.O. (mg/L)	pH	Salinity (‰)
05/02/23	0	18.6	8.1	8.0	28
05/02/27	3	19.7	7.8	8.0	27
05/03/02	6	18.6	8.5	8.0	27
05/03/05	9	21.4	7.9	8.1	27
05/03/08	12	CH ee ~~22.5~~ 20.3	CH ee 7.4 7.5	8.0	26
05/03/11	15	21.0	7.5	8.0	27
05/03/14	18	21.5	7.5	8.0	26
05/03/17	21	20.5	7.4	8.0	27
05/03/21	~~24~~ 25	20.3	7.7	8.0	27

Randomization Chart for *Neanthes* Tests
Use the coloured dots to find appropriate concentrations
Position Map
Back Wall

5	10	15	20	25	30	35	E
4	9	14	19	24	29	34	D
3	8	13	18	23	28	33	C
2	7	12	17	22	27	32	B
1	6	11	16	21	26	31	A

Front of Counter

Client # 76

Position #	Treatment	Replicate	Colour
12	Control 1	A	Lt. Blue
32	Control 1	B	Lt. Blue
34	Control 1	C	Lt. Blue
22	Control 1	D	Lt. Blue
28	Control 1	E	Lt. Blue
2	Control 2	A	Red
26	Control 2	B	Red
10	Control 2	C	Red
8	Control 2	D	Red
5	Control 2	E	Red
4	S17	A	Lt. Green
19	S17	B	Lt. Green
3	S17	C	Lt. Green
17	S17	D	Lt. Green
29	S17	E	Lt. Green
1	S18	A	Orange
18	S18	B	Orange
6	S18	C	Orange
14	S18	D	Orange
23	S18	E	Orange
20	S23	A	White
7	S23	B	White
13	S23	C	White
25	S23	D	White
15	S23	E	White
16	S24	A	White
21	S24	B	Yellow
24	S24	C	Yellow
33	S24	D	Yellow
30	S24	E	Yellow
27	S26	A	Dk. Green
31	S26	B	Dk. Green
9	S26	C	Dk. Green
11	S26	D	Dk. Green
35	S26	E	Dk. Green

Client # Ref Tox

Position #	Treatment	Replicate	Colour
9	Control	A	White
8	Control	B	White
2	3.2	A	White
12	3.2	B	White
3	5.6	A	White
10	5.6	B	White
4	10	A	White
11	10	B	White
5	18	A	White
1	18	B	White
6	32	A	White
7	32	B	White

Vizon SciTec Inc.
Vancouver, BC

***Neanthes arenaceodentata* 28-d Test**
Dry Weights of Polychaete Worms

KK 05/03/30

Client # & Name: #076 Seacor

Start Date and Time: 24-Feb-05 @ ~~10:35~~ 11:15

Sample Date: 05/02/03

End Date: 24-Mar-05

Sample Received: 05/02/05

Weighing Dates: 24-Feb-05 / 27-Feb-05

Organism Lot #: DR050222

Vizon # 050207F-01to-05

Sample ID: S17, 18, 23, 24, 26

Toxcalc. File ID: NA076-0105
NA076-0205

Analyst(s): mk, J. Ross

Boat #	Replicate	# Worms	Boat Wt. (g)	Boat & Worms Wt. (g)
1	A	5	1.14775	1.15179
2	B	5	1.14759	1.14908
3	C	5	1.14260	1.14449
4	D	5	1.15738	1.16101
5	E	5	1.14880	1.15121
Analyst		mk	mk	JR

28-d *Neanthes* Test Observations

Date: 05/02/15 Sample ID's: S17, S18, S23, S24, S26

Client # & Name: #76 Seacor Project No. 2-11-0932C

- Salinity of Overlying/Porewater in samples.
- Refractometer #1 - Calibrated to 0 ‰ DI H_2O
- Removed samples from 4±2°C at 7:15 am

Sample ID	Salinity	Analyst
S17	dry	KK
S18	dry	KK
S23	18	KK
S24	15	KK
S26	25	KK

- S24 - lid not completely on - S26 as well.
- S23 - no N_2 as did not open very far to remove H_2O.
- Covered with N_2 gas - S17, S18, S24, S26
- Returned to cold room @ 8:15 am

K. Kinnee

Vizon SciTec
Vancouver, BC

***Neanthes* Sediment Test**
Porewater Measurements

Client # & Name: #76 Seacor

Start Date: 05/02/24 c 11:15

Date Measured: 05/02/23

Start Time: 11:15

Sample ID	Salinity (‰)	Temperature (°C)	pH	NH_3 Sample Taken	Analyst
S17	—	—	—	—	KK
S18	—	19.3°C KK EC 05/02/23	—	—	KK
S23	17	~~21.0°C~~	6.5	✓	KK
S24	8	21.0°C	7.6	—	KK
S26	—	—	—	—	KK
Control	20	14.5	7.7	✓	KK

KK 05/03/23

Comments

- S18, S17 + S26 - no porewater available for measurements
- S24 - only sufficient porewater to ~~do~~ do pH, salinity + temperature. (< 10 mL)
- S23 - only sufficient porewater to do NH_3, pH, salinity + temperature (< 100 mL)

ANALYSIS REPORT

DATE: March 29/05
PROJECT No: 2-11-932C
APPROVED BY:

CLIENT: Michael McLeay
Environmental Scientist/Biologist
Seacor Environmental Inc.
#6-40 Cadillac Avenue
Victoria, B.C. V8Z 1T2
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VIZON SCITEC
Vancouver, B.C.
3650 Wesbrook Mall
Vancouver, B.C.
Canada
TEL: (604) 224-4331
FAX: (604) 224-0540

COMMENTS: Ammonia Analysis Results

Sample Description	Sample Date	Ammonia mgN/L	QC True mgN/L	QC Found mgN/L	Log#
S 23 Porewater	Feb.23/05	2.19 (2.37)	0.103	0.108	050224B-01
S 17 Seawater Day 0	Feb.24/05	0.142			B-02
S 18 Seawater Day 0	Feb.24/05	0.053			B-03
S 23 Seawater Day 0	Feb.24/05	0.205			B-04
S 24 Seawater Day 0	Feb.24/05	0.646			B-05
S 26 Seawater Day 0	Feb.24/05	0.363			B-06
Control Seawater Day 0	Feb.24/05	0.020			B-07
S 17 Seawater Day 28	Mar. 24/05	0.253	0.069	0.073	050324A-01
S 18 Seawater Day 28	Mar. 24/05	0.540			A-02
S 23 Seawater Day 28	Mar. 24/05	0.267			A-03
S 24 Seawater Day 28	Mar. 24/05	0.353			A-04
S 26 Seawater Day 28	Mar. 24/05	0.187			A-05
Control Seawater Day 28	Mar. 24/05	0.403 (0.403)			A-06

Results in parenthesis are for duplicates

Vizon SciTec, Inc.
Vancouver, BC

Total and Unionized Ammonia Results for Seacor *Neanthes* Tests - February/March 2005

	Porewater Ammonia Initial (mg/L)			Overlying Ammonia Day 0 (mg/L)			Overlying Ammonia Day 28 (mg/L)		
Seacor Sample Name	Total	% Unionized Ammonia[a]	Unionized	Total	% Unionized Ammonia [a]	Unionized	Total	% Unionized Ammonia [a]	Unionized
Control	0.046	1.20	0.0006	0.020	2.55	0.0005	0.403	1.36	0.0055
S17	[b]	-	-	0.142	2.55	0.0036	0.253	1.09	0.0028
S18	[b]	-	-	0.053	2.55	0.0014	0.540	1.09	0.0059
S23	2.19	[c]	-	0.205	1.63	0.0033	0.267	[d]	-
S24	[b]	-	-	0.646	1.03	0.0067	0.353	1.09	0.0038
S26	[b]	-	-	0.363	2.50	0.0091	0.187	1.36	0.0025

[a] Values from Bower CE and Bidwell, JP. 1978. Ionization of Ammonia in Seawater: Effects of Temperature, pH and Salinity. Journal of Fisheries Research Board of Canada 35:1012-1016.

[b] Ammonia was not measured due to insufficient sample volume.

[c] No values listed for salinity of 17‰ and pH 6.5.

[d] No values listed for pH of 7.4.

DR0502212

450 worms 20/bad

Billing for 450

Nereites Arenaceodentata

Lab population established in 1964
from 6 worms — no new "blood" added

Salinity ~ 35.0 ppt
D.O. & pH not taken - no need

Hewicks, Mgr

Vizon SciTec

Neanthes arenaceodentata

Juvenile Survival and Growth Test Arrival Conditions

Client # : #76 Seacor

Date & Time of Arrival: 05/02/22 @ 9:39

Vizon #: 050207F-01 thru 05

Age upon Arrival: juvenile

Organism Lot #: DR050222

Number of *Neanthes* Ordered: 480

Water (ml) per Bag: 5

Number of Shipping Bags: 24

Arrival Conditions

Bag ID	# Dead	% Dead	Salinity (‰)	Temp. (ºC)	pH	DO (mg/L)	Feeding	Analyst
	0	0	35	x216	—	—	✓	JP
					7.4	9.9		JP
05/02/23 final	0	0	30	19.1	7.8	6.9	✓	CH
05/02/23 initial	—	—	278 CH	18.6	8.0	8.1	✓	CH
05/02/24 final			29	20.4	7.8	7.0		SB
					KK 05/03/22			
Total	0	0	—	—	—	—	—	—

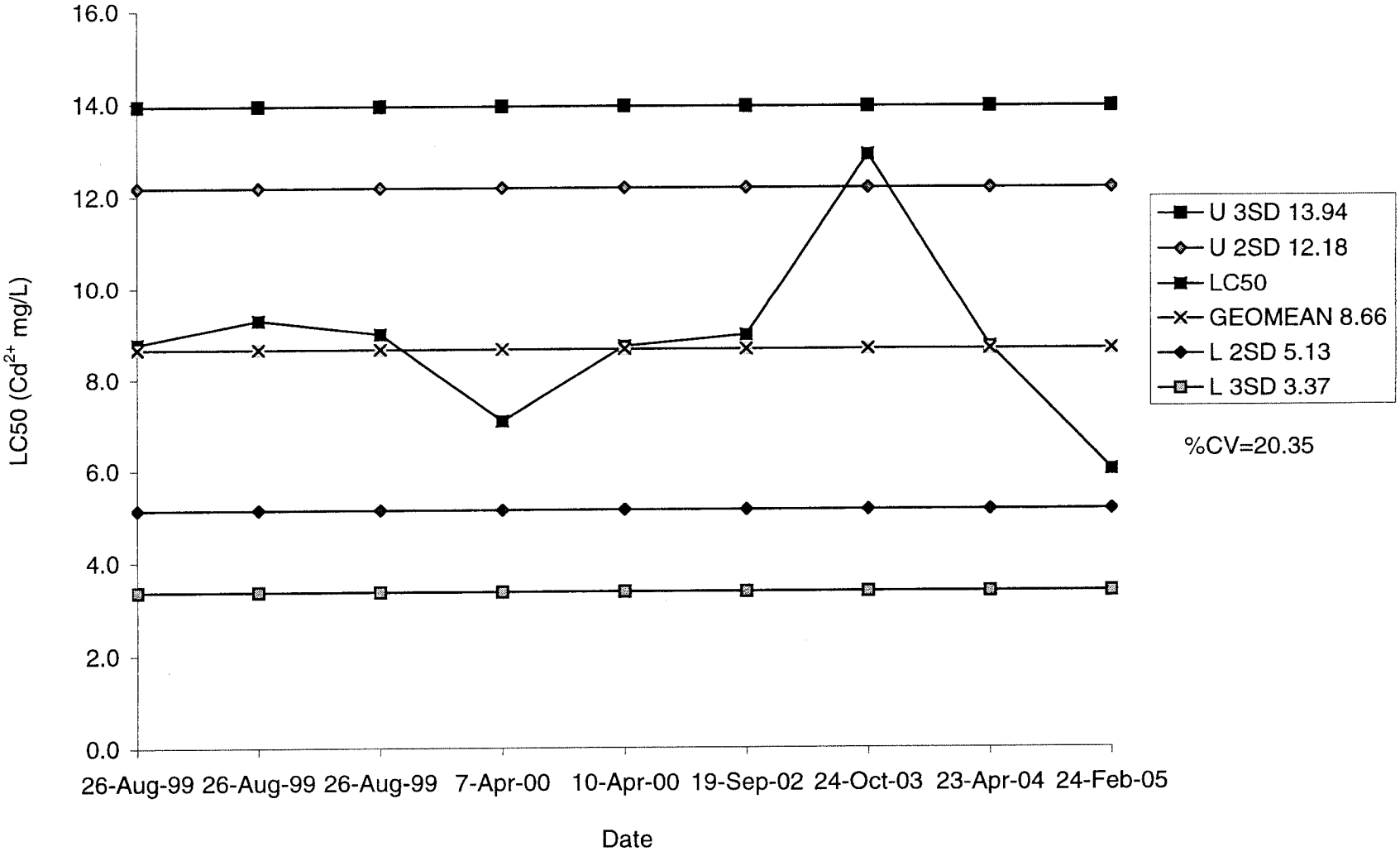
Comments 05/02/22 Analyst

Neanthes were placed into 8 glass pans. (about 30/pan. 750 ml of seawater (30‰) was added. The resulting seawater was 31‰. 8 mL of Tetra Marine Feed (8g/L) feed to each pan. Covered w/plastic wrap & aerated JP

05/02/23 H2O Δ on all pans. CH
Fed 8mL of Tetramarine Feed (8g/L) to each pan @ 09:30.
All appear normal @ H2O Δ.

VIZON SCITEC INC.
Vancouver, BC

Neanthes arenaceodentata
96-hr Reference Toxicant Control Chart for Cadmium Chloride



December 2005

Laboratory Report

Seacor Environmental Inc.

Marine Toxicity Testing

September 2005 Samples

PREPARED FOR:

Seacor Environmental Inc.
Victoria, BC

PREPARED BY:

EVS environment consultants

A Member of the Golder Group of Companies

Seacor Environmental Inc.

Marine Sediment Toxicity Testing

SEPTEMBER 2005 SAMPLES

LABORATORY REPORT

Prepared for

Seacor Environmental Inc.
#6-40 Cadillac Avenue
Victoria, BC
Canada V8Z 1T2

Prepared by

EVS-Golder North Vancouver Laboratory
195 Pemberton Avenue
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V7P 2R4
CANADA

Golder Project No.

04-1424-076

December 2005

TABLE OF CONTENTS

TABLE OF CONTENTS i
LIST OF TABLES ii
ACKNOWLEDGEMENTS iii

1.0 INTRODUCTION 1

2.0 METHODS 2

2.1 28-d Polychaete (*Neanthes arenaceodentata)* Survial and Growth Toxicity Test 2
2.2 Statistical Analysis 2
2.3 Quality Assurance/Quality Control (QA/QC) 2

3.0 RESULTS 6

3.1 28-d Polychaete (*Neanthes arenaceodentata)* Survial and Growth Toxicity Test 6
3.2 Quality Assurance/Quality Control (QA/QC) 6

4.0 REFERENCES 9

APPENDIX I Raw Data and Statistical Analyses: 28-d *Neanthes arenaceodentata* Toxicity Test

APPENDIX II Chemical Analysis Data

APPENDIX III Chain-of-Custody Forms

LIST OF TABLES

Table 1: 28-d polychaete (*Neanthes arenaceodentata*) survival and growth toxicity test methods. 4

Table 2: Reference toxicant test conditions for *N. arenaceodentata*..... 5

Table 3: Summary of results for the 28-d *N. arenaceodentata* toxicity test.. 7

Table 4: Summary of Bulk ammonia and sulphide values for the *N. arenaceodentata* sediment toxicity test..... 8

Table 5: Summary of ammonia and sulphide values for the *N. arenaceodentata* sediment toxicity test..... 8

Table 6: Summary of interstitial pH and salinity for the *N. arenaceodentata* sediment toxicity test..... 8

ACKNOWLEDGEMENTS

Toxicity testing was conducted by Marriah Grey, Ann-Marie Norris, Lee Card, Meg Lauder and Mike Brassil. Statistical analyses were performed by Ann-Marie Norris and Marriah Grey. The report was written by Ann-Marie Norris and reviewed by Edmund Canaria. Quality Assurance/Quality Control (QA/QC) review was conducted by Julianna Galfi Kalocai.

1.0 INTRODUCTION

EVS-Golder North Vancouver, BC laboratory conducted marine sediment toxicity testing for Seacor Environmental Inc. on six sediment samples identified as S27, S28, S29, S30, S31 and S33. The samples were collected on September 16 and 17, 2005. They were received at the Golder North Vancouver laboratory on September 19, 2005 and were stored in the dark at 4°C until test initiation.

All sediment samples were tested using the standard *Neanthes arenaceodentata* toxicity test. The test exposure period was modified and extended from the standard 20 d to a longer period of 28 d as requested by the client. ALS Environmental, Vancouver, BC performed all the relevant ammonia and sulphide analyses for the toxicity test.

This report describes the methods and results of these toxicity tests. The raw data and statistical analyses are provided in Appendix I, the Chemical analyses are provided in Appendix II and the chain-of-custody forms are provided in Appendix II.

2.0 METHODS

2.1 28-D POLYCHAETE (*NEANTHES ARENACEODENTATA*) SURVIAL AND GROWTH TOXICITY TEST

The polychaete (*Neanthes arenaceodentata)* survival and growth toxicity test was conducted in accordance with procedures described in Puget Sound Estuary Program (PSEP, 1995). The organism exposure period was modified to 28 days instead of 20 days as requested by the client. Test conditions and methods are summarized in Table 1.

N. arenaceodentata were exposed to test sediments for 28 days. The test was monitored for temperature and aeration daily. Every three days, approximately 1/3 of the overlying water in each test vessel was renewed. Water quality parameters (temperature, dissolved oxygen, pH, and salinity) were measured prior to each water renewal. The organisms were fed 40 mg of ground TetraMarine™ per test vessel every two days. At test termination, the organisms were collected from the sediments and final survival was recorded. Surviving organisms were rinsed in distilled water, transferred to corresponding pre-weighed aluminum pans, and dried in an oven at approximately 60°C for 24 h. The pans containing the organisms were then desiccated and weighed to determine dry weights.

2.2 STATISTICAL ANALYSIS

Statistical analyses for all tests were conducted using the computer software program TOXCALC (version 5.0.23; Tidepool Scientific Software, 1994).

2.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This study followed a comprehensive QA/QC Program to ensure full documentation and minimize possible errors in computation and reporting of results. The following general QA/QC guidelines were applied in this test: use of negative controls, use of positive controls, replication, instrument calibration, water quality maintenance and record-keeping, and use of standard operating procedures (SOPs). To ensure that the generated data and reporting met quality standards, all data and statistical analyses were reviewed by a member of our QA/QC Committee prior to reporting the results.

Toxicity testing was carried out in accordance with applicable test methodologies and/or standards of practice. Our liability is limited solely to the cost of re-testing in the event of non-compliance with such test specifications or standards of practice. Golder/EVS accepts no responsibility or liability for the interpretation or use of these testing results by

others, nor for any delay, loss, damage or interruptions of testing, collection, preparation, and delivery of samples or test results resulting from events or circumstances beyond our control.

Table 1: 28-d polychaete (*Neanthes arenaceodentata*) survival and growth toxicity test methods.

TEST PARAMETER	TEST CONDITIONS
Organism collection details	Laboratory cultured *N. arenaceodentata* collected by Dr. Donald Reish, California State University, Long Beach, CA on October 17, 2005.
Acclimation	Organisms received at 21.0 °C and 35 ppt salinity and held at 20 ± 1 °C, 30 ppt and 24:0 (light: dark) 3 days prior to testing; no temperature or salinity acclimation was required.
Organism age and size	Juvenile; 0.5 – 1.0 mg.
Sample holding time	~1 month prior to test initiation.
Test vessel	1-L glass jars; 175 mL (2 cm) sediment; 800 mL overlying seawater.
Dilution water	Natural seawater collected from a depth of 15 – 20 m in Burrard Inlet, Vancouver, BC; filtered through a 0.45-μm filter and ultraviolet light-sterilized within 2 days of use; aerated vigorously prior to use.
Negative control	Silica sand (#30 grit).
Test duration	28 d.
Organism seeding	*N. arenaceodentata* of appropriate sizes were randomly transferred from holding chambers to vials of seawater (5/vial) and each test replicate was randomly seeded with one vial of organisms.
No. of replicates	5 replicates per treatment; 5 organisms per replicate.
Feeding regime	40 mg crushed TetraMarine™ fish flakes per replicate every 2 days.
Test treatments	Test sediments and negative control.
Measurements	Temperature measured daily; dissolved oxygen, pH, and salinity measured every 3 days before water renewal; porel water ammonia and sulphides measured at day-1; overlying water ammonia and sulphide measured at test initiation and termination.
Aeration	All replicates gently aerated throughout test at ~100 bubbles/min.
Water renewal	1/3 of overlying water renewed every 3 days.
Lighting	Overhead full spectrum fluorescent lights; ambient light.
Photoperiod	24:0 (Light:Dark).
Test temperature	20 ± 1°C.
Endpoints	Survival; average individual dry weight; average individual growth rate; total dry weight.
Test validity	≥ 90% mean control survival; ≥ 0.38 mg/worm/day mean control growth rate.
Reference protocols	PSEP (1995).

Table 2: Reference toxicant test conditions for *N. arenaceodentata*.

***N. ARENACEODENTATA* 96-H REFERENCE TOXICANT TEST CONDITIONS**	
Reference toxicant	Cadmium (from $CdCl_2 \bullet 2½H_2O$)
No. of replicates	One replicate of 900 mL test solution in 1-L glass jars
Concentrations	3.2, 5.6, 10, 18, and 32 mg/L Cd, plus seawater negative control
Feeding regime	None
Aeration	All treatments are gently aerated throughout test at ~100 bubbles/min
Photoperiod	24:0 (light:dark)
Temperature	20 ± 1°C
Endpoint	Survival
Test validity	LC50 estimate within two standard deviations of the laboratory mean; ≥ 90% mean control survival

3.0 RESULTS

Summary of results for the *Neanthes arenaceodentata* toxicity test is provided in Table 3. Total ammonia and sulphide values are provided in Tables 4 and 5 The daily test monitoring data, results of the statistical and chemical analyses are provided in Appendices I and II.

3.1 28-D POLYCHAETE (*NEANTHES ARENACEODENTATA*) SURVIAL AND GROWTH TOXICITY TEST

The results of the *N. arenaceodentata* sediment toxicity tests are summarized in Table 3. Data from test monitoring and statistical analyses are provided in Appendix I.

The mean survival for the negative control was 100%. There were no statistically significant differences in any of the samples for the survival endpoint relative to the negative control ($p \leq 0.05$).

The mean individual dry weight for the negative control was 19.6 ± 4.8 mg/worm. No statistically significant response was observed in any of the samples relative to the negative control ($p \leq 0.05$).

The mean individual growth rate for the negative control was 0.68 ± 0.17 mg/worm/day. This endpoint showed no statistically significant individual growth rate response in any of the samples relative to the negative control ($p \leq 0.05$).

The mean total dry weight for the negative control was 98.2 ± 23.9 mg. This endpoint also showed no statistically significant response in any of the samples when compared to the negative control ($p \leq 0.05$).

3.2 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The *N. arenaceodentata* sediment toxicity tests met all specified criteria for test validity as outlined in the Puget Sound Estuary Program (1995) protocol.

Point estimates for the reference toxicant test were all within two standard deviations of the laboratory mean, indicating that the tests were within acceptable limits of variability.

Table 3: Summary of results for the 28-d *N. arenaceodentata* toxicity test.

Sample ID	Survival (%) (Mean ± SD)[1]	Individual Dry Weight (mg/worm) (Mean ± SD)[1]	Individual Growth Rate (mg/worm/day) (Mean ± SD)[1]	Total Dry Weight (mg) (Mean ± SD)[1]
Control	100.0 ± 0.0	19.6 ± 4.8	0.68 ± 0.17	98.2 ± 23.9
S27	100.0 ± 0.0	15.1 ± 4.0	0.52 ± 0.14	75.7 ± 20.2
S28	96.0 ± 8.9	22.1 ± 5.7	0.77 ± 0.20	105.4 ± 26.3
S29	100.0 ± 0.0	20.2 ± 7.8	0.70 ± 0.28	100.9 ± 39.2
S30	100.0 ± 0.0	18.8 ± 4.2	0.65 ± 0.15	94.2 ± 21.2
S31	96.0 ± 8.9	21.4 ± 2.9	0.75 ± 0.10	102.6 ± 15.8
S33	100.0 ± 0.0	14.5 ± 5.1	0.50 ± 0.18	72.5 ± 25.4

[1]n = 5 replicates per treatment; 5 worms per replicate

Table 4: Summary of Bulk ammonia and sulphide values for the *N. arenaceodentata* sediment toxicity test.

Sample ID	S27	S28	S29	S30	S31	S33
Bulk Pore Water Ammonia (mg/L N)	2.85	4.69	5.39	3.68	0.639	37.4
Bulk Pore Water Sulphides (mg/L S)	<0.020	0.73	0.76	<0.020	<0.020	0.093

Table 5: Summary of ammonia and sulphide values for the *N. arenaceodentata* sediment toxicity test.

Sample ID	Overlying Water Ammonia (mg/L N) Day 0	Overlying Water Ammonia (mg/L N) Day 28	Overlying Water Sulphides (mg/L S) Day 0	Overlying Water Sulphides (mg/L S) Day 28
D-Control	0.358	4.51	<0.020	<0.020
S27	0.611	4.22	<0.020	<0.020
S28	1.07	0.300	<0.020	<0.020
S29	0.489	3.98	<0.020	<0.020
S30	0.048	0.546	<0.020	<0.020
S31	1.13	6.20	<0.020	<0.020
S33	<0.020	0.155	<0.020	<0.020

Table 6: Summary of interstitial pH and salinity for the *N. arenaceodentata* sediment toxicity test.

Sample ID	S27	S28	S29	S30	S31	S33
Intersitial Salinity(ppt)	16	17	22	24	26	30
Interstitial pH	6.6	7.4	6.9	6.8	4.5	7.6

4.0 REFERENCES

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. Final Report, July 1995. 85 pp

Tidepool Scientific Software. 1994. TOXCALC Comprehensive Toxicity Data Analysis and Database Software, Version 5.0.23 Tidepool Scientific Software, McKinleyville, CA. 80 pp.

APPENDIX I

Raw Data and Statistical Analyses: 28-d *Neanthes arenaceodentata* Toxicity Test

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
MARINE POLYCHAETE SEDIMENT TOXICITY TEST DATA SUMMARY

Client: Seacor
Lab Project No.: 04-1424-076
Lab Work Order No.: 0500398

Lab Analysts: SXB, MFB, MTG, LJC, MCL, AKN, AXF, RSD (PSEP 1995 ~~EAMN~~ EAMN)
Test Type/Duration: 28 d Marine toxicity test
Test Initiation Date (Day 0): Oct 21, 2005

SAMPLE

Identification: Various
Amount Received: 1x3L
Date Collected: Sept 16, 17, 2005
Date Received: Sept 19, 2005

TEST SPECIES INFORMATION

Organism: N. arenaceodentata
Source/ Date Received: Don Reish / Oct 18, 2005
Day 0 Dry Weight (mg/worm): 0.56
Reference Toxicant: Cadmium
Current Reference Toxicant Result
96-h LC50 (and 95% CL): 6.0 (5.0-7.1) mg/L Cd
Reference Toxicant Warning Limits (mean ± 2SD) and CV
8.6 ± 2.8 mg/L Cd ; CV = 16%

TEST CONDITIONS

Temperature Range (°C): 19.0 - 21.0
pH Range: ~~7.1~~ ~~7.4~~ - 8.2
Dissolved Oxygen Range (mg/L): ~~1.8~~ ~~7.7~~ 5.5 - 7.7
Salinity Range (ppt): 29.5 - 32
Photoperiod (L:D h): 24:0
Total Ammonia Ranges (mg/L N)
Bulk: 0.639 - ~~5.39~~ 37.4
Purging: —
IW: Day 0 — Day 10 — Day 20 —
OW: Day 0 <0.02 - 1.13 Day 10 — Day 20 0.155-6.20
Total Sulphide Ranges (mg/L S)
Bulk: <0.020 - 0.76
Purging: —
IW: Day 0 — Day 10 — Day 20 —
OW: Day 0 <0.02 Day 10 — Day 20 ~~<0~~ <0020

DILUTION/CONTROL WATER (initial water quality)

Water Type: UV sterilized, filtered seawater (day-1)
Temperature (°C): 20.0
pH: 7.9
Dissolved Oxygen (mg/L): 7.6
Salinity (ppt): 29
Other: —

REFER TO ATTACHED TABLE(S) FOR SUMMARY OF RESULTS

Comments: This test was based on methodology described in PSEP 1995 for the ~~20d~~ of Neanthes 20day test for survival and growth. The test was run for an additional 8 days

Data Verified By: Gal Jich
Date Verified: Dec. 9/05

Client	Seacor	**Species**	*N. arenaceodentata*
Project No.	04-1424-076	**Initiation Date**	21-Oct-05
WO No.	0500398		

Summary of Results for the 28-d Marine Polychaete Sediment Toxicity Test

Sample ID	Survival (%) (Mean ± SD)[1]	Individual Dry Weight (mg/worm) (Mean ± SD)[1]	Individual Growth Rate (mg/worm/day) (Mean ± SD)[1]	Total Dry Weight (mg) (Mean ± SD)[1]
Control	100.0 ± 0.0	19.6 ± 4.8	0.68 ± 0.17	98.2 ± 23.9
S27	100.0 ± 0.0	15.1 ± 4.0	0.52 ± 0.14	75.7 ± 20.2
S28	96.0 ± 8.9	22.1 ± 5.7	0.77 ± 0.20	105.4 ± 26.3
S29	100.0 ± 0.0	20.2 ± 7.8	0.70 ± 0.28	100.9 ± 39.2
S30	100.0 ± 0.0	18.8 ± 4.2	0.65 ± 0.15	94.2 ± 21.2
S31	96.0 ± 8.9	21.4 ± 2.9	0.75 ± 0.10	102.6 ± 15.8
S33	100.0 ± 0.0	14.5 ± 5.1	0.50 ± 0.18	72.5 ± 25.4

[1]n = 5 replicates per treatment; 5 worms per replicate

Qualified
Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
28-d *Neanthes* MARINE SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Client Seacor

Lab Project No. 04-1424-076

Lab Work Order No. 0500398

Test Initiation Date (Day 0) Oct 21/2005

Test Termination Date (Day 28) Nov 18/2005

Test Species Neanthes arenaceodentata

Sample ID	Temperature (°C) – Day 0 to 14														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
S28	20.0	21.0	21.0	21.0	20.5	20.5	20.0	19.5	20.0	20.0	20.0	21.0	20.5	20.0	20.0
S29	20.0	21.0	21.0	21.0	20.5	20.5	20.5	19.5	20.0	20.5	20.0	20.0	20.5	20.0	20.5
Control	20.0	21.0	21.0	21.0	20.5	20.5	20.0	19.5	20.0	20.5	20.0	20.5	20.5	20.0	20.0
S33	20.0	21.0	21.0	21.0	20.5	20.5	20.0	19.5	20.0	21.0	20.0	20.5	21.0	20.0	20 SXB 20.5
S27	20.0	21.0	21.0	21.0	20.5	20.5	20.0	19.5	20.0	21.0	20.0	20.0	20.5	20.0	20.0
S31	20.0	21.0	21.0	21.0	20.5	20.5	20.0	19.5	20.0	21.0	20.0	20.0	20.5	20.0	20.0
S30	20.0	21.0	21.0	21.0	20.0	20.5	20.0	19.5	19.0	21.0	19.0	20.0	20.5	20.0	20.0
Technician Initials	ML	ML	SXB	SXB	ML	ML	~	MFB	~	~	ML MFB	AXF	~	~	MFB/SXB

WQ Instruments Used: Temp. Calibrated Hg Thermometer

Comments

Data Verified By Ralph Ky

Date Verified Dec 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
28-d *Neanthes* MARINE SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Client Seacor
Lab Project No. 04-1424-076
Lab Work Order No. 0500398

Test Initiation Date (Day 0) Oct 21, 2005
Test Termination Date (Day 28) Nov 18, 2005
Test Species N. arenaceodentata

Sample ID	Temperature (°C) – Day 15 to 28													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
S28	20.0	21.0	21.0	20.0	20.0	21.0	21.0	20.0	19.5	19.5	19.5	19.5	20.0	20.5
S29	20.0	21.0	20.5	20.0	20.0	21.0	20.5	20.0	19.5	19.5	19.5	19.5	19.5	21.0
Control	20.0	21.0	20.5	20.0	20.0	21.0	20.5	19.5	19.5	19.5	19.5	19.5	19.5	21.0
S33	20.0	21.0	20.5	20.0	20.0	21.0	20.5	20.0	19.5	19.5	19.5	19.5	19.5	21.0
S27	20.0	21.0	20.5	20.0	20.0	21.0	20.5	20.0	19.5	19.5	19.5	19.5	19.5	21.0
S31	20.5	21.0	20.0	20.0	20.0	21.0	20.5	20.0	19.5	19.5	19.5	19.5	19.0	21.0
S30	20.5	21.0	20.5	20.0	20.0	20.5	20.5	20.0	20.0	19.5	19.5	19.5	19.0	21.0
Technician Initials	SRJ	SRJ	SXB	MFB	MFB	JH	SXB/MFB	SXB	SXB	MC	MC	MFB	MFB	MC

WQ Instruments Used: Temp. Calibrated Hg thermometer

Comments

Data Verified By Ralph H Date Verified Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
28-d *Neanthes* MARINE SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Client Seacor
Lab Project No. 04-1424-076
Lab Work Order No. 0502398

Test Initiation Date (Day 0) Oct 21, 2005
Test Termination Date (Day 28) Nov 18, 2005
Test Species N. arenaceodentata

Sample ID	pH – Day 0 to 28													
	0	3	6	9	12	15	18	21	24	27	28			
S28	7.7	7.8	7.8	7.7	7.8	7.8	7.8	7.5	7.4	7.8	8.0			
S29	7.8	7.5	7.9	7.7	7.8	7.8	7.8	7.8	~~8.0~~ 7.8	7.9	7.9			
Control	8.0	7.8	7.8	7.8	8.0	8.0	8.0	7.1	7.9	8.0	8.0			
S33	8.1	8.0	8.1	8.1	8.2	8.2	8.2	8.1	7.9	8.1	8.2			
S27	7.9	7.8	7.9	7.9	7.9	7.9	8.0	7.9	7.9	8.1	8.0			
S31	7.8	7.9	7.5	7.4	7.4	7.4	7.5	7.5	7.4	7.6	7.6			
S30	7.9	7.7	7.9	7.8	7.9	7.9	7.9	7.9	7.8	7.9	7.9			
Technician Initials	NZN/AXF	SAB	~	~	~	SRS	MFB	SAB/MFB	MFB	MFB	~			

WQ Instruments Used: pH II-A-03030

Comments

Data Verified By Qualified

Date Verified Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
28-d *Neanthes* MARINE SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Client: Seacor
Lab Project No.: 04-1424-076
Lab Work Order No.: 0500398

Test Initiation Date (Day 0): Oct 21, 2005
Test Termination Date (Day 28): 0 Nov 18, 2005
Test Species: N. arenaceodentata

Sample ID	Dissolved Oxygen (mg/L) – Day 0 to 14														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
S28	7.8 (7 ppt)	–	–	7.0	–	–	7.2	–	–	6.6	–	–	7.4	–	–
~~229~~ S29	7.9 (7 ppt)	–	–	6.4	–	–	7.4	–	–	6.6	–	–	7.6	–	–
Control	7.9 (7 ppt)	–	–	6.9	–	–	7.4	–	–	6.6	–	–	7.4	–	–
S33	7.9 (7 ppt)	–	–	6.7	–	–	7.2	–	–	6.4	–	–	7.4	–	–
S27	7.9 (7 ppt)	–	–	7.0	–	–	7.2	–	–	6.4	–	–	7.6	–	–
S31	7.9 (7 ppt)	–	–	6.9	–	–	7.2	–	–	6.4	–	–	7.6	–	–
S30	7.6	–	–	6.8	–	–	7.0	–	–	6.2	–	–	7.6	–	–
Technician Initials	AXF	–	–	SXB	–	–	~	–	–	~	–	~~~	~	–	–

WQ Instruments Used: DO II-A-20

Comments:

Data Verified By: [signature]

Date Verified: Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
28-d *Neanthes* MARINE SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Client Seacor
Lab Project No. 04-1424-076
Lab Work Order No. 0500398

Test Initiation Date (Day 0) Oct 21, 2005
Test Termination Date (Day 28) Nov 18, 2005
Test Species N. arenaceodentata

Sample ID	Dissolved Oxygen (mg/L) – Day 15 to 28													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
S28	7.2	—	—	6.5	—	—	5.5	-	-	7.2 MFB / ~~7.8~~	-	-	7.2	7.2
~~S29~~ S29	7.2	—	—	7.0	—	—	7.1	-	-	7.2	-	-	7.2	7.0
Control	7.5	—	—	6.6	—	—	7.0	-	-	7.3	—	-	7.2	7.0
S33	7.3	—	—	6.8	—	—	6.8	-	-	7.1	—	-	7.2	7.4
S27	7.2	—	—	6.8	-	—	6.8	-	-	7.3	—	—	7.2	7.2
S31	7.4	—	—	6.4	—	—	7.0	-	-	7.2	—	—	7.2	7.0
S30	7.4	—	—	7.0	—	—	7.0	-	-	7.1	-	—	7.2	7.0
Technician Initials	SR	~	—	MFB	—	—	SRB / MFB	—	—	MC	—	—	MFB	4

WQ Instruments Used: DO II-A-20

Comments ① DO from sample S28; Rep E = 7.2 mg/L; WQ Rep of S28 was 1.8 mg/L. used Rep E for measurement

Data Verified By Qaljk

Date Verified Dec-9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
28-d *Neanthes* MARINE SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING

Client Seacor

Lab Project No. 04-1424-076

Lab Work Order No. 0500398

Test Initiation Date (Day 0) Oct 21, 2005

Test Termination Date (Day 28) Nov 18, 2005

Test Species N arenaceodentata

Sample ID	Salinity (ppt) – Day 0 to 28													
	0	03	6	9	12	15	18	21	24	27	28			
S28	30	27.5	30	30	31	30	30	30	31	30	30			
~~229~~ S29	30	30	30	30	31	30	31	30	31	31	30			
Control	30 ~~31~~ AXF	30	30	31	32	31	32	31	32	31	31			
S33	30	30	30	31	32	31	31	31	32	31	31			
S27	30	30	30	30	31	30	31	31	31	31	31			
S31	30	30	30	31	32	31	32	31	31	31	31			
S30	30	30	30	31	32	31	31	31	32	31	31			
Technician Initials	~~MA~~ AXF	SxB	~	~	~	SRS	MFB	SxB/MFB	AZ	MFB	~			

WQ Instruments Used: Salinity II-A-050801

Comments

Data Verified By Qualified

Date Verified Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
SEDIMENT TOXICITY TESTS – SURVIVAL AND FINAL WATER QUALITY DATA

Client: Seacor
Lab Project No.: 04-1424-076
Lab Work Order No.: 0500398

Test Species/Test Type: N. arenaceodentata / 28d tox test
Test Initiation Date (Day 0): Oct 21, 2005
Test Termination Date: Nov 18, 2005

Sample ID	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	Temp. (°C)	pH	Cond. (µmhos/cm) ☒ Salinity (ppt) ☑	DO (mg/L)
Control	A	1	5	0	5	0	ML	20.0	8.0	31	7.4
	B	2	5	0	5	0		20.0	8.0	31	7.2
	C	3	5	0	5	0		20.0	8.0	31	7.2
	D	4	5	0	5	0		20.0	8.0	31	7.2
	E	5	5	0	5	0		20.0	8.0	31	7.0
S27	A	6	5	0	5	0	AXF	20.0	8.0	31	7.2
	B	7	5	0	5	0	AXF	20.0	8.0	31	7.2
	C	8	5	0	5	0	AXF	20.0	7.9	31	7.2
	D	9	5	0	5	0	ML	20.0	7.9	30 31	7.2
	E	10	5	0	5	0	AXF	20.0	8.0	31	7.0
S28	A	11	5	0	5	0	SRS	20.0	7.9	31	7.0
	B	12	5	0	5	0	SRS	20.0	7.9	31	7.0
	C	13	5	0	5	0	ML	20.0	7.9	31	7.1
	D	14	4	0	4	1	SRS	20.0	7.9	30 31	7.0
	E	15	5	0	5	0	SRS	20.0	7.9	31	7.0
						Technician Initials		AXF	AXF	AXF	AXF

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-030301 Cond./Sal. II-A-0501 DO II-A-14

Data Verified By: Galji

Date Verified: Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
SEDIMENT TOXICITY TESTS – SURVIVAL AND FINAL WATER QUALITY DATA

Client: Seacor
Lab Project No.: 04-1424-076
Lab Work Order No.: 0500398

Test Species/Test Type: N. arenaceodentata / 28 day tox test
Test Initiation Date (Day 0): Oct 21, 2005
Test Termination Date: Nov 18, 2005

Sample ID	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☐	DO (mg/L)
S29	A	16	5	0	5	0	MFB	20.0	7.9	31	7.3
	B	17	5	0	5	0	MFB	20.0	7.9	31	7.2
	C	18	5	0	5	0	MFB	20.0	7.9	31	7.2
	D	19	5	0	5	0	MFB	20.0	7.9	31	6.8
	E	20	5	0	5	0	MFB	20.0	7.8	31	7.0
S30	A	21	5	0	5	0	MFB	20.0	7.8	31	7.0
	B	22	5	0	5	0		20.0	7.8	31	6.8
	C	23	5	0	5	0		20.0	7.8	31	7.0
	D	24	5	0	5	0		20.0	7.7	31	7.0
	E	25	5	0	5	0		20.0	7.7	31	7.0
S31	A	26	5	0	5	0	"	20.0	7.6	31	7.0
	B	27	5	0	5	0	"	20.0	7.6	31	7.2
	C	28	5	0	5	0	"	20.0	7.6	31	7.0
	D	29	5	0	5	0	"	20.0	7.6	31	7.0
	E	30	4	0	4	#01	"/MFB	20.0	7.6	31	7.0
						Technician Initials		" / TM	TM / "	" / TM	" / TM

WQ Instruments Used: Temp (calibrated Hg thermometer) pH II-A-030301 Cond./Sal. II-A-0501 DO II-A-14
Data Verified By: Qualified Date Verified: Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
SEDIMENT TOXICITY TESTS – SURVIVAL AND FINAL WATER QUALITY DATA

Client: Seacor
Lab Project No.: 04-1424-096
Lab Work Order No.: 05000398

Test Species/Test Type: N. arenaceodentata / 28d tox tc34
Test Initiation Date (Day 0): Oct 21, 2005
Test Termination Date: Nov 18, 2005

Sample ID	Rep.	Pan No.	No. Alive	No. Dead	Total Recovered	No. Missing	Tech. Init.	Temp. (°C)	pH	Cond. (µmhos/cm) ☐ Salinity (ppt) ☑	DO (mg/L)
S33	A	31	5	0	5	0	AXF	20.0	8.2	31	7.1
	B	32	5	0	5	0	AXF	20.0	8.2	31	7.1
	C	33	5	0	5	0	AXF	20.0	8.1	31	7.0
	D	34	5	0	5	0	AXF	20.0	8.1	31	7.0
	E	35	5	0	5	0	AXF	20.0	8.2	31	7.0
							Technician Initials				

WQ Instruments Used: Temp (Calibrated Hg thermometer) pH I-A-03001 Cond./Sal. I-A-0501 DO I-A-14

Data Verified By: Dalfk

Date Verified: Dec. 9/05

EVS ENVIRONMENT CONSULTANTS

Sediment Toxicity Tests - Dry Weight Data

CLIENT:	Seacor	TEST TYPE:	28-d Marine Sediment
PROJECT #:	04-1424-076	TEST SPECIES:	*Neanthes arenaceodentata*
WORK ORDER #:	0500398	TEST INITIATION DATE:	21-Oct-05
BALANCE TYPE:	Metler AG104		

Pan No.	Rep	Sample ID	Survival At Start	Number of Survivors	Number Weighed	Pan Weight (mg)	Pan + Organism Weight (mg)	Organism Weight (mg)	Tech'n Initials	Avg Weight per Worm (mg)	Avg Initial Weight (mg)
N-A	-	initial wt	-	-	5	1226.52	1229.1	2.5	RSD	0.51	0.56
N-B	-	initial wt	-	-	5	1227.8	1230.6	2.8	RSD	0.56	
N-C	-	initial wt	-	-	5	1236.21	1239.3	3.1	RSD	0.62	
N-1	A	CONTROL	5	5	5	1064.14	1171.3	107.2	AKN		
N-2	B		5	5	5	1056.03	1186.2	130.2	AKN		
N-3	C		5	5	5	1066.42	1130.6	64.2	AKN		
N-4	D		5	5	5	1060.06	1155.5	95.4	AKN		
N-5	E		5	5	5	1063.44	1157.6	94.2	AKN		
N-6	A	S27	5	5	5	1058.15	1129.4	71.3	AKN		
N-7	B		5	5	5	1062.3	1140.1	77.8	AKN		
N-8	C		5	5	5	1061.58	1106.8	45.2	AKN		
N-9	D		5	5	5	1060.78	1144.6	83.8	AKN		
N-10	E		5	5	5	1054.93	1155.4	100.5	AKN		
N-11	A	S28	5	5	5	1058.02	1196.8	138.8	AKN		
N-12	B		5	5	5	1059.75	1172.8	113.1	AKN		
N-13	C		5	5	5	1057.22	1162.2	105.0	AKN		
N-14	D		5	4	4	1054.36	1159.2	104.8	AKN		
N-15	E		5	5	5	1054.62	1120.2	65.6	AKN		
N-16	A	S29	5	5	5	1051.72	1184.1	132.4	AKN		
N-17	B		5	5	5	1062.8	1215.5	152.7	AKN		
N-18	C		5	5	5	1063.65	1145.3	81.6	AKN		
N-19	D		5	5	5	1061.79	1124.9	63.1	AKN		
N-20	E		5	5	5	1057.46	1132.1	74.6	AKN		
N-21	A	S30	5	5	5	1056.28	1158.8	102.5	AKN		
N-22	B		5	5	5	1057.88	1160.1	102.2	AKN		
N-23	C		5	5	5	1059.89	1117.4	57.5	AKN		
N-24	D		5	5	5	1056.46	1153.4	96.9	AKN		
N-25	E		5	5	5	1059.66	1171.7	112.0	AKN		
N-26	A	S31	5	5	5	1061.06	1159.3	98.2	AKN		
N-27	B		5	5	5	1067	1194.8	127.8	AKN		
N-28	C		5	5	5	1066.12	1173.2	107.1	AKN		
N-29	D		5	5	5	1062.85	1152.6	89.8	AKN		
N-30	E		5	4	4	1059.35	1149.6	90.3	AKN		
N-31	A	S33	5	5	5	1060.3	1125.6	65.3	AKN		
N-32	B		5	5	5	1059.1	1114.4	55.3	AKN		
N-33	C		5	5	5	1056.23	1100.8	44.6	AKN		
N-34	D		5	5	5	1062.32	1167.5	105.2	AKN		
N-35	E		5	5	5	1058.03	1150.1	92.1	AKN		
N-1 (d)			5	5	5	1064.14	1171.8	107.7 ✓	AKN		
N-15(d)			5	5	5	1054.62	1121.1	66.5 ✓	AKN		
N-23(d)			5	5	5	1059.89	1116.8	56.9 ✓	AKN		
N-31 (d)			5	5	5	1060.3	1125.1	64.8 ✓	AKN		

(d) - duplicate; pan reweighed after being dried and desiccated a second time.

QA/QC Review: Dec. 9/05

Test: PW-Polychaete Worm Growth and Survival Test Test ID: 0500398
Species: NA-Neanthes arenaceodentata Protocol: PSEP 95 modified to a 28 day test
Sample ID: VARIOUS Sample Type: SEDIMENT1-Marine
Start Date: 10/21/2005 End Date: 11/18/2005 Lab ID: NVNLAB-Golder North Vancouver Laboratory

Pos	ID	Rep	Group	Survival Start	Survival Day 20	# of Worms Weighed	Initial Worm Wt (mg/worm)	Pan Weight (mg)	Pan + Worms (mg)
	1	1	Control	5	5	5	0.56	1064.14	1171.3
	2	2	Control	5	5	5	0.56	1056.03	1186.2
	3	3	Control	5	5	5	0.56	1066.42	1130.6
	4	4	Control	5	5	5	0.56	1060.06	1155.5
	5	5	Control	5	5	5	0.56	1063.44	1157.6
	6	1	S27	5	5	5	0.56	1058.15	1129.4
	7	2	S27	5	5	5	0.56	1062.3	1140.1
	8	3	S27	5	5	5	0.56	1061.58	1106.8
	9	4	S27	5	5	5	0.56	1060.78	1144.6
	10	5	S27	5	5	5	0.56	1054.93	1155.4
	11	1	S28	5	5	5	0.56	1058.02	1196.8
	12	2	S28	5	5	5	0.56	1059.75	1172.8
	13	3	S28	5	5	5	0.56	1057.22	1162.2
	14	4	S28	5	4	4	0.56	1054.36	1159.2
	15	5	S28	5	5	5	0.56	1054.62	1120.2
	16	1	S29	5	5	5	0.56	1051.72	1184.1
	17	2	S29	5	5	5	0.56	1062.8	1215.5
	18	3	S29	5	5	5	0.56	1063.65	1145.3
	19	4	S29	5	5	5	0.56	1061.79	1124.9
	20	5	S29	5	5	5	0.56	1057.46	1132.1
	21	1	S30	5	5	5	0.56	1056.28	1158.8
	22	2	S30	5	5	5	0.56	1057.88	1160.1
	23	3	S30	5	5	5	0.56	1059.89	1117.4
	24	4	S30	5	5	5	0.56	1056.46	1153.4
	25	5	S30	5	5	5	0.56	1059.66	1171.7
	26	1	S31	5	5	5	0.56	1061.06	1159.3
	27	2	S31	5	5	5	0.56	1067	1194.8
	28	3	S31	5	5	5	0.56	1066.12	1173.2
	29	4	S31	5	5	5	0.56	1062.85	1152.6
	30	5	S31	5	4	4	0.56	1059.35	1149.6
	31	1	S33	5	5	5	0.56	1060.3	1125.6
	32	2	S33	5	5	5	0.56	1059.1	1114.4
	33	3	S33	5	5	5	0.56	1056.23	1100.8
	34	4	S33	5	5	5	0.56	1062.32	1167.5
	35	5	S33	5	5	5	0.56	1058.03	1150.1

Comments: Seacor test modified to 28 day; 04-1424-076; 0500398

Reviewed by: Galfft Dec. 9/05

Polychaete Worm Growth and Survival Test-28 d Survival

Start Date:	10/21/2005	Test ID:	500398	Sample ID:	VARIOUS
End Date:	11/18/2005	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95 modified to a 28 da	Test Species:	NA-Neanthes arenaceodentata
Comments:	Seacor test modified to 28 day; 04-1424-076; 0500398				

Conc-	1	2	3	4	5
Control	1.0000	1.0000	1.0000	1.0000	1.0000
S27	1.0000	1.0000	1.0000	1.0000	1.0000
S28	1.0000	1.0000	1.0000	0.8000	1.0000
S29	1.0000	1.0000	1.0000	1.0000	1.0000
S30	1.0000	1.0000	1.0000	1.0000	1.0000
S31	1.0000	1.0000	1.0000	1.0000	0.8000
S33	1.0000	1.0000	1.0000	1.0000	1.0000

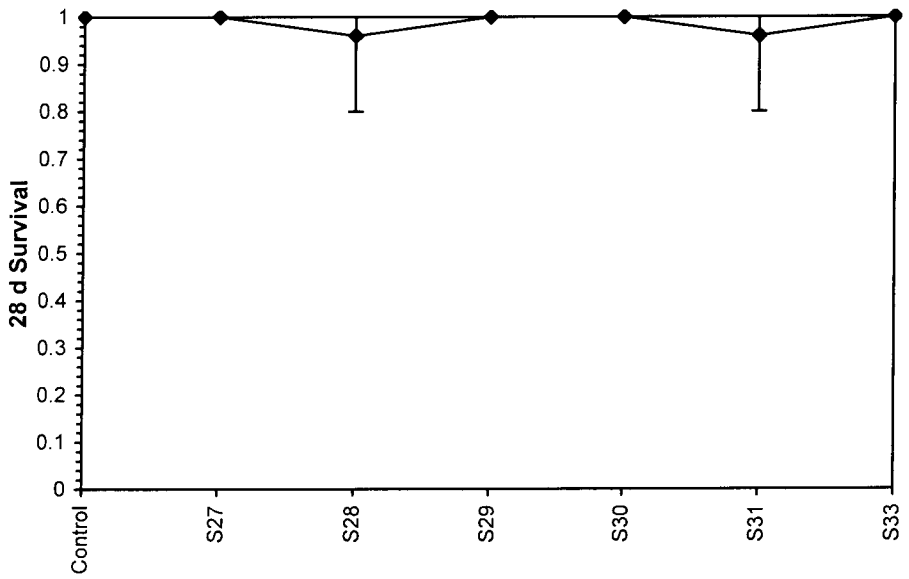
			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
S27	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	19.00
S28	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	19.00
S29	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	19.00
S30	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	19.00
S31	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	19.00
S33	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.51902	0.91	-2.9335	9.90057
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

Dose-Response Plot



Reviewed by: Dec. 9/05

Polychaete Worm Growth and Survival Test-Avg Individual Dry Weight

Start Date:	10/21/2005	Test ID:	500398	Sample ID:	VARIOUS
End Date:	11/18/2005	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Seacor test modified to 28 day; 04-1424-076; 0500398				

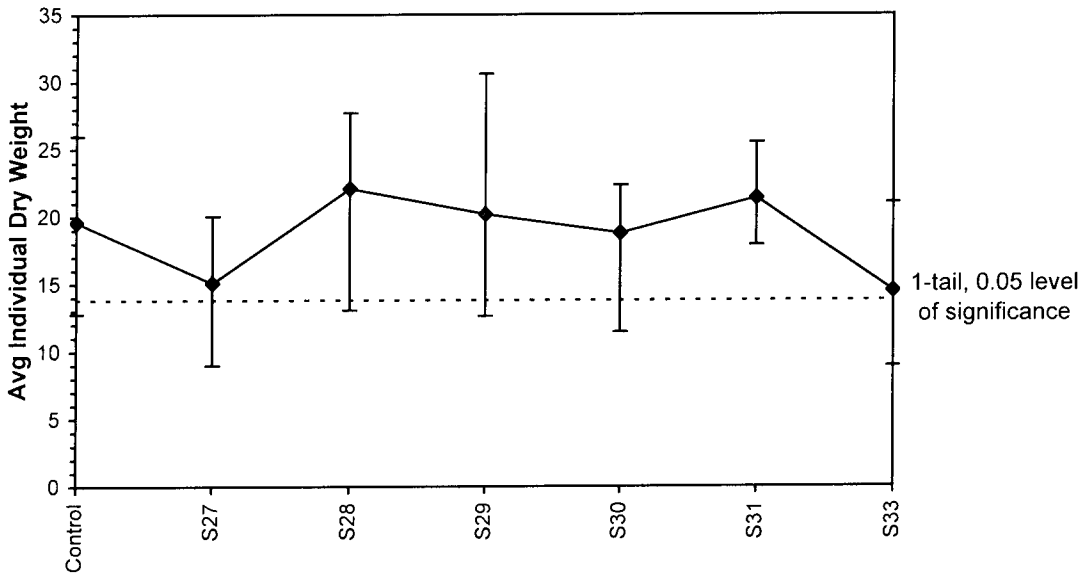
Conc-	1	2	3	4	5
Control	21.432	26.034	12.836	19.088	18.832
S27	14.250	15.560	9.044	16.764	20.094
S28	27.756	22.610	20.996	26.210	13.116
S29	26.476	30.540	16.330	12.622	14.928
S30	20.504	20.444	11.502	19.388	22.408
S31	19.648	25.560	21.416	17.950	22.563
S33	13.060	11.060	8.914	21.036	18.414

			Transform: Untransformed					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	19.644	4.779	19.644	12.836	26.034	24.326	5			
S27	15.142	4.041	15.142	9.044	20.094	26.685	5	1.609	1.860	5.204
S28	22.138	5.724	22.138	13.116	27.756	25.857	5	-0.748	1.860	6.201
S29	20.179	7.850	20.179	12.622	30.540	38.902	5	-0.130	1.860	7.643
S30	18.849	4.249	18.849	11.502	22.408	22.542	5	0.278	1.860	5.318
S31	21.427	2.899	21.427	17.950	25.560	13.531	5	-0.713	1.860	4.648
S33	14.497	5.078	14.497	8.914	21.036	35.029	5	1.651	1.860	5.799

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97798	0.91	-0.0336	-0.5101
Bartlett's Test indicates equal variances (p = 0.65)	4.19089	16.8119		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	5.79892	0.29519	43.7871	26.5434	0.17068	6, 28

Dose-Response Plot



ToxCalc v5.0.23

Reviewed by: Dec. 9/05

Polychaete Worm Growth and Survival Test-Growth Rate

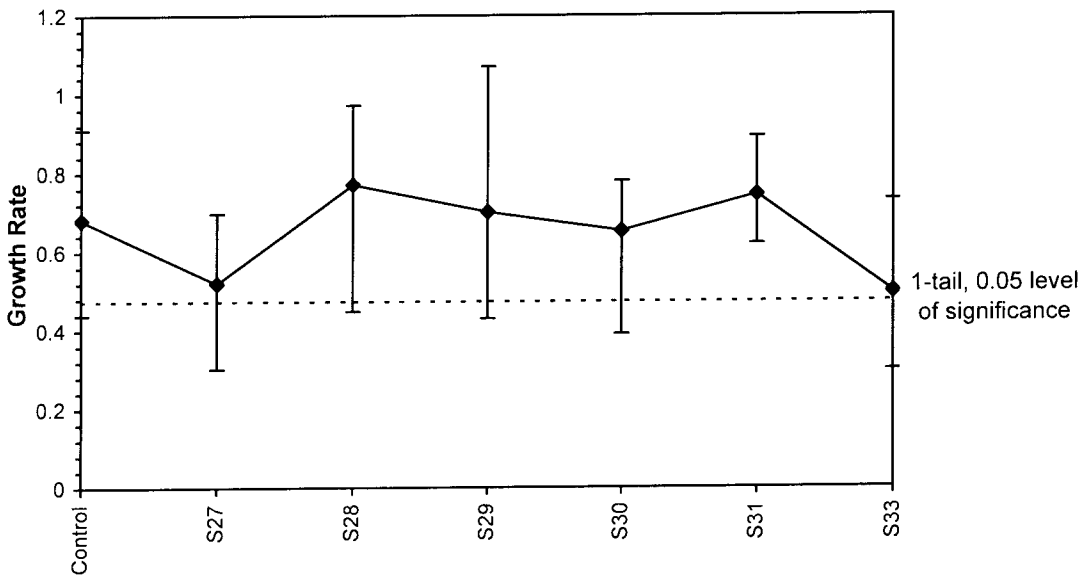
Start Date:	10/21/2005	Test ID:	500398	Sample ID:	VARIOUS
End Date:	11/18/2005	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Seacor test modified to 28 day; 04-1424-076; 0500398				

Conc-	1	2	3	4	5
Control	0.7454	0.9098	0.4384	0.6617	0.6526
S27	0.4889	0.5357	0.3030	0.5787	0.6976
S28	0.9713	0.7875	0.7299	0.9161	0.4484
S29	0.9256	1.0707	0.5632	0.4308	0.5131
S30	0.7123	0.7101	0.3908	0.6724	0.7803
S31	0.6817	0.8929	0.7449	0.6211	0.7858
S33	0.4464	0.3750	0.2984	0.7313	0.6376

			Transform: Untransformed					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	0.6816	0.1707	0.6816	0.4384	0.9098	25.040	5			
S27	0.5208	0.1443	0.5208	0.3030	0.6976	27.709	5	1.609	1.860	0.1859
S28	0.7706	0.2044	0.7706	0.4484	0.9713	26.529	5	-0.748	1.860	0.2215
S29	0.7007	0.2804	0.7007	0.4308	1.0707	40.013	5	-0.130	1.860	0.2730
S30	0.6532	0.1518	0.6532	0.3908	0.7803	23.233	5	0.278	1.860	0.1899
S31	0.7453	0.1035	0.7453	0.6211	0.8929	13.894	5	-0.713	1.860	0.1660
S33	0.4977	0.1814	0.4977	0.2984	0.7313	36.437	5	1.651	1.860	0.2071

Auxiliary Tests	Statistic	Critical			Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97798	0.91			-0.0336	-0.5101
Bartlett's Test indicates equal variances (p = 0.65)	4.19089	16.8119				
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	0.2071	0.30386	0.05585	0.03386	0.17068	6, 28

Dose-Response Plot



* growth rate was determined for the 28 day period

Reviewed by Dec. 9/05

Polychaete Worm Growth and Survival Test-Total Dry Weight

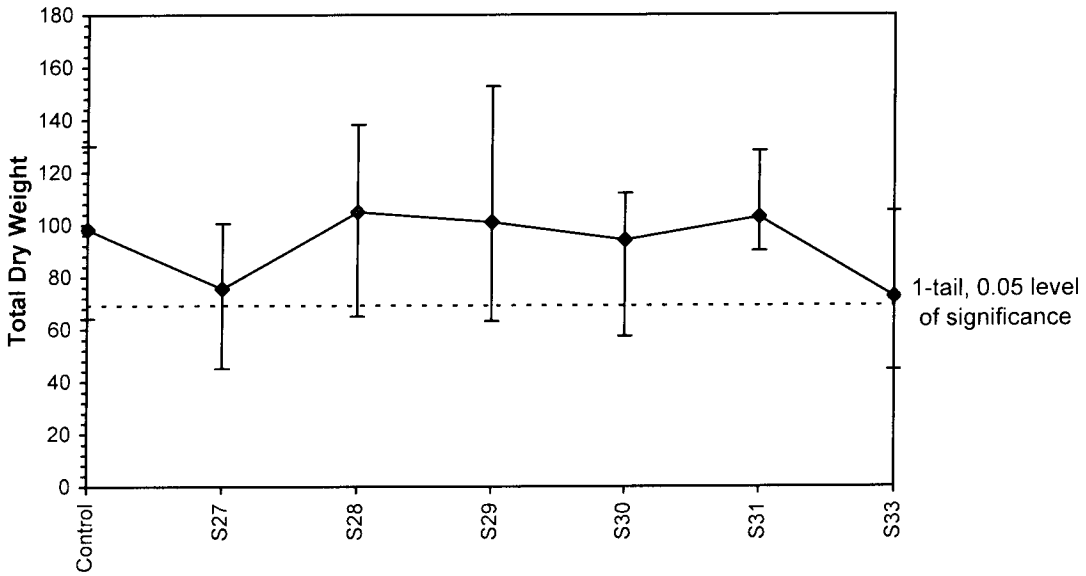
Start Date:	10/21/2005	Test ID:	500398	Sample ID:	VARIOUS
End Date:	11/18/2005	Lab ID:	NVNLAB-Golder North Vanc	Sample Type:	SEDIMENT1-Marine
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Seacor test modified to 28 day; 04-1424-076; 0500398				

Conc-	1	2	3	4	5
Control	107.16	130.17	64.18	95.44	94.16
S27	71.25	77.80	45.22	83.82	100.47
S28	138.78	113.05	104.98	104.84	65.58
S29	132.38	152.70	81.65	63.11	74.64
S30	102.52	102.22	57.51	96.94	112.04
S31	98.24	127.80	107.08	89.75	90.25
S33	65.30	55.30	44.57	105.18	92.07

			Transform: Untransformed					1-Tailed		
Conc-	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	98.22	23.89	98.222	64.180	130.170	24.326	5			
S27	75.71	20.20	75.712	45.220	100.470	26.685	5	1.609	1.860	26.022
S28	105.45	26.26	105.446	65.580	138.780	24.906	5	-0.455	1.860	29.527
S29	100.90	39.25	100.896	63.110	152.700	38.902	5	-0.130	1.860	38.214
S30	94.25	21.25	94.246	57.510	112.040	22.542	5	0.278	1.860	26.589
S31	102.62	15.75	102.624	89.750	127.800	15.344	5	-0.344	1.860	23.797
S33	72.48	25.39	72.484	44.570	105.180	35.029	5	1.651	1.860	28.995

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96903		0.91		0.07696	-0.5195
Bartlett's Test indicates equal variances (p = 0.72)	3.70574		16.8119			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	28.9946	0.29519	881.838	650.488	0.26659	6, 28

Dose-Response Plot



ToxCalc v5.0.23

Reviewed by: Ralph 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
SEDIMENT DESCRIPTION AND CHARACTERIZATION

Client Seacor

Lab Project No. 04-1424-076

Lab Work Order No. 05003985

Test Species ~~Hyalella azteca~~ N. arenaceodentata

Test Type/Duration 28day marine polychaete

Day 0 ~~Oct 20 05~~ Oct 21, 2005

Sample ID	Colour	Grain Size	Smell	Shells/ Debris	Interstitial Salinity (ppt)	Other Observations	Tech. Initial
S27	red water BLACK SAND	sand	~~A~~	A. Bit	MEA EA 16	Pore water pH 6.6	MG/
S28	Dark brown	Silty	N/A	N/A	17	pH 7.4	MG
S29	red brown	Silt Gravel	N/A	N/A	22	pH 6.9	MG
S30	redwater BLACK	Sand a Gravel	N/A	Some wood Bits	24	pH 6.8	MFB
S31	brown	silty/sand	N/A	N/A	26	pH 7.5	MG
S33	dark grey	pebble + sand	Araldite epoxy MFB strong	MG- Yes shells present	30.0	pH ~~6.8~~ MB 7.6	MG

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 Verified By _____ Date Verified _____

JGL Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
MARINE POLYCHAETE SEDIMENT TOXICITY TEST DATA SUMMARY

Client: Seacor
Lab Project No.: 04-1424-076
Lab Work Order No.: 05C00398

Lab Analysts: SXB, MTG, RSD
Test Type/Duration: ~~28d Marine tox test~~ 96hr Cd Repro
Test Initiation Date (Day 0): Oct 21, 2005

SAMPLE

Identification: Cadmium 05-Cd-004
Amount ~~Received~~ Prep'd: 1L
Date ~~Collected~~ Prep'd: Oct 18, 2005
Date Received: NA

TEST SPECIES INFORMATION

Organism: N. arenaceodentata
Source/Date Received: Dr Don Reish / Oct 18, 2005
Day 0 Dry Weight (mg/worm): 0.56
Reference Toxicant: Cadmium
Current Reference Toxicant Result:
96-h LC50 (and 95% CL): ~~6.0~~ 6.0 (5.0-7.1) mg/L Cd
Reference Toxicant Warning Limits (mean ± 2SD) and CV
6.6 ± 2.3 mg/L Cd ; CV = 16%

TEST CONDITIONS

Temperature Range (°C): 20.0 - 21.0
pH Range: 7.8 - 7.9
Dissolved Oxygen Range (mg/L): 7.4 - 7.6
Salinity Range (ppt): 29 - 30
Photoperiod (L:D h): 24:0
Ammonia Type and Ranges (mg/L N): N/A
□ Inter: Day 0 — Day 10 — Day 20 —
□ Over: Day 0 — Day 10 — Day 20 —
Sulphide Type and Ranges (mg/L S): N/A
□ Inter: Day 0 — Day 10 — Day 20 —
□ Over: Day 0 — Day 10 — Day 20 —

DILUTION/CONTROL WATER (initial water quality)

Water Type: Moderately Hard H2O (day 0)
Temperature (°C): 20.0
pH: 7.9
Dissolved Oxygen (mg/L): 7.6
Salinity (ppt): 29
Other: —

Sample ID (mg/L Cd)	Mean ± SD			
	Survival (%)	Individual Dry Weight (mg/worm)	Individual Growth Rate (mg/worm/day)	Total Dry Weight (mg)
Control	100			
3.2	100			
5.6	60			
10	0			
18	0			
32	0			

Data Verified By: Galph
Date Verified: Dec. 9/05

GOLDER ASSOCIATES-NORTH VANCOUVER LABORATORY
MARINE SEDIMENT - 96-h REFERENCE TOXICANT TEST DATA

Client: Seacor
Lab Project No.: 04-1424-076
Lab Work Order No.: 0500398
Test Initiation Date: Oct 21, 2005

Reference Toxicant: Cadmium
Lab Stock ID/Preparation Date: ~~Cd-Cl-05~~ 05-Cd-004
Test Species: N. arenaceodentata
Source/~~Age~~ on Day 0: ~~AP~~ Don Reish / 0.56mg/mm
No. Organisms/Test Volume: 10/900mL

Concentration	Number of Survivors (24 to 96 h)				Dissolved Oxygen (mg/L)		Temperature (°C)					pH		Salinity (ppt)	
mg/L Cd	24	48	72	96	0	96	0	24	48	72	96	0	96	0	96
Control	10	10	10	10	7.6	7.4	20.0	21.0	21.0	21.0	20.5	7.9	7.9	29	30
3.2	10	10	10	10	7.6	7.4	20.0	20.5	21.0	20.0	20.5	7.9	7.9	29	30
5.6	10	10	6	6	7.6	7.4	20.0	21.0	21.0	20.0	20.5	7.9	7.9	29	30
10	10	10	5	0	7.6	7.4	20.0	21.0	21.0	20.0	20.5	7.9	7.9	29	30
18	10	4	0	0	7.6	7.5	20.0	21.0	21.0	20.0	20.5	7.9	7.9	29	30
32	10	1	0	0	7.6	7.5	20.0	21.0	21.0	20.0	20.5	7.8	7.9	29	30
Technician Initials	MK	SXB	SXB	MK	RSO	MK	RSO	MK	SXB	SXB	MK	RSO	MK	RSO	MK

Sample Description: Clear Stock Solution MK
WQ Instruments Used: Temp: Calibrated Hg Thermometer pH II-A-030301 DO IL 420 Salinity II-A-SAL
Comments:

Test Set Up By: SXB / RSO Data Verified By: Quality Date Verified: Dec 9/05

Test: PA -Polychaete Acute Test						Test ID: RTNACD41
Species: NA-Neanthes arenaceodentata						Protocol: PSEP 95
Sample ID: RTNACD41						Sample Type: CD-Cadmium
Start Date: 10/21/2005			End Date: 10/25/2005			Lab ID: BCEVS-EVS Environment Consultants
Pos	ID	Rep	Group	0-h	96-h	Notes
	1	1	D-Control	10	10	
	2	1	3.200	10	10	
	3	1	5.600	10	6	
	4	1	10.000	10	0	
	5	1	18.000	10	0	
	6	1	32.000	10	0	

Comments: Seacor; 04-1424-076; 0500398

Polychaete Acute Test-96-h

Start Date:	10/21/2005	Test ID:	RTNACD41	Sample ID:	RTNACD41
End Date:	10/25/2005	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	CD-Cadmium
Sample Date:		Protocol:	PSEP 95	Test Species:	NA-Neanthes arenaceodentata
Comments:	Seacor; 04-1424-076; 0500398				

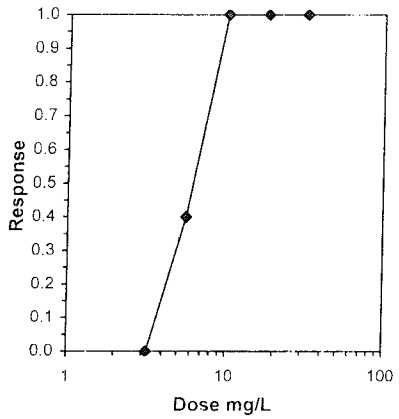
Conc-mg/L	1
D-Control	1.0000
3.2	1.0000
5.6	0.6000
10	0.0000
18	0.0000
32	0.0000

Conc-mg/L	Mean	SD	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical	Number Resp	Total Number
D-Control	1.0000	0.0000	0	10	10	1			0	10
3.2	1.0000	0.0000	0	10	10	1	1.0000	0.0500	0	10
*5.6	0.6000	0.0000	4	6	10	1	0.0433	0.0500	4	10
10	0.0000	0.0000	10	0	10	1			10	10
18	0.0000	0.0000	10	0	10	1			10	10
32	0.0000	0.0000	10	0	10	1			10	10

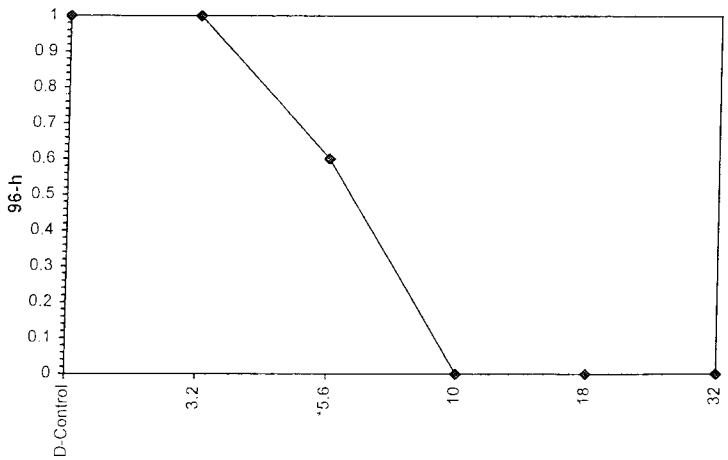
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Fisher's Exact Test	3.2	5.6	4.2332	

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%	5.9583	4.9942	7.1086
5.0%	5.9892	4.9185	7.2929
10.0%	6.0199	4.8103	7.5336
20.0%	6.0799	4.4428	8.3201
Auto-0.0%	5.9583	4.9942	7.1086



Dose-Response Plot



Reviewed by

APPENDIX II

Chemical Analysis Data

COC ✓
Seacor → Bulk NBS

ALS Environmental

CERTIFICATE OF ANALYSIS

Date:	November 8, 2005
ALS File No.	W6247
Report On:	04-1424-0766 Water Analysis
Report To:	**EVS-Golder Associates Ltd.** 195 Pemberton Ave North Vancouver, BC V7P 2R4
Attention:	**Ms. Ann-Marie Norris**
Received:	October 20, 2005

ALS ENVIRONMENTAL
per:

Heather A. Ross-Easton, B.Sc. - Project Chemist
Leanne Harris, B.Sc. - Project Chemist

File No. W6247

RESULTS OF ANALYSIS

	Ammonia Nitrogen N	Sulphide S
Water		
S27 2005 Oct 20 *ALS ID 1*	2.85	<0.020
S28 2005 Oct 20 *ALS ID 2*	4.69	0.73
S29 2005 Oct 20 *ALS ID 3*	5.39	0.76
S30 2005 Oct 20 *ALS ID 4*	3.68	<0.020
S31 2005 Oct 20 *ALS ID 5*	0.639	<0.020
S33 2005 Oct 20 *ALS ID 6*	37.4	0.093

These samples are identified as Day 1, Bulk, 28 day Neanthes.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

A Campbell Brothers Limited Company

File No. W6247

Appendix 1 - QUALITY CONTROL - Replicates

Water		S31	S31
		05-10-20	QC # 470625
Nutrients			
Ammonia Nitrogen	N	0.639	0.626
Inorganic Parameters			
Sulphide	S	<0.020	0.021

These samples are identified as Day 1, Bulk, 28 day Neanthes.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

A Campbell Brothers Limited Company

File No. W6247

Appendix 1 - QUALITY CONTROL - Reference Materials

Water

		Result	Target	Units	DL	ALSQC#	Method
SPEX Nutrients, 17-3N							
Nutrients							
Ammonia Nitrogen	N	6.06	6.29	mg/L	0.02	473428	a

Methods:
a = Electrode

A Campbell Brothers Limited Company

File No. W6247

Appendix 1 - QUALITY CONTROL - Spikes

Water

		Result	Target	Units	DL	ALSQC#	Method
Inorganic Parameters							
Sulphide	S	0.99	1.00	mg/L	0.02	470868	a
Sulphide	S	0.95	1.00	mg/L	0.02	472152	a

Methods:
a = Colourimetry

A Campbell Brothers Limited Company

File No. W6247

Appendix 1 - QUALITY CONTROL - Blanks

Water

		Result	Target	Units	DL	ALSQC#	Method
Nutrients							
Ammonia Nitrogen	N	<0.02	<0.02	mg/L	0.02	473427	a
Inorganic Parameters							
Sulphide	S	<0.02	<0.02	mg/L	0.02	470867	b
Sulphide	S	<0.02	<0.02	mg/L	0.02	472153	b

Methods:
a = Electrode
b = Colourimetry

A Campbell Brothers Limited Company

File No. W6247

Appendix 2 - DETECTION LIMITS - Water

		Detection Limit	
Nutrients			
Ammonia Nitrogen	N	0.020	mg/L
Inorganic Parameters			
Sulphide	S	0.020	mg/L

DLs indicated are the Minimum (Lowest) Reported Detection Limits for this work order.
The DL achieved for any given sample may differ from these values.

A Campbell Brothers Limited Company

File No. W6247

Appendix 3 - METHODOLOGY

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

Ammonia in Water by Selective Ion Electrode

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Sulphide in Water

This analysis is carried out using procedures adapted from APHA Method 4500-S2 "Sulphide". Sulphide is determined using the methlyene blue colourimetric method.

Recommended Holding Time:
Sample: 7 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report

A Campbell Brothers Limited Company

COC ✓

Seacor days O over N TS

ALS Environmental

CERTIFICATE OF ANALYSIS

Date:	November 1, 2005
ALS File No.	W6369
Report On:	04-1424-076 Water Analysis
Report To:	**EVS-Golder Associates Ltd.** 195 Pemberton Ave North Vancouver, BC V7P 2R4
Attention:	**Ms. Ann-Marie Norris**
Received:	October 21, 2005

ALS ENVIRONMENTAL
per:

Heather A. Ross-Easton, B.Sc. - Project Chemist
Leanne Harris, B.Sc. - Project Chemist

File No. W6369

RESULTS OF ANALYSIS

	Ammonia Nitrogen N	Sulphide S
Water		
S27- OverN 2005 Oct 21 *ALS ID 1*	0.358	-
S28- OverN 2005 Oct 21 *ALS ID 2*	0.611	-
S29- OverN 2005 Oct 21 *ALS ID 3*	1.07	-
S30- OverN 2005 Oct 21 *ALS ID 4*	0.489	-
S31- OverN 2005 Oct 21 *ALS ID 5*	0.048	-
S33- OverN 2005 Oct 21 *ALS ID 6*	1.13	-
Control OverN 2005 Oct 21 *ALS ID 7*	<0.020	-
S27- OverS 2005 Oct 21 *ALS ID 8*	-	<0.020
S28- OverS 2005 Oct 21 *ALS ID 9*	-	<0.020
S29- OverS 2005 Oct 21 *ALS ID 10*	-	<0.020
S30- OverS 2005 Oct 21 *ALS ID 11*	-	<0.020
S31- OverS 2005 Oct 21 *ALS ID 12*	-	<0.020
S33- OverS 2005 Oct 21 *ALS ID 13*	-	<0.020
Control OverS 2005 Oct 21 *ALS ID 14*	-	<0.020

These samples are identified as Day 0, 28 day Neanthes.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

A Campbell Brothers Limited Company

File No. W6369

Appendix 1 - QUALITY CONTROL - Replicates

Water		S29-OverN 05-10-21	S29-OverN QC # 470928	S29-OverS 05-10-21	S29-OverS QC # 470929
Nutrients					
Ammonia Nitrogen	N	1.07	1.04	-	-
Inorganic Parameters					
Sulphide	S	-	-	<0.020	<0.020

These samples are identified as Day 0, 28 day Neanthes.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

A Campbell Brothers Limited Company

File No. W6369

Appendix 1 - QUALITY CONTROL - Reference Materials

Water

		Result	Target	Units	DL	ALSQC#	Method
SPEX Nutrients, 17-3N							
Nutrients							
Ammonia Nitrogen	N	6.65	6.29	mg/L	0.02	472554	a

Methods:
a = Electrode

A Campbell Brothers Limited Company

File No. W6369

Appendix 1 - QUALITY CONTROL - Spikes

Water

	Result	Target	Units	DL	ALSQC#	Method
Inorganic Parameters						
Sulphide S	0.97	1.00	mg/L	0.02	471791	a

Methods:
a = Colourimetry

A Campbell Brothers Limited Company

File No. W6369

Appendix 1 - QUALITY CONTROL - Blanks

Water

		Result	Target	Units	DL	ALSQC#	Method
Nutrients							
Ammonia Nitrogen	N	<0.02	<0.02	mg/L	0.02	472553	a
Inorganic Parameters							
Sulphide	S	<0.02	<0.02	mg/L	0.02	471790	b

Methods:
a = Electrode
b = Colourimetry

A Campbell Brothers Limited Company

File No. W6369

Appendix 2 - DETECTION LIMITS - Water

		Detection Limit	
Nutrients			
Ammonia Nitrogen	N	0.020	mg/L
Inorganic Parameters			
Sulphide	S	0.020	mg/L

DLs indicated are the Minimum (Lowest) Reported Detection Limits for this work order.
The DL achieved for any given sample may differ from these values.

A Campbell Brothers Limited Company

File No. W6369

Appendix 3 - METHODOLOGY

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

Ammonia in Water by Selective Ion Electrode

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Sulphide in Water

This analysis is carried out using procedures adapted from APHA Method 4500-S2 "Sulphide". Sulphide is determined using the methlyene blue colourimetric method.

Recommended Holding Time:
Sample: 7 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

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End of Report

A Campbell Brothers Limited Company

Seacor
Day 28
over
NTS

DEC 5 2005

ALS Environmental

CERTIFICATE OF ANALYSIS

Date:	November 30, 2005
ALS File No.	W7719b
Report On:	05-1421-057 Water Analysis
Report To:	**EVS-Golder Associates Ltd.** 195 Pemberton Ave North Vancouver, BC V7P 2R4
Attention:	**Ms. Ann-Marie Norris**
Received:	November 18, 2005

ALS ENVIRONMENTAL
per:

Heather A. Ross-Easton, B.Sc. - Project Chemist
Leanne Harris, B.Sc. - Project Chemist

ALS CANADA LTD.
1988 Triumph Street, Vancouver, BC Canada V5L 1K5
Phone: 604-253-4188 Fax: 604-253-6700 Website: www.alsenviro.com

File No. W7719b

RESULTS OF ANALYSIS - Water

Sample ID		CONTROL	S27	S28	S29	S30
Sample Date		05-11-18	05-11-18	05-11-18	05-11-18	05-11-18
ALS ID		*14*	*15*	*16*	*17*	*18*
Nutrients						
Ammonia Nitrogen	N	4.51	4.22	0.300	3.98	0.546
Inorganic Parameters						
Sulphide	S	<0.020	<0.020	<0.020	<0.020	<0.020

Day 28; 28d Marine polychaete.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

A Campbell Brothers Limited Company

File No. W7719b

RESULTS OF ANALYSIS - Water

Sample ID		S31	S33
Sample Date		05-11-18	05-11-18
ALS ID		*19*	*20*
Nutrients			
Ammonia Nitrogen	N	6.20	0.155
Inorganic Parameters			
Sulphide	S	<0.020	<0.020

Day 28; 28d Marine polychaete.
Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

A Campbell Brothers Limited Company

File No. W7719b

Appendix 1 - METHODOLOGY

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

Ammonia in Water by Selective Ion Electrode

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Sulphide in Water

This analysis is carried out using procedures adapted from APHA Method 4500-S2 "Sulphide". Sulphide is determined using the methlyene blue colourimetric method.

Recommended Holding Time:
Sample: 7 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report

A Campbell Brothers Limited Company

APPENDIX III

Chain-of-Custody Forms

1 of 2

CHAIN-OF-CUSTODY / TEST REQUEST FORM

No 1536

Client Name SEACOR
Address #6-40 Cadillac Ave
Victoria, BC
V8Z 1T2

Client Contact Michael McLeay
Phone (250) 475-9595
Fax (250) 475-9596
Sampled by M. McLeay

Ship to EVS/Golder
N. Vancouver

Attn. Julianna

Shipping Date Sept 18, 05

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested: Topsmelt Surv. & Growth	Test(s) Requested: Sand Dollar Fertilization	Test(s) Requested: Oyster Larvae Surv. & Devel.	Test(s) Requested: Neanthes (28-day)		4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)
17/Sept/05	12:55	SW9	SW		C	1X20L	CC	✓	✓	✓			~~20 ‰~~ 21 ‰
17/Sept/05		SW11	SW		C	1X20L	CC	✓	✓	✓			~ 27 ‰
17/Sept/05	11:25	SW12	SW		C	1X20L	CC	✓	✓	✓			~ 29 ‰
17/Sept/05	13:40	BH20	GW		C	1X20L	CC	✓	✓	✓			~ 5 ‰ 4.5 sal
17/Sept/05	14:41	BH16	GW		C	1X20L	CC	✓	✓	✓			~ 15 ‰
16/Sept/05	10:55	S27	SED		G	1X3L	P				✓		
16/Sept/05	11:00	S28	SED		G	1X3L	P				✓		
16/Sept/05	11:15	S29	SED		G	1X3L	P				✓		
16/Sept/05	12:30	S30	SED		G	1X3L	P				✓		
16/Sept/05	12:50	S31	SED		G	1X3L	P				✓		

PO/Reference No. 201.01022.01 Task 0019
Project Title Union Bay
Results Needed By

Comments/Instructions

1) Released by: Michael McLeay Date: 18/Sept/05
Company: SEACOR Time: ~12:00
Courier Name: Air Canada / Loomis

1) Received by: JAP Date: 19 Sept 05
Company: Golder Time: 12:57

2) Released by: Date:
Company: Time:
Courier Name:

1) Received by: Date:
Company: Time:

Shaded area to be completed by Golder Laboratory upon sample receipt.
Golder Project No. 04-1424-076
Golder Work Order No. 0500395/396/397/398
Condition Upon Receipt Cool
Receipt Sample Temp. (°C) 4.7°C

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); ~~Stormwater (SW);~~ Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

GW = groundwater
SW = seep water

Please see instructions for completion on back of form

Distribution of copies:
White, Yellow — accompany the shipment
Pink — kept by consignor (e.g. shipper)
Yellow — kept by consignee (e.g. receiver)
White — returned to consignor by consignee

CHAIN-OF-CUSTODY / TEST REQUEST FORM

2 of 2

No 1537

Client Name SEACOR Client Contact M. McLeay Ship to

Address Phone

Fax

Sampled by Attn. Shipping Date

Golder Associates
195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.golder.com

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G=grab C=composite	Number of Sample Containers x Volume of Sample Containers (1 x 20L)	3 Sample Container Type by Code	Test(s) Requested					4 Sample Notes (preserved, saltwater, freshwater, may contain sewage...)
											Neurotox (28-day)	Hold	
17/Sept/05	1105	S32	SED		G	1X3L	P					✓	
17/Sept/05	1116	S33	SED		G	1X3L	P				✓		

PO/Reference No. 20/01022.01/ Task 0019

Project Title

Results Needed By

Comments/Instructions

1) Released by:	Date:	2) Released by:	Date:	*Shaded area to be completed by Golder Laboratory upon sample receipt.*
Company:	Time:	Company:	Time:	Golder Project No.
Courier Name:		Courier Name:		Golder Work Order No.
1) Received by:	Date:	1) Received by:	Date:	Condition Upon Receipt
Company:	Time:	Company:	Time:	Receipt Sample Temp. (°C)

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW): Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); glass jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Please see instructions for completion on back of form

Distribution of copies: White, Yellow — accompany the shipment
Pink — kept by consignor (e.g. shipper)
Yellow — kept by consignee (e.g. receiver)
White — returned to consignor by consignee

Revision Date: November 22, 2004

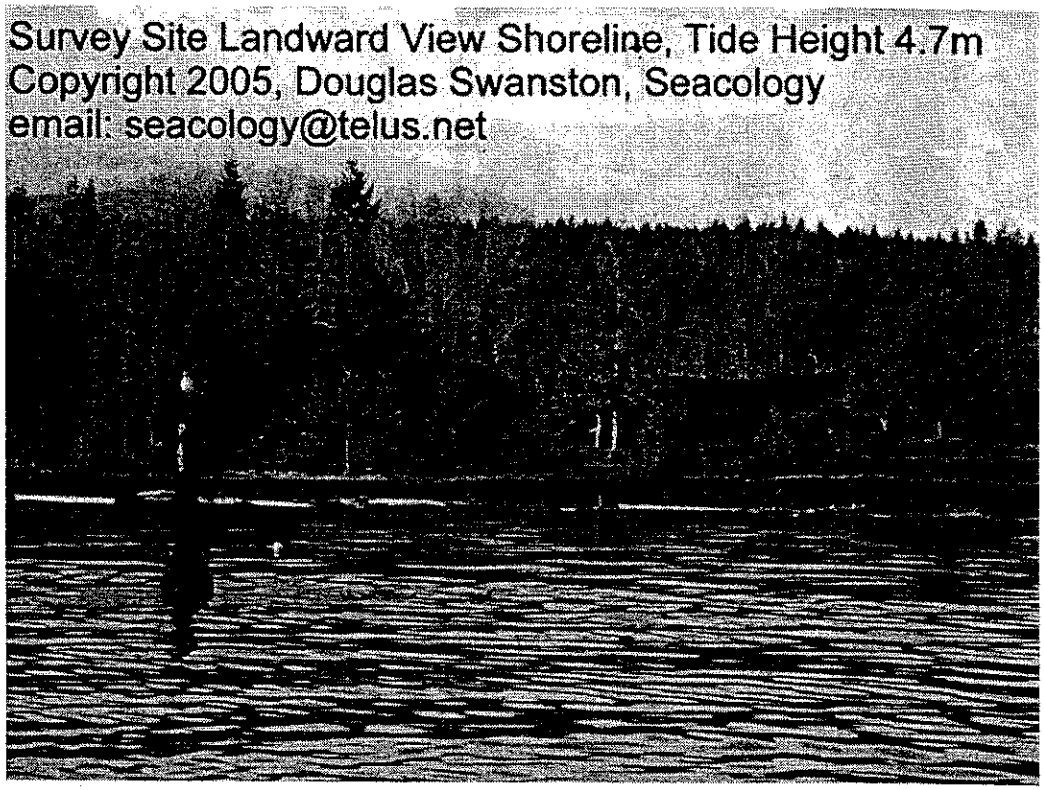
APPENDIX D

SEACOLOGY Subtidal Survey Report

Revised Problem Formulation and
Preliminary Quantitative Risk Assessment,
Union Bay Waste Coal Pile, BC Site 4291
Seacor Project: 201.01022.01 & 201.01069.01

Draft Report

Subtidal Sediment Coring and Biophysical Survey of the Union Bay Coal Mining Debris Pile Site



Submitted to:
Tara Siemens, MET, Environmental Toxicologist
SEACOR Environmental Inc., Suite 200 - 1620 West 8th Ave., Vancouver, BC, V6J 1V4
Phone: 604.738.2500, Fax: 604.738.2508, Direct Line: 604.742.3882
e-mail: tsiemens@seacorcanada.com

By:
Douglas Swanston, Seacology
3025 Sunnyhurst Road, North Vancouver, B.C., Canada, V7K 2G4
Phone/Fax: 604.987.4675 email: seacology@telus.net

Submitted 31 March 2005

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Preamble

This is a confidential document intended for the use of the recipient listed on the title page. Depths are listed as elevations above (+) and below (-) zero chart datum. All observations were made during a winter season site visit.

Overview

Between January 31 and February 5 2005, Seacology collected 15 sediment cores and conducted a subtidal biophysical survey of the epibenthos around a shoreline deposit of coal mining debris at Union Bay on Vancouver Island. This report summarizes the results of the field work.

Core Methods

Core locations were selected in consultation with Searor's onsite staff representative, Michael McLeay. 15 cores were collected. When possible the core tube was pushed to a penetration depth of 1.2 m or more. A core hammer was used to drive cores if the pushed penetration was less than 1 meter. Refusal was determined when hammering resulted in no further core penetration. The top of the core tubes were capped and cores extracted by hand. Once free of the substrate a core cap was also placed over the bottom of the core to prevent the core from winnowing or washing out.

Biophysical Survey Methods

Three transect lines were established to document subtidal observations around the site. The first transect line (1400 m. length) was placed parallel to the shoreline, at an elevation of -3 m. The second and third transect lines were established perpendicular to the shoreline from the -25 m. elevation to intertidal depth and documented using underwater video.

The 1400 m. long transect established at the -3 m. elevation was carried by divers and observations were recorded on dive slates or by the diver support crew in the dive tender. The metered transect line was used as a reference point for recording observations. The divers used a "free swim" technique and underwater diver propulsion vehicles (DPV's) to survey the near shore subtidal and intertidal between the -10 m. and +1 m. elevations.

The two transects established perpendicular to the shoreline were carried from the deep to the shallow end. Both transects were videotaped using a digital video camera, underwater housing and underwater lights. A second diver accompanying the videographer recorded depths and made observations on biota and substrate. Video and diver observations were located on the transect using markers placed every 5 meters along the transect line.

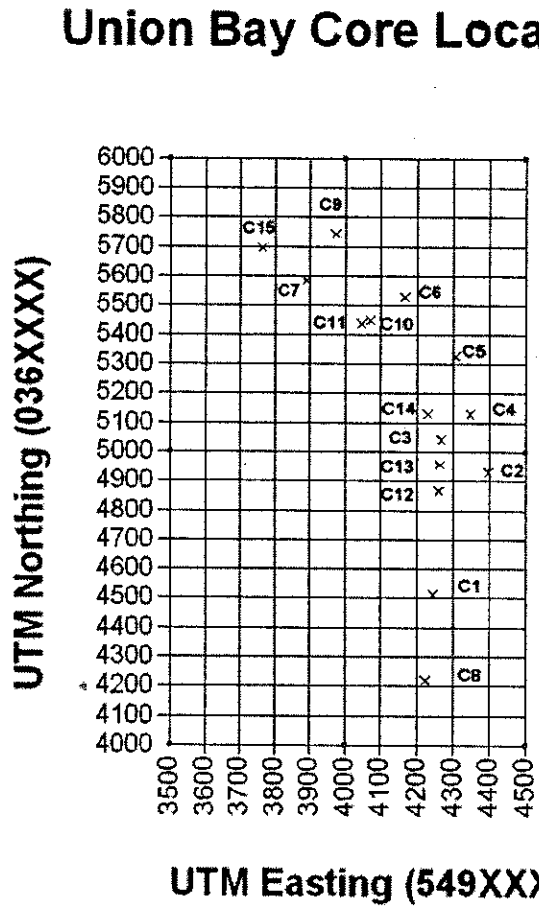
Deliverables

15 Cores with core locations are listed in the table below and illustrated in Figure 1. UTM Grid With Core Locations.

Table 1. Core location coordinates (UTM NAD 83)

Core	Easting	Northing	Core	Easting	Northing
1	364244	5494514	8	364223	5494222
2	364395	5494930	9	363971	5495743
3	364268	5495043	10	364071	5495447
4	364347	5495130	11	364045	5495438
5	364307	5495325	12	364259	5494868
6	364164	5495527	13	364264	5494956
7	363888	5495584	14	364228	5495128
			15	363763	5495696

Figure 1. UTM Grid With Core Locations



Site description

Subtidal Coal Observations

Evidence of coal debris is visible throughout the intertidal zone and subtidally offshore to depths of more than 9 m. below zero chart datum and 30 m. offshore from zero chart datum. Video transect 1 has coal debris visible to a depth of -6.9 m below chart datum and 30 m. offshore from zero chart datum. Video transect 2 has visible coal debris to a depth of -9.5 m below chart datum and 25 m. offshore from zero chart datum.

Substrate Size
Intertidal substrate is primarily sand, gravel, pebble and occasionally cobble sized coal debris. A rust stained area (more than 200 $m.^2$) colours the surface sediments along the southeastern shoreline and extends subtidally to -0.8 m. below chart datum. Near the base of an offshore slope coal debris transitions to a near level bottom of grey silt. See Figure 1. Video Transect 1 Profile and Figure 2. Video Transect 2 Profile.

Transect 1 Slopes - Southern Shoreline
Slope in the low intertidal is relatively flat 0.013 (rise/run) between +1.7 m. and zero chart datum elevations. Just below zero chart datum slope increases to maximum of 0.37 (rise /run) between -2.93 m. and -4.76 m. below chart datum, 20 m. offshore from zero chart datum. Slope levels out 35 m. offshore from zero chart datum to 0.034 (rise /run) between -8.11 m elevation and the deep end of the transect at -11.17 m. elevation.

Transect 2 Slopes - Northern Shoreline
Slope in the low intertidal is relatively flat 0.009 (rise/run) between +1.6 and zero chart datum elevations. Just below zero chart datum slope increases to maximum of 0.49 (rise /run) between -2.22 m. and -9.54 m. below chart datum, 20 m. offshore of zero chart datum. Slope levels out 25 m. offshore from zero chart datum to 0.041 (rise /run) between -10.43 m elevation and the deep end of the transect at -13.11 m. elevation.

Waves and Currents
South eastern storm winds generate significant wave action with a wind fetch of more than 18 kilometers along the length of Baynes Sound. The field crew experienced tide generated surface currents along the northern shoreline of the study site estimated to be between 0.5 and 1.5 knots. No significant current was detected by the divers during subtidal diving activities.

Biota - Species list - Habitats

Evidence of at least 43 distinctive taxa were observed in the survey (see Table 2. Taxa Observed or Evident from Site Observations). One plant taxon (a drifting Laminariale), three invertebrate taxa (all medusae) and two vertebrate taxa (harbour seal and stellers sea lion) are incidental pelagic visitors. Five distinctive habitats were observed; offshore grey silt with mounds, holes and craters; the coal debris slope; shallow subtidal and intertidal coal debris with horse clams and moon snails; eelgrass; and low intertidal coal debris. A brief description of these habitats follows.

1. Offshore Grey Silt with Mounds, Holes and Craters
The offshore appears typical of many shallow (above -30 m elevation) subtidal marine areas in coastal B.C. (see Picture 1. Grey Silt Substrate). Soft sediments with evidence of abundant infauna represented by the presence of holes, mounds and craters were observed. Substrates such as large woody debris, pebble to boulder sized rocks (very few of which were observed at this site), bivalve

shells, bivalve siphons and polychaete parchment tubes are encrusted with epifauna including Serpulidae calcareous tube worms, the green false-jingle, barnacles and plumose anemones. Occasional observations of the sunflower star or the pink star were also made.

2. Coal Debris Slope

Pebble sized coal debris substrate and a steep subtidal slope characterized this. Various smaller percentages of sand and silt were also observed. This substrate was not easily cored using the diver operated core methods employed by this survey. Small pebble sized substrate did not appear to favour colonization by epifauna. For example barnacle covered pebbles were only occasionally observed. A large dungeness crab was observed buried in this substrate habitat (see Picture 2. Coal Debris Pebbles Slope). Juvenile crabs, probably dungeness and red rock crabs were also observed. Small substrate size combined with wave and current induced sediment transport forces may limit the stability of this habitat for colonization by epifauna.

3. Shallow Subtidal and Intertidal Coal Debris with Horse Clams and Moon Snails

A significant bed of horse clams was observed in the shallow subtidal and intertidal bench, especially along video transect 2 (see Picture 3. Horse clam siphons and Moon Snail). Moon snails are a clam predator and were also observed in abundance here. Predator sea stars including the pink star, the sunflower star and the mottled star were also common.

4. Eelgrass

An extensive eelgrass bed fences the site in the low intertidal and shallow subtidal (See Picture 4. Eelgrass). Eelgrass is an important marine plant in coastal B.C. The eelgrass bed observed appeared in "good" condition given the wintertime observation period of this survey and the presence of a large rust stain (evidence of iron oxide leachate, see Picture 6. Eelgrass with Iron Oxide). Eelgrass, mostly *Zostera marina,* occurred in the survey between elevations of -1.40 and + 0.74 m along video transect 1. Eelgrass, mostly *Zostera japonica*, occurred along video transect 2 at elevations between and + 1.32 and + 1.9 0 m. The greatest tide generated "along shore" surface current was observed on this transect.

5. Low Intertidal Coal Debris

Sand, gravel and pebble sized coal debris in the intertidal zone characterized this habitat. Very few epifauna were observed. Horse clam siphons, occasional shore crabs, the hairy hermit crab, a small patch of sand dollars, barnacles, egg laying *Nucella* sp. snails, bivalve shells and red filamentous algae were observed (see Picture 7. Intertidal Coal Debris).

Figure 1 . Video Transect 1 Profile

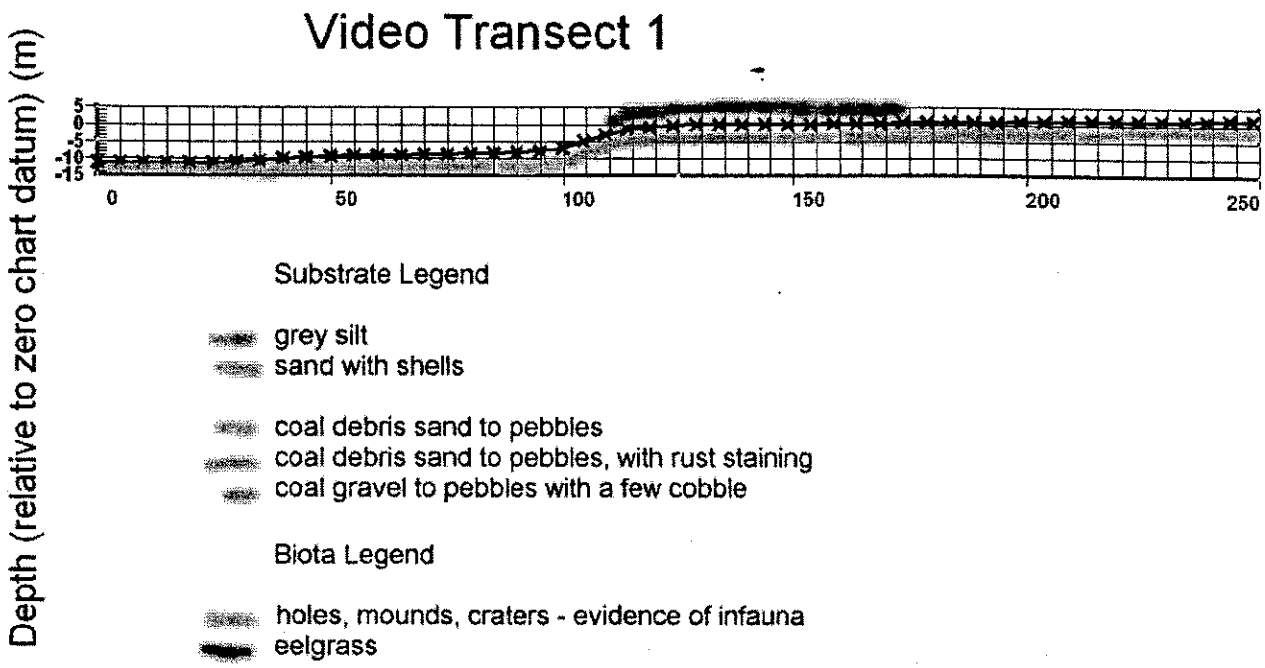
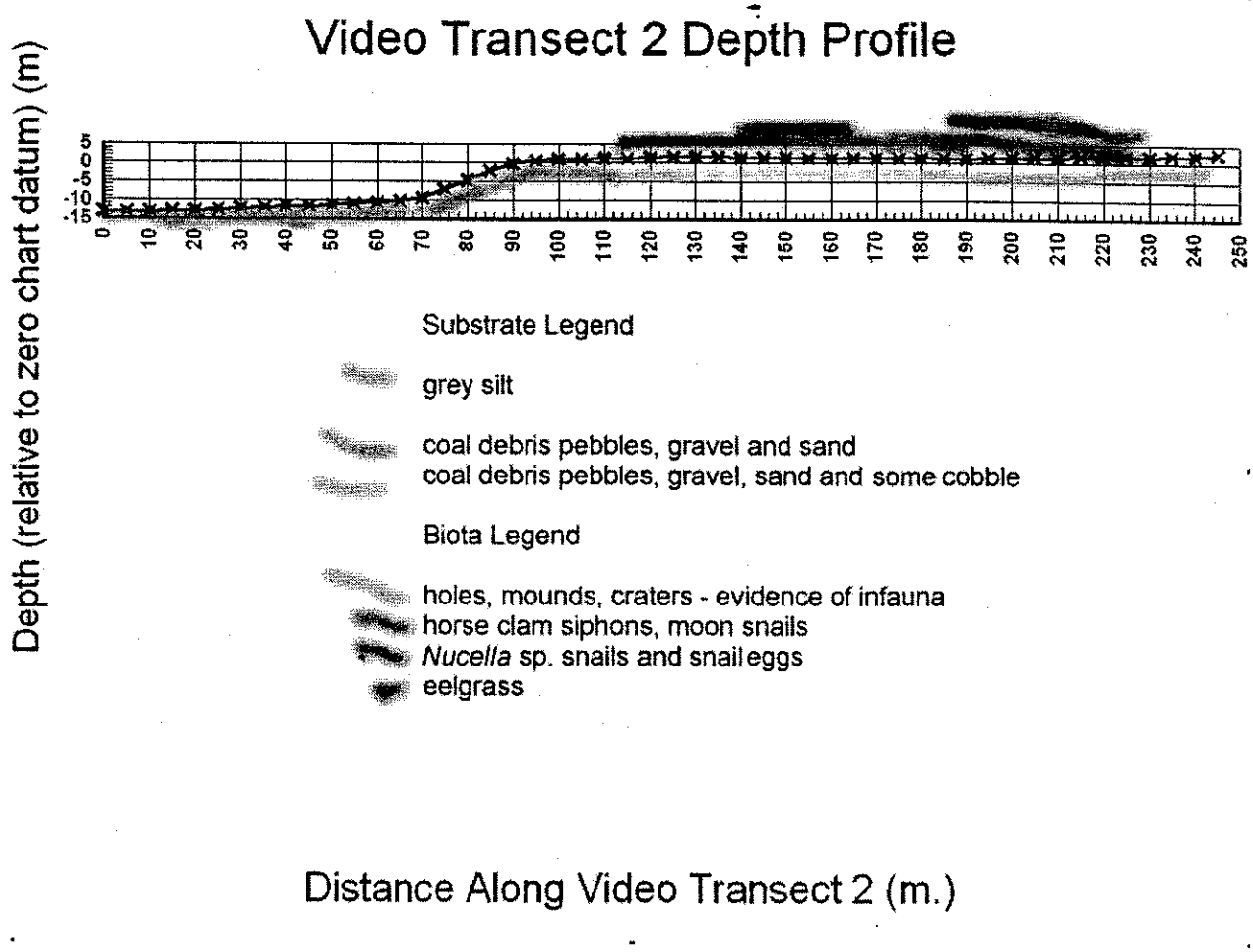
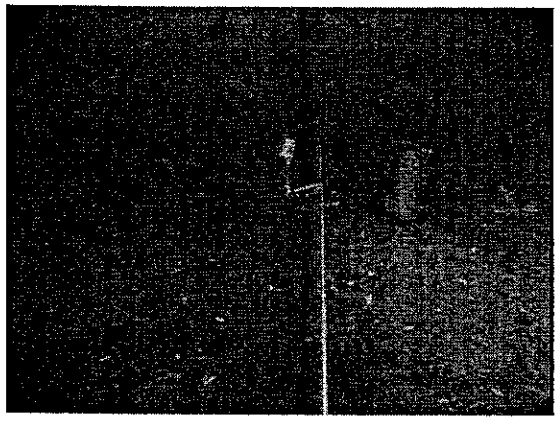
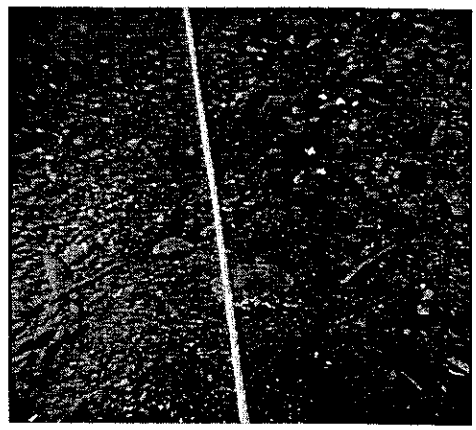


Figure 2 . Video Transect 2 Profile

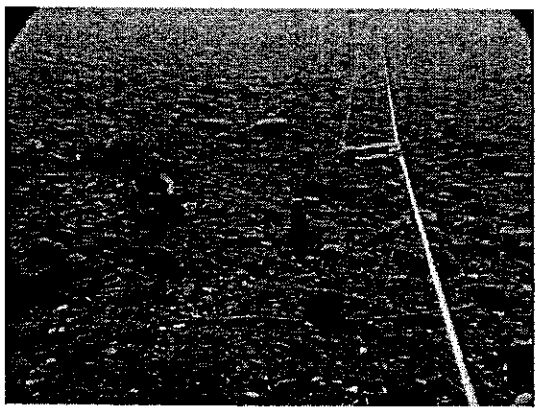




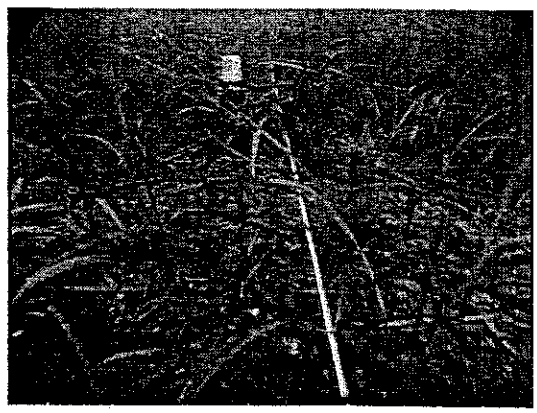
Picture 1. Grey Silt



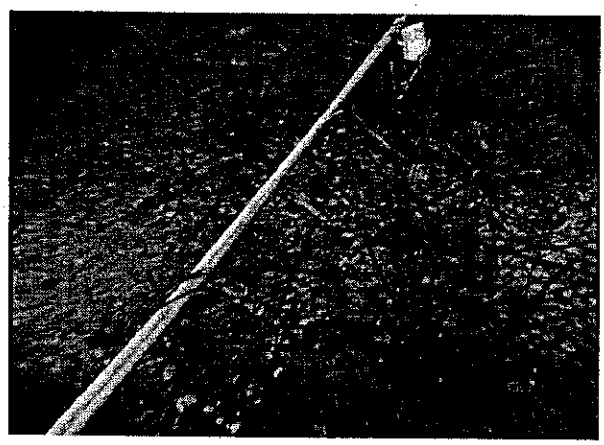
Picture 2. Coal Debris Pebble Slope



Picture 3. Horse clam siphons and Moon Snail



Picture 4. Eelgrass



Picture 6. Eelgrass with Iron Oxide



Picture 7. Intertidal Coal Debris

Table 2. Taxa Observed or Evident from Site Observations.

Kingdom	Phylum	Taxa Observed or Evidence of Presence	Video Transect 1	Video Transect 2	Free Swim
Plant	Anthophyta	*Zostera japonica*, eelgrass	T1	T2	Free swim
Plant	Anthophyta	*Zostera marina*, eelgrass	T1	T2	Free swim
Plant	Phaeophyta	Order Laminariales drift, brown blade algae drift	T1	T2	Free swim
Plant	Phaeophyta	*Sargassum muticum*, wireweed			Free swim
Plant	Rhodophyta	Rhodophyta red filamentous algae	T1	T2	Free swim
Plant	Chrysophyta	diatom mat	T1	T2	Free swim
Animal	Annalida	Serpulidae, calcareous tube worm casings	T1	T2	Free swim
Animal	Annalida	Sabellida, parchment tube worm	T1	T2	Free swim
Animal	Annalida	Sabellida, white parchment tube worm casing	T1		
Animal	Annalida	Sabellida, white tenticled parchment tube worm	T1		
Animal	Arthropoda	*Balanus* sp., barnacles	T1	T2	Free swim
Animal	Arthropoda	*Cancer magister* shells, dungeness crab shells		T2	Free swim
Animal	Arthropoda	*Cancer magister*, dungeness crab		T2	
Animal	Arthropoda	*Cancer productus*, red rock crab			Free swim
Animal	Arthropoda	*Cancer* sp. shell, crab shell	T1	T2	
Animal	Arthropoda	*Cancer* sp.juveniles, cancer crab juvenilies		T2	
Animal	Arthropoda	*Hemigrapsus* sp. shore crab	T1		Free swim
Animal	Arthropoda	*Pagurus hirsutiusculus*, hairy hermit	T1		Free swim
Animal	Arthropoda	*Pagurus* sp., hermit crab	T1	T2	
Animal	Arthropoda	*Pugettia gracilis*, graceful kelp crab		T2	Free swim
Animal	Cnidaria	*Aequorea aequorea*, water jelly	T1	T2	Free swim
Animal	Cnidaria	*Aurelia aurita*, moon jelly			Free swim
Animal	Cnidaria	*Metridium farcimen*, plumose anemone	T1	T2	Free swim
Animal	Cnidaria	*Pachycerianthus fimbriatus*, tube-dwelling anemone	T1	T2	Free swim
Animal	Cnidaria	*Polyorchis penicillatus*, medusae	T1		
Animal	Echinodermata	*Evasterias troschelii*, mottled sea star		T2	Free swim
Animal	Echinodermata	*Parastichopus californicus*, California sea cucumber		T2	Free swim
Animal	Echinodermata	*Pisaster brevispinus*, pink stars	T1	T2	Free swim
Animal	Echinodermata	*Pycnopodia helianthoides*, sunflower star	T1	T2	Free swim
Animal	Echinodermata	*Dendraster excentricus*, sand dollar			Free swim
Animal	Mollusca	bivalve shells	T1	T2	Free swim
Animal	Mollusca	*Clinocardium* sp. shell, cockle shell	T1	T2	Free swim
Animal	Mollusca	*Crassostrea gigas* shell, pacific oyster shell		T2	Free swim
Animal	Mollusca	*Modiolus rectus* shell, strait horsemussel shell	T1	T2	
Animal	Mollusca	*Modulus rectus*, strait horsemussel	T1		
Animal	Mollusca	*Nucella* sp. eggs, snail eggs	T1	T2	Free swim
Animal	Mollusca	*Nucella* sp., snail	T1	T2	Free swim
Animal	Mollusca	*Panopea abrupta*, geoduck	T1		Free swim
Animal	Mollusca	*Panopea abrupta* shell, geoduck shell	T1	T2	Free swim
Animal	Mollusca	*Pododesmus machrochisma*, green false-jingle	T1	T2	Free swim
Animal	Mollusca	*Polinices lewisii* shell, moon snail shell	T1	T2	Free swim
Animal	Mollusca	*Polinices lewisii*, moon snail	T1	T2	Free swim
Animal	Mollusca	*Saxidomus gigantea* shell, butter clam shell	T1	T2	Free swim
Animal	Mollusca	*Tresus capax* shell, fat gaper shell	T1	T2	Free swim
Animal	Mollusca	*Tresus capax*, fat gaper	T1	T2	Free swim
Animal	Mollusca	*Melibe liona*, lion nudibranch			Free swim
Animal	Mollusca	*Janolus fuscus*, tricoloured nudibranch			Free swim
Animal	Various	Holes, munds & craters - evidence of infauna	T1	T2	
Animal	Chordata	*Sygnathus griseolineatus*, bay pipefish	T1	T2	
Animal	Chordata	*Phoca vitulina*, harbour seal			Free swim
Animal	Chordata	*Eumetopias jubatus*, steller sea lion			Free swim
		Plants	**5**	**5**	**6**
		Invertebrates (not counting "empty" shells or tubes)	**18**	**17**	**22**
		Vertebtrates	**1**	**1**	**2**
		Taxa Count (not counting "empty" shells or tubes)	**24**	**23**	**28**
		Taxa Count (including distinctive "empty" shells or tubes)	**29**	**29**	**33**

Summary of the Taxa Count (Plants = 6, Invertebrates = 34, Vertebrates = 3) = 43

APPENDIX E

UPDATED PROTOCOL 5

Revised Problem Formulation and
Preliminary Quantitative Risk Assessment,
Union Bay Waste Coal Pile, BC Site 4291
Seacor Project: 201.01022.01 & 201.01069.01

Appendix C - Report Summary

Site Information Summary

Common name of site (if applicable)	Union Bay - Waste Coal Pile and Kensington Property - Areas 1 and 2			BCE SITE ID#:		4291
Civic address of site street:	Island Highway					
city/postal code:	Union Bay, B.C.					
Owner of site name:	Kensington Island Properties Ltd.			West Fraser Timber Mills Ltd.		
Owner's address street:	201 - 1830 Riverside Road			501 - 858 Beatty Street		
City, prov/state, postal code, country:	Courtenay, BC V9N 8C7			Vancouver, B.C. V6B 1C1		
Site occupant(s) (if different than owner)	N/A (Site is vacant)					
Latitude (NAD 83 ± 0.5 seconds)	Degrees:	49	Minutes:	35	Seconds:	30
Longitude (NAD 83 ± 0.5 seconds)	Degrees:	124	Minutes:	53	Seconds:	0
PIDs/PINs of site (attach separate page if necessary)	Refer to Figure 2 for Legal Lot Boundaries and Tables 2.1 and 2.2 in DSI (2005)[3]					
Legal description or meets and bounds: (attach separate page if necessary)	Refer to Figure 2 for Legal Lot Boundaries and Appendix A of DSI (2005) report[3] for Metes and Bounds Survey Plan and Descriptions (based on proposed land use)					
Company official & address re sending AiP/Certificates by Registered Mail:	J. Malick, SEACOR Environmental Inc. Suite 200 1620 West 8 Avenue Vancouver, BC V6J1V4					

Report(s) Submitted		Report Date(s)	
		Past Submissions	Present
x	("x" as appropriate)	(yy-mm-dd)	(yy-mm-dd)
x	Preliminary Site Investigation - First Stage	95/05/11[1] 05-05-31[3]	
x	Preliminary Site Investigation - Second Stage	98/05/14[2] 05-05-31[3]	
x	Detailed Site Investigation	05-05-31[3], 06/08/31	
x	Remediation Plan with Risk Assessment	05-05-31[3]	06/09/08
	Remediation Plan without Risk Assessment		
	Confirmatory Sampling		
	Monitoring		

Report Name	Revised Problem Formulation and Preliminary Quantitative Risk Assessment, Union Bay Waste Coal Pile, Union Bay, BC, BC Site 4291
Consultant's Name	SEACOR Environmental Inc.
Consultant's file number	201.01022.01

Summary of Actions Taken (Current Status)

Revised the earlier Problem Formulation included in the May 31st submission, performed additional human health risk calculations, and included aquatic toxicity test results.

Accompanying Information

Supplemental Detailed Site Investigation Union Bay Waste Coal Pile (August 31, 2006)
Remedial Option Evaluation, with Case Study Review
Update Land Use and Development Plan
Remediation of Site as per proposed Remediation Plan (Section 6.0 of DSI[3]).
Post remediation monitoring and subsequent post remediation risk assessment.

1 - Reports Phase II Environmental Site Assessments, Areas 1, 2 and 3, Union Bay, British Columbia, Norecol, Dames and Moore Job #29638-004-310, dated December 6, 1995
2 - Final Report Re-Evaluation of Data Site Investigation Areas 1, 2 and 3 Union Bay, British Columbia, Norecol, Dames and Moore Job #38933-001-310, dated May 14, 1998
3 - Stage 1 Preliminary Site Investigation, Detailed Site Investigation, Problem Formulation and Remediation Plan

The above information is a summary only and persons who may be relying on the report are encouraged to review the entire document so as to avoid the use of information out of context.

Appendix C Continued

Soil and Groundwater Sampling and Analysis Summary

SITE ID#	4291

Site Data	
Total area of site (m^2)	approx 150000 m2
Total area of building(s) (m^2)	no buildings on Site
Total paved surface area (m^2)	no pavement on Site
Current land use	vacant/unused
Proposed land use	commercial/residential/parkland
Suspect land uses	coal processing and shipping
Contaminant source(s)	waste coal pile, coke ovens, briquette plant, coal washer building, machine shop, warehouse, foundry, oil house, railway, laboratory, car repair shop
Presence of free product	LNAPL (N) DNAPL (N)
Number of soil contaminant zones	3
No. of groundwater contaminant plumes	1
Contaminant Migration potential	? : Low: X High:

Area Information	
Nearest groundwater water supply (m)	none
Nearest surface water (m)	Baynes Sound and Washer Creek
Nearest sensitive area (m)	Baynes Sound, immediately adjacent
Uses of adjacent water resources	See Section 3.1 of report
Annual rainfall (mm) + snowfall (cm)	1,442 mm
100/200 year flood potential of site	
100/200 yr flood potential of area	
Adjacent land uses	vacant/waterfront to the north and south, vacant and residential to the east (upgradient)

Soil Sample Information	
Number of testpits	48
Number of boreholes	70
Number of surface samples collected	32
Number of soil samples collected	n/a
Number of soil samples analyzed (n)	47
Soil Contaminant(s) PCOCs	Soil Quality (AL,PL, RL,CL,IL,W, SW)
Shallow (depth, 0 to 1 m)	
napthalene, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)floranthene, arsenic, copper, antimony, lead	>CSR PL/RL (and > CL/IL at some locations)
Intermediate (depth, > 3 m)	
napthalene, phenanthrene, arsenic, copper, lead	>CSR PL/RL
Deep (depth, 10 m to)	
napthalene, phenanthrene, arsenic, copper	>CSR PL/RL

Groundwater Sample Information	
Approx. depth to groundwater (m)	varies due to great variation in topography
No. of affected aquifers & depths (m)	1
No. of monitoring wells developed	23
No. of groundwater samples collected	30
No. groundwater samples analyzed (n)	30
Groundwater Contaminant(s) PCOCs	Water Quality (AW, IW, LW, DW)
Shallow (depth, m)	
Intermediate (depth, m)	
Deep (depth, m)	
cadmium, cobalt, copper, nickel, zinc, sulphate	> CSR AWM and AWF

Notes: Migration potential refers to contaminant plume(s) and "?" = "unknown"
"surface samples" = soil samples obtained using hand trowels, shovels and hand augers at depths less than 0.5 metres
PCOC = Potential contaminants of concern

AL = Agricultural
PL = Urban Park
RL = Residential
CL = Commercial
IL = Industrial
W = Waste
SW = Special Waste

AW = Aquatic Life
LW = Livestock
IW = Irrigation
DW = Drinking Water

The above information is a summary only and persons who may be relying on the report are encouraged to review the entire document so as to avoid the use of information out of context.

Report Date: _____

Appendix C Continued

Statistical Summary of Soil and Groundwater Analyses

Site ID#	4291

SOIL -- Zones of Soil Contamination (referenced to attached Site Plan)

Depth Range (m)	Volume (m3)	Quality (CL, IL, etc.)	Soil Contaminants (concentrations in µg/g)								
			PCOC	Number of Analyses	Sample Mean	Standard Deviation	Minimum Value	Maximum Value	Median	75th Percentile	90th Percentile
0 - 3	0.6 million	>CSR PL	Napthalene	14	6.299	3.280	0.05	11.9	6.46	8.1225	9.252
0 - 3	0.6 million	>CSR PL	Phenanthrene	14	6.682	3.284	0.05	10.7	8.11	8.77	8.922
> 3	0.6 million	<CSR CL	Napthalene	34	3.011	3.957	0.05	13.8	1.475	1.99	9.731
> 3	0.6 million	<CSR CL	Phenanthrene	34	4.970	3.264	0.05	11.3	4.84	6.405	9.072
0 - 3	0.6 million	>CSR PL	Arsenic	25	41.44	49.27	6.4	173	26.1	37.5	56.67
0 - 3	0.6 million	>CSR PL	Copper	25	64.50	42.14	22.3	190	51.8	69.6	90.8
> 3	0.6 million	>CSR CL	Arsenic	31	20.29	29.82	7	173	11.2	20.85	32.8
> 3	0.6 million	>CSR CL	Copper	31	69.40	48.65	29	274	56.4	68.35	77.3
0 - >3	220000	>CSR PL	Phenanthrene	74	3.296	4.023	0.025	18.1	1.27	5.655	8.416
0 - >3	220000	>CSR PL	Napthalene	74	1.461	2.261	0.025	10.7	0.5375	2.025	4.15
0 - >3	40000	>CSR PL	Benzo(a)anthracene	74	0.3747	0.5879	0.025	3.9	0.146	0.505	0.9884
0 - >3	40000	>CSR PL	Benzo(a)pyrene	74	0.2470	0.6438	0.025	5.18	0.081	0.256	0.4
0 - >3	40000	>CSR PL	Benzo(b)fluoranthene	74	0.3899	0.6920	0.025	4.75	0.1745	0.5025	0.7814
0 - >3	40000	>CSR PL	Benzo(k)fluoranthene	74	0.1063	0.2310	0.01	1.66	0.025	0.088	0.1794
0 - >3	10000	>CSR PL	HEPH	9	1,091	2,179	0.1	5960	0.1	180.025	3854
0 - >3	11000	>CSR PL	Arsenic	60	10.66	7.221	2.5	37.9	8	16.275	19.17
0 - >3	11000	>CSR PL	Antimony	43	22.33	107.3	5	709	5	5	5
0 - >3	11000	>CSR PL	Copper	60	111.9	239.6	5.5	1480	51.55	74.7	126
0 - >3	11000	>CSR PL	Lead	43	122.8	441.6	25	2890	25	47.775	102.46
0 - >3	1200	>CSR PL	Napthalene	14	2.132	2.861	0.053	9.43	0.984	2.505	7.422
0 - >3	1200	>CSR PL	Phenanthrene	14	3.241	2.470	0.084	7.42	2.89	6.185	7.006
0 - >3	1200	>CSR PL	Arsenic	8	13.88	5.770	5.9	21.6	12.85	18.6	20.72
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Acenaphthene	79	0.2811	0.1696	0.04	0.665	0.2485	0.393	0.510
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Acenaphthylene	79	0.1500	0.07453	0.05	0.337	0.131	0.192	0.240
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Anthracene	79	0.1563	0.09985	0.05	0.619	0.129	0.216	0.273
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Benzo(a)anthracene	79	0.2450	0.1124	0.05	0.522	0.24	0.314	0.395
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Chrysene	79	0.3924	0.2290	0.05	0.897	0.408	0.559	0.678
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Fluorene	79	0.5157	0.4142	0.05	1.64	0.4395	0.749	1.006
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Naphthalene	79	1.721	1.348	0.05	5.27	1.46	2.520	3.606
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	Phenanthrene	79	3.027	2.034	0.05	7.9	2.88	4.410	5.752
0 - 1	NA	>BC Marine SedQC$_{SCS/STS}$	2-Methylnaphthalene	57	2.901	2.524	0.05	9.39	2.385	4.405	6.466
0 - 1	NA	>BC Marine SedQC$_{SCS}$	Arsenic	55	16.64	10.00	5.1	49.2	14.1	21.725	28.480
0 - 1	NA	>BC Marine SedQC$_{SCS}$	Copper	55	44.08	14.71	12.2	94.3	44.8	49.700	62.400
0 - 1	NA	>BC Marine SedQC$_{SCS}$	Mercury	55	0.2680	0.1272	0.069	0.558	0.244	0.343	0.452
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	Acenaphthene	6	0.1978	0.09438	0.04	0.334	0.164	0.225	0.290
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	Acenaphthylene	6	0.1003	0.01228	0.05	0.112	0.1025	0.108	0.111
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	Anthracene	6	0.1005	0.04845	0.05	0.16	0.091	0.130	0.148
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	Fluorene	6	0.1977	0.2140	0.05	0.618	0.1325	0.188	0.411
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	Naphthalene	6	1.473	0.6320	0.05	2.18	1.4135	1.918	2.075
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	Phenanthrene	6	2.800	0.4891	0.05	3.52	2.615	2.890	3.268
1 - 4	NA	>BC Marine SedQC$_{SCS/STS}$	2-Methylnaphthalene	6	2.860	1.213	0.05	4.24	2.76	3.685	4.018
1 - 4	NA	<BC Marine SedQC$_{SCS}$	Arsenic	5	11.85	4.554	6.9	16.6	11.95	15.175	16.030
1 - 4	NA	<BC Marine SedQC$_{SCS}$	Copper	5	35.06	18.97	17	64.5	32.8	40.500	54.900
1 - 4	NA	<BC Marine SedQC$_{SCS}$	Mercury	5	0.1975	0.1464	0.094	0.301	0.1975	0.249	0.280
0 - 1	NA	>BC Freshwater SedQC$_{SCS}$	Naphthalene	4	0.1693	0.1119	0.084	0.296	0.128	0.212	0.262
0 - 1	NA	>BC Freshwater SedQC$_{SCS}$	Phenanthrene	4	0.3253	0.1294	0.18	0.428	0.368	0.398	0.416
0 - 1	NA	>BC Freshwater SedQC$_{SCS}$	2-Methylnaphthalene	4	0.2637	0.2070	0.11	0.499	0.182	0.341	0.436
0 - 1	NA	>BC Freshwater SedQC$_{SCS}$	Arsenic	5	21.64	5.915	14.3	30.4	21.6	23.000	27.440

Linear velocity of plume = Darcy velocity (V_{Darcy}) divided by the effective porosity (n_e)

PCOC = potential contaminant of concern

is a summary only and persons who may be relying on the report are encouraged to review the entire document so as to avoid the use of information out of context.

Appendix C Continued

Statistical Summary of Soil and Groundwater Analyses

GROUNDWATER -- Groundwater Contaminant Plumes (referenced to attached Site Plan)

Depth Range (m)	Velocity Linear (m/yr)	Quality (AW, DW, etc.)	Groundwater Contaminants (concentrations in µg/L) PCOCs & pH, Hardness	Number of Analyses	Sample Mean	Standard Deviation	Minimum Value	Maximum Value	Median	75th Percentile	90th Percentile
3-17	100	>CSR AWM/F	Cadmium (dissolved)	51	5.375	3.932	0.44	13.1	5.88	8.25	11.09
3-17	100	>CSR AWM/F	Cadmium (total)	10	6.183	4.708	0.55	14.4	7.3	7.7	10.56
3-17	100	>CSR AWM/F	Cobalt (dissolved)	51	238.9	146.0	19	504	224	347	449.2
3-17	100	>CSR AWM/F	Cobalt (total)	10	309.2	157.2	86.2	528	350	381.75	475.5
3-17	100	>CSR AWM/F	Copper (dissolved)	51	151.7	167.0	20.8	634	65.7	235	318.5
3-17	100	>CSR AWM/F	Copper (total)	10	202.8	172.0	56	469	154	270	389.4
3-17	100	>CSR AWM/F	Lead (dissolved)	51	6.280	7.331	2.09	22.6	3.5	5.43	12.34
3-17	100	>CSR AWM/F	Lead (total)	10	21.00	17.45	5	50	17.5	25	50
3-17	100	>CSR AWM/F	Nickel (dissolved)	51	322.4	212.5	31	790	269	501.25	567
3-17	100	>CSR AWM/F	Nickel (total)	10	455.3	245.5	53	840	490	575	665
3-17	100	>CSR AWM/F	Zinc (dissolved)	51	987.5	841.4	13	2990	818.5	1595	2120
3-17	100	>CSR AWM/F	Zinc (total)	10	1,205	1,107	46.5	3160	1030.5	2037.5	2395
3-17	100	>CSR AWM/F	Sulphate-SO4 (mg/L)	39	2,537	953.0	77.8	4370	2550	2915	3880
3-17	100	>CSR AWM/F	Titanium (total)	9	1,353	1,709	59	3290	710	2000	2774
~2	100	>CSR AWM/F	Sulphate	5	1,395	2,205	3.66	5060	11.7	1890	3792
0-1	N/A	<BCWQ	Copper (dissolved)	2	1.165	0.5728	0.76	1.57	1.165	1.3675	1.489
0-1	N/A	>BCWQ	Copper (total)	2	2.560	0.5091	2.2	2.92	2.56	2.74	2.848
0-1	N/A	>BCWQ	Iron (dissolved)	12	4,538	14,910	6.77	49500	15.7	78.6	168
0-1	N/A	>BCWQ	Iron (total)	6	8,710	20,720	10.6	51000	99.45	818.5	26020
0-1	N/A	>BCWQ	Manganese (dissolved)	2	938.7	1,275	37.4	1840	938.7	1389.35	1659.74
0-1	N/A	>BCWQ	Manganese (total)	2	1,085	1,266	190	1980	1085	1532.5	1801
1-1.75	N/A	>BCWQ	Iron (dissolved)	7	29.73	23.15	1.94	61.6	24.5	44.6	61.3
1-1.75	N/A	>BCWQ	Iron (total)	4	47.63	33.77	11.7	81	48.9	73.8	78.12
N/A	N/A	>BCWQ	Cadmium (dissolved)	13	0.1252	0.08450	0.067	0.27	0.081	0.13	0.214
N/A	N/A	<BCWQ	Cadmium (total)	17	0.06617	0.01426	0.051	0.092	0.063	0.069	0.081
N/A	N/A	>BCWQ	Copper (dissolved)	13	1.347	0.4602	0.44	2.1	1.29	1.75	1.852
N/A	N/A	>BCWQ	Copper (total)	17	1.306	0.9554	0.32	3.84	0.89	1.95	2.36
N/A	N/A	>BCWQ	Iron (dissolved)	21	51,520	45,400	9710	206000	42500	51700	109000
N/A	N/A	>BCWQ	Iron (total)	25	47,780	41,220	5830	185000	36600	54700	101280
N/A	N/A	>BCWQ	Manganese (dissolved)	13	1,815	956.6	511	3520	1940	2460	2938
N/A	N/A	>BCWQ	Manganese (total)	17	1,506	932.6	344	3110	1520	2230	2640
N/A	N/A	>BCWQ	Nickel (dissolved)	13	19.42	10.90	4.2	47.2	17.2	23.1	29.86
N/A	N/A	>BCWQ	Nickel (total)	17	15.97	11.22	0.673	42	13.5	20.5	29.88
N/A	N/A	>BCWQ	Zinc (dissolved)	13	54.08	147.0	5.23	543	11.5	19.9	24.96
N/A	N/A	>BCWQ	Zinc (total)	17	10.11	6.952	2.09	30	9.35	13.15	15.95
N/A	N/A	<BCWQ	Cadmium (dissolved)	3	0.06700	0.005292	0.061	0.071	0.069	0.07	0.0706
N/A	N/A	>BCWQ	Cadmium (total)	22	0.07043	0.03869	0.049	0.233	0.06	0.067	0.078
N/A	N/A	<BCWQ	Copper (dissolved)	3	0.4310	0.08190	0.375	0.525	0.393	0.459	0.4986
N/A	N/A	>BCWQ	Copper (total)	22	0.9936	1.229	0.354	6.16	0.7415	0.916	1.428
N/A	N/A	>BCWQ	Iron (dissolved)	12	2,197	2,084	44	4570	1350	4270	4450
N/A	N/A	>BCWQ	Iron (total)	22	1,258	1,712	28	6480	709	1335	3143
N/A	N/A	>BCWQ	Manganese (dissolved)	3	98.05	85.77	6.16	176	112	144	163.2
N/A	N/A	>BCWQ	Manganese (total)	22	142.5	184.9	3.31	701	97.3	152.5	362.7
N/A	N/A	<BCWQ	Zinc (dissolved)	3	2.657	0.4738	2.11	2.95	2.91	2.93	2.942
N/A	N/A	>BCWQ	Zinc (total)	22	2.306	3.299	0.8	16.2	1.38	1.95	2.59
N/A	N/A	>BCWQ	Cadmium (dissolved)	10	0.9407	0.6289	0.114	1.95	0.99	1.265	1.638
N/A	N/A	>BCWQ	Cadmium (total)	16	0.8453	0.7755	0.079	2.36	0.738	1.1375	1.709
N/A	N/A	>BCWQ	Copper (dissolved)	10	5.555	7.128	1.35	25.1	2.88	5.565	8.873
N/A	N/A	>BCWQ	Copper (total)	16	5.811	4.579	0.54	20.6	5.625	7.07	8.055
N/A	N/A	>BCWQ	Iron (dissolved)	13	108,000	94,070	7570	292000	58700	166000	225400
N/A	N/A	>BCWQ	Iron (total)	19	88,140	81,710	2670	242000	60800	155500	216800
N/A	N/A	>BCWQ	Lead (dissolved)	10	1.251	1.118	0.295	2.86	0.925	1.5025	2.317
N/A	N/A	>BCWQ	Lead (total)	16	1.040	0.9103	0.3	2.98	0.625	1.4025	2.251
N/A	N/A	>BCWQ	Manganese (dissolved)	10	944.5	561.1	256	1970	823.5	1115	1790
N/A	N/A	>BCWQ	Manganese (total)	16	1,022	712.0	48.8	2450	823	1517.5	1990
N/A	N/A	>BCWQ	Nickel (dissolved)	10	54.67	39.23	2.8	127	49.25	68.875	111.7
N/A	N/A	>BCWQ	Nickel (total)	16	51.47	47.27	0.57	161	50.65	64.575	119
N/A	N/A	>BCWQ	Zinc (dissolved)	10	169.5	142.0	12	480	162.5	209.25	324.3
N/A	N/A	>BCWQ	Zinc (total)	16	189.7	186.9	2.9	637	134	233.75	466
N/A	N/A	>BCWQ	Cadmium (total)	3	0.07950	0.04031	0.051	0.108	0.0795	0.09375	0.1023
N/A	N/A	>BCWQ	Copper (total)	3	2.017	1.211	1.1	3.39	1.56	2.475	3.024
N/A	N/A	>BCWQ	Iron (total)	3	3,559	5,337	360	9720	597	5158.5	7895.4
N/A	N/A	>BCWQ	Manganese (total)	3	109.7	163.1	11.3	298	19.8	158.9	242.36
N/A	N/A	<BCWQ	Cadmium (dissolved)	3	0.06333	0.006658	0.059	0.071	0.06	0.0655	0.0688
N/A	N/A	<BCWQ	Cadmium (total)	3	0.07300	0.01778	0.053	0.087	0.079	0.083	0.0854
N/A	N/A	<BCWQ	Copper (dissolved)	3	0.8667	0.2282	0.626	1.08	0.894	0.987	1.0428
N/A	N/A	<BCWQ	Copper (total)	3	0.7500	0.2543	0.565	1.04	0.645	0.8425	0.961

Appendix C Continued

Contaminant Risk Summary 1

HUMAN HEALTH

SITE ID #: 4291

CARCINOGENS

COPC	Exposure Pathway	Maximum Calculated Incremental Lifetime Cancer Risk	Risk-based Standard
Arsenic	Ingestion of intertidal sediment	See Appendix summary table on following page. Summarizes all risks in excess of CSR risk-based standards. Risks calculated for recreator only. Values vary depending on assumed exposure scenario.	1.00E-05
	Ingestion of intertidal precipitate (ferricrete)		
	Ingestion of intertidal water		
	Ingestion of clams		
	Ingestion of oysters		
	Dermal contact with intertidal sediment		
	Dermal contact with intertidal precipitate (ferricrete)		
	Dermal contact with intertidal water		
	Inhalation of intertidal sediment		
	Combined pathways		

NON-CARCINOGENS

COPC	Exposure Pathway	Maximum Calculated Hazard Index	Risk-based Standard
Aluminium	All above pathways	See Appendix summary table on following page. Summarizes all risks in excess of CSR risk-based standards. Risks calculated for recreator only. Values vary depending on assumed exposure scenario.	1.00E+00
Arsenic	All above pathways		
Cadmium	Ingestion of intertidal water, clams, oysters; Dermal contact with intertidal water		
Cobalt	Ingestion of clams, oysters		
Copper	Ingestion of clams, oysters		
Iron	All above pathways		
Lead	Ingestion of clams, oysters		
Manganese	All above pathways		
Molybdenum	Ingestion of ferricrete; Dermal contact with ferricrete		
Nickel	Ingestion of clams, oysters		
Zinc	Ingestion of clams, oysters		
Naphthalene	Ingestion of waste coal/soil, sediment, ferricrete; Dermal contact with waste coal/soil, sediment, ferricrete; Inhalation of waste coal/soil, sediment.		
Phenanthrene	Ingestion of waste coal/soil, sediment, ferricrete; Dermal contact with waste coal/soil, sediment, ferricrete; Inhalation of waste coal/soil, sediment; Ingestion of clams.		

The above information is a summary only and persons who may be relying on the report are encouraged to review the entire document so as to avoid the use of information out of context.

Date: _____

TABLE 2.3: INDIVIDUAL PATHWAY RISK ESTIMATES EXCEEDING RISK BASED STANDARDS					
	Sediment Ingestion (3 days/week)	Sediment Ingestion (5 days/week)	Ferricrete Ingestion (5 days/week)	Clam Ingestion (1 meal per week)	Oyster Ingestion (1 meal per week)
ADULT					
Arsenic	--	--	--	ILCR = 3.8E-05	ILCR = 2.1E-05
TEEN (12-19 Yr)					
Cadmium	--	--	--	HQ = 1.1	--
CHILD (5-11 Yr)					
Arsenic	--	--	--	ILCR = 1.2E-05	--
Cadmium	--	--	--	HQ = 1.7	--
TODDLER (0.5-4 Yr)					
Arsenic	--	ILCR = 1.4E-05	--	--	--
Cadmium	--	--	--	HQ = 1.9	--
NON-ADULT (0.5 to 19 Yr Combined)					
Arsenic	ILCR = 1.2E-05	ILCR = 1.9E-05	ILCR = 1.2E-05	ILCR = 2.9E-05	ILCR = 1.6E-05

TABLE 2.4: COMBINED PATHWAY RISK ESTIMATES EXCEEDING RISK BASED STANDARDS						
	Intertidal Area Use Including Shellfish Ingestion			Intertidal Area Use Excluding Shellfish Ingestion		
	1 day/week	3 days/week	5 days/week	1 day/week	3 days/week	5 days/week
ADULT						
Arsenic	ILCR = 3.2E-05	ILCR = 3.7E-05	ILCR = 4.2E-05	--	--	1.20E-05
TEEN (12-19 Yr)						
Arsenic	--	--	ILCR = 1.1E-05	--	--	--
Iron	--	--	HQ = 1.1	--	--	--
CHILD (5-11 Yr)						
Arsenic	--	ILCR = 1.2E-05	ILCR = 1.3E-05	--	--	--
Cadmium	HQ = 1.1	HQ = 1.1	HQ = 1.1	--	--	--
Iron	--	--	HQ = 1.5	--	--	HQ = 1.1
TODDLER (0.5 – 4 Yr)						
Arsenic	--	ILCR = 1.4E-05	ILCR = 2.0E-05	--	--	ILCR = 1.3E-05
Cadmium	HQ = 1.2	HQ = 1.2	HQ = 1.2	--	--	--
Iron	--	HQ = 1.5	HQ = 2.2	--	HQ = 1.1	HQ = 1.8
NON-ADULT (0.5 – 19 Yr Combined)						
Arsenic	ILCR = 2.7E-05	ILCR = 3.5E-05	ILCR = 4.4E-05	--	ILCR = 1.3E-05	ILCR = 2.1E-05

Appendix C Continued

Contaminant Risk Summary 2

ECOLOGICAL HEALTH

SITE ID #: 4291

Terrestrial

Substance	Critical Receptor	Exposure Pathway	Risk Estimate	Risk Characterization
COPCs not finalized. Wildlife hazard quotients not calculated. Receptors of concern selected and site conceptual model completed. Results of aquatic toxicity testing and biological surveys discussed. See report Titled:				
Revised Problem Formulation and Preliminary Quantitative Risk Assessment, Union Bay Waste Coal Pile				

Aquatic

Substance	Critical Receptor	Exposure Pathway	Risk Estimate	Risk Characterization
COPCs not finalized. Wildlife hazard quotients not calculated. Receptors of concern selected and site conceptual model completed. Results of aquatic toxicity testing and biological surveys discussed. See report Titled:				
Revised Problem Formulation and Preliminary Quantitative Risk Assessment, Union Bay Waste Coal Pile				

The above information is a summary only and persons who may be relying on the report are encouraged to review the entire document so as to avoid the use of information out of context.

Date: _____

Summary of Report Participants

BCE SITE ID#:_**4291**__

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2. Contributors to report: Dr. J.G. Malick, R.P.Bio., P.Ag.

3. The report entitled "*Revised Problem Formulation And Preliminary Quantitative Risk Assessment, Union Bay Waste Coal Pile, Union Bay, BC"*, dated September 8, 2006, prepared by SEACOR Environmental Inc. (SEACOR) on behalf of West Fraser Mills Ltd. and Kensington Island Properties, was prepared in accordance with all requirements in the Environmental Management Act and the Contaminated Sites Regulation. The authors of the report, Mr. Michael McLeay, M.Sc., R.P.Bio. and Mr. Sam Reimer, M.Sc., P.Ag. have 24 years of combined experience in the assessment and remediation of contaminated sites and are familiar with the works carried out at the Site.

	September 8, 2006
Signed	Date
	September 8, 2006
Signed	Date

Affix stamp or seal above, where applicable