Environmental Technology Verification Report

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ETV Advanced Monitoring Systems Center

Sediment Ecotoxicity Assessment Ring (SEA Ring)

by
Ramona Darlington and Amy Dindal, Battelle
John McKernan and Doug Grosse, EPA

Notice

Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the nation's air, water, and land resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, the EPA's Office of Research and Development provides data and science support that can be used to solve environmental problems and build the scientific knowledge base needed to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks.

The Environmental Technology Verification (ETV) Program has been established by the EPA to verify the performance characteristics of innovative environmental technology across all media and report this objective information to permitters, buyers, and users of the technology, thus substantially accelerating the entrance of new environmental technologies into the marketplace. Verification organizations oversee and report verification activities based on testing and quality assurance protocols developed with input from major stakeholders and customer groups associated with the technology area. ETV consists of six environmental technology centers. Information about each of these centers can be found on the Internet at http://www.epa.gov/etv/.

Effective verifications of monitoring technologies are needed to assess environmental quality and to supply cost and performance data to select the most appropriate technology for that assessment. Under a cooperative agreement, Battelle has received EPA funding to plan, coordinate, and conduct such verification tests for "Advanced Monitoring Systems for Air, Water, and Soil" and report the results to the community at large. Information concerning this specific environmental technology area can be found on the Internet at http://www.epa.gov/etv/centers/center1.html.

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Abbreviations

ADQ	audit of data quality
AMEC	AMEC Environment and Infrastructure
AMS	Advanced Monitoring System
ASTM	American Society for Testing and Materials
CAB	Cellulose Acetate Butyrate
cc	cubic centimeter
CCV	continuing calibration verification
Cd	cadmium
CETIS	Comprehensive Environmental Toxicity Information System
Cu	copper
CV	coefficient of variation
DB	Discovery Bay, OR
DO	dissolved oxygen
EC50	effective concentration
EPA	U.S. Environmental Protection Agency
ERDC	Engineer Research Development Center
ETV	Environmental Technology Verification
FSW	filtered seawater
GC	gas chromatography
ICC	initial calibration
ICP-MS	inductively coupled plasma mass spectrometry
ICV	initial calibration verification
LC50	median lethal concentration
LCL	lower confidence limit
MS	Metals Contaminated Sediment
MSD	minimum significant difference
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
PCB	polychlorinated biphenyl
PEA	performance evaluation audit
PPE	personal protective equipment
ppm	parts per million
PSNS	Puget Sound Naval Shipyard

QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QMP	Quality Management Plan
SEA Ring	Sediment Ecotoxicity Assessment Ring
SED	surficial sediment
SOP	Standard Operating Procedure
SPAWAR	Space and Naval Warfare Systems Center
SRM	standard reference material
SRT	standard reference toxicant
SSC	SPAWAR Systems Center
SWI	sediment water interface
TAC	test acceptability criteria
TOC	total organic carbon
TMX	2-(3-cyano-4-isobutoxyphenyl)-4-methylthiazole-5-carboxylic acid
TSA	technical systems audit
UCL	upper confidence limit
UHMWPE	Ultra-high molecular weight polyethylene
USACE	U.S. Army Corps of Engineers
VTC	verification test coordinator
WC	water column
YB	Yaquina Bay, OR

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Section 1: Background

The U.S. Environmental Protection Agency (EPA) Environmental Technology Verification (ETV) Program's Advanced Monitoring System (AMS) conducts third-party performance testing of commercially available technologies that detect or monitor natural species or contaminants in air, water, soil, and sediment. The purpose of ETV is to provide objective and quality assured performance data on environmental technologies so that users, developers, regulators, and consultants can make informed decisions about purchasing and applying these technologies. Stakeholder committees of buyers and users of such technologies recommend technology categories, and technologies within those categories become priorities for testing. Among the technology categories recommended for testing is toxicity testing technologies, including sediment and aqueous toxicity for assessment of environmental quality in marine, freshwater and estuarine systems.

Traditionally, the bioavailability and toxicity of contaminated sediments or water samples are assessed on grab or composite samples collected in the field and tested in a laboratory. Test organisms are added to site sediment or water samples in beakers and exposed under controlled conditions (e.g., temperature, pH, salinity, photoperiod, feeding regime, aeration) for a specified time period (e.g., EPA, 1994; EPA, 2000; ASTM, 2000; ASTM, 2010). This laboratory-based method of assessing sediment quality, although widely used and well established, does not necessarily represent the true in-situ exposure and effects to organisms in the field. This is especially true when the source of contamination is ephemeral, meaning exposure varies over time and with ambient conditions. Another challenge with laboratory testing is that sediment sample manipulation removes the natural vertical contaminant stratification, which in turn alters the exposure to test organisms. Such manipulation may also result in alteration of the contaminant bioavailability through processes including degradation, volatilization, and redox changes. Sediment samples removed from the field undergo physical and chemical changes which change the bioavailability and toxicity of the contaminants and may lead to misleading results in the laboratory and subsequent difficulty in program decision making.

In addition, laboratory tests may overestimate toxicity from sediment-associated contaminants due to buildup of contaminant concentrations in the overlying water as toxicants desorb from the sediment into the water column (WC). In aqueous exposures, laboratory tests may also misrepresent actual exposure in the field when static exposures are used as a means of assessing the potential for adverse effects of a time-varying stressor (e.g., stormwater runoff, combined sewer overflow, etc.). The limitations of standard laboratory toxicity testing and chemical analyses can lead to potentially inappropriate and costly management decisions.

Section 2: Technology Description

The Sediment Ecotoxicity Assessment (SEA) Ring (U.S. Patent No. 8,011,239) is an integrated, field tested, toxicity and bioavailability assessment device. This device was developed at the Space and Naval Warfare Systems Command (SPAWAR) in San Diego, California and is commercially available from Zebra-Tech, LTD. Figure 2.1a shows the first generation version of the SEA Ring technology. The second generation model (Figure 2.1b) is the version used in this ETV. The second generation system is the commercialized version of the prototype, which was designed to be more user-friendly, more autonomous, and more rigorous to withstand environmental conditions over exposure time. The unit consists of 10 cylindrical chambers fixed to a circular ultra-high molecular weight polyethylene (UHMWPE) platform. The top end of each chamber is fitted with an integrated, multifunctional cap. The cap includes both overlying water intake and outlet ports, and an organism delivery port (opening for an optional modified plastic 30 cubic centimeter [cc] syringe). The intake port connects to a peristaltic pump that is housed in the center of the device and powered by rechargeable batteries stored in a separate housing underneath the pump. The pump is programmable to provide chamber water volume exchange at a rate (range ~6 to >50 turnovers per day) desired for the site- or project-specific preferences.

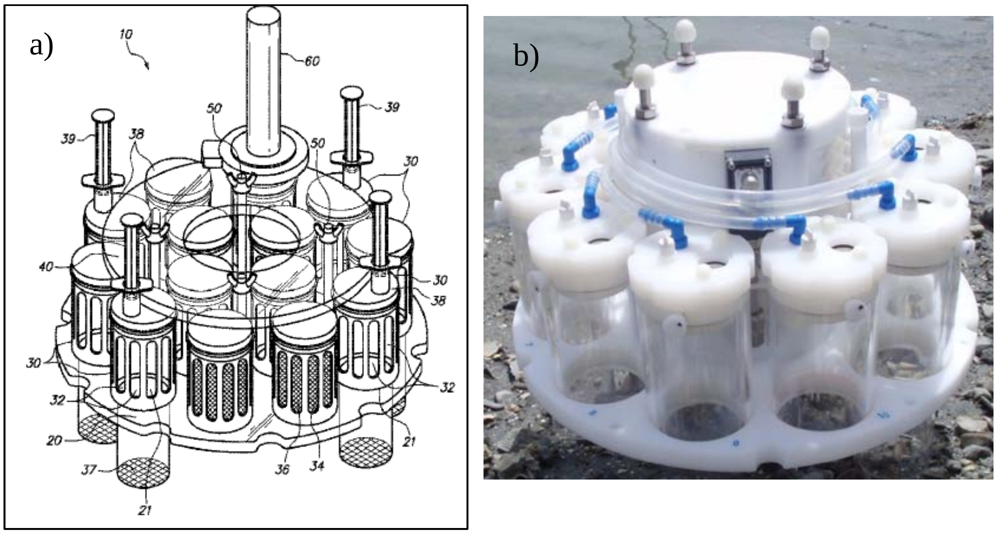

Figure 2.1. SEA Ring Technology (U.S. Patent Number 7,758,813) a) First Generation; b) Second Generation, Used in ETV Testing

The SEA Ring was designed to evaluate toxicity in the WC, sediment water interface (SWI), and/or surficial sediment (SED). The SED chambers are open on the bottom, 10 inches in length, 2.75 inches in diameter, and extend 5 inches below the base of the system (Figure 2.2a). Small sediment dwelling organisms can be introduced into the SED chambers through the organism delivery port built into the cap with a modified 30 cc plastic syringe. The syringe is plugged with a silicone stopper inside the test chamber to retain the organisms until desired release. For larger organisms, a ½ inch stainless steel mesh is integrated into the bottom opening of the exposure chamber, allowing organisms to be preloaded prior to deployment. The WC and SWI chambers are 5 inches in length, 2.75 inches in diameter, and have a closed bottom. The bottom consists of a solid plastic polyethylene cap or mesh insert for SWI testing. Organisms for the WC and SWI tests can be loaded in the laboratory or in the field immediately prior to deployment. The center of the circular platform houses a custom-built peristaltic pump and battery. These components are fully encased and water tight. The intake to the test chambers is located on top of the cap (Figure 2.2b). Each inlet is directly connected to the pump through individual tubes that pass over the pump roller. As the pump rotor turns, compressing and releasing pressure on the tubing, ambient water from the surrounding area is circulated through each chamber. Water then leaves each chamber through an outlet port also located in the cap. The inlet and outlet ports house small screens to prevent the loss of organisms from the chamber. A water quality sensor or passive sampler can also be attached to one of the chambers. Water quality sensors are used to measure a variety of physical parameters including pH, temperature, depth, salinity, conductivity, and dissolved oxygen (DO) from inside the exposure chambers.

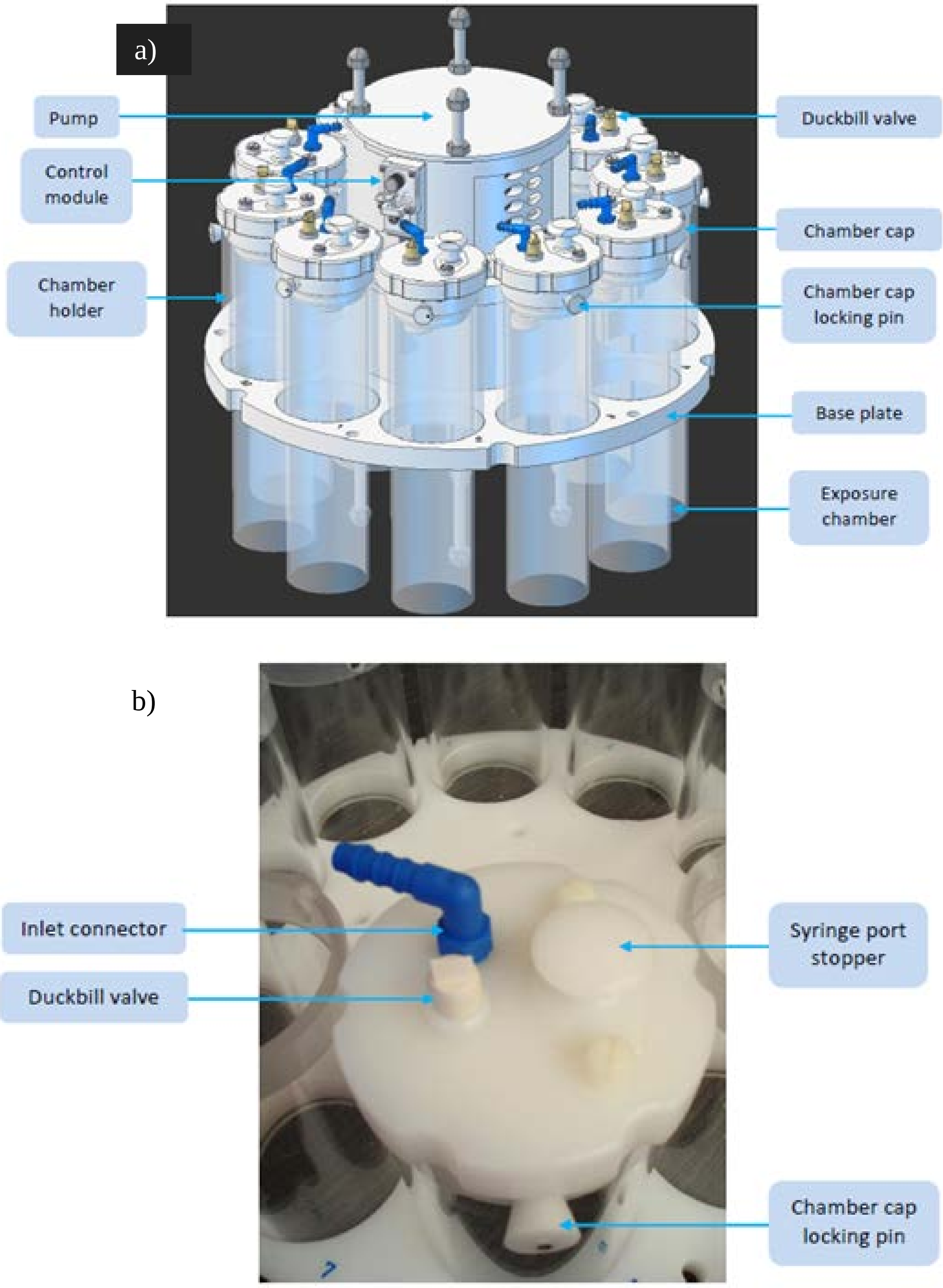

Figure 2.2. Second Generation SEA Ring Technology (U.S. Patent Number 7,758,813) a) Schematic of SEA Ring; b) Exposure Chamber Cap

Section 3: Test Design and Procedures

3.1 Test Overview

The purpose of the test was to generate performance data on the SEA Ring for assessing WC toxicity and contaminated SED toxicity and bioaccumulation potential using indigenous organisms. All testing was conducted at the SPAWAR Systems Center (SSC) Pacific Bioassay Laboratory (referred to as SPAWAR) by SPAWAR staff with Battelle and AMEC Environment and Infrastructure (AMEC) conducting the technical systems audit and quality assurance (QA) oversight. The performance of the SEA Ring to EPA and ASTM methods was evaluated utilizing two different species: Pacific topsmelt (*Atherinops affinis*) and mysid shrimp (*Americamysis bahia*) for water toxicity testing; and three different species, the bent-nosed clam (*Macoma nasuta*), marine amphipod (*Eohaustorius estuarius*), and marine polychaete (*Neanthes arenaceodentata*) were used for sediment toxicity and bioaccumulation testing. Four sediment types (two control sediments, a metals contaminated sediment [MS] and a polychlorinated biphenyl [PCB] contaminated sediment from Puget Sound Naval Shipyard [PSNS]), and four copper concentrations (0, 100, 200 and 400 µg/L) were used for the sediment and water toxicity tests, respectively. The primary evaluation assessed survival, growth, and bioaccumulation of contaminants in the aquatic and benthic organisms exposed in the SEA Ring compared to responses achieved in the laboratory using standard ASTM and EPA methods. In performing the verification test, SPAWAR and Battelle followed the technical and QA procedures specified in the SEA Ring Verification Quality Assurance Project Plan (QAPP; Battelle, 2012), and also complied with the data quality requirements in the AMS Center Quality Management Plan (QMP; Battelle, 2011).

The SEA Ring tests were evaluated on the following performance parameters:

- Repeatability - the variability in biological response among the five replicate exposure chambers in a SEA Ring
- Comparability - comparison between results obtained from tests in the SEA Ring and traditional EPA and ASTM laboratory methods.
- Intra-unit Reproducibility - to determine if different SEA Rings are capable of producing the same results.

- Operational factors (qualitative assessment) - includes ease of use, training and sustainability (sampling time, waste produced, and the amount of protective equipment required by the individual operating the technology).

Testing was conducted in the laboratory, in two rounds, by SPAWAR staff with support from the technology representative and QA oversight by Battelle staff and Adrienne Cibor of AMEC. The first round of testing was conducted in November and December 2012, while the second round of testing was conducted in February and March 2013.

3.2 Test Location

SEA Ring and concurrent bench-top tests following relevant EPA and ASTM methods were set up and evaluated at SPAWAR. With the exception of PCB congener analyses in sediment and tissue by the U.S. Army Corps of Engineers (USACE) Engineer Research Development Center (ERDC) Chemistry Laboratory, all analyses were performed at SPAWAR.

3.3 Experimental Design

The following sections describe the test procedures that were used to evaluate each of the performance parameters listed below:

- Repeatability;
- Comparability;
- Intra-unit reproducibility; and
- Operational factors.

Prior to initiation of the SEA Ring verification test, sediment samples were collected for use in the experiment and test organisms were obtained from commercial vendors. Sample collection records included the collection date, location, name of collector, and storage conditions (Appendix A). Test organism records included the source, date and location of collection as well as organism age, and holding and acclimation conditions (Appendix A).

3.3.1 Sediment, Water and Organism Sources

Four different types of sediment were used in the ETV verification of the SEA Ring, each of which was sampled using standard sediment collection and storage procedures (ASTM, 2008). Sediment samples were collected using sampling equipment that was pre-cleaned, scrubbed and rinsed with site water, with careful attention not to sample from the sides of the sediment sampling device (box corer or Van veen grab sampler depending on the site) to avoid cross-contamination. Sediment samples were shipped overnight on ice to SPAWAR and were stored in the dark at 4 ^{0}C until used for experiments. Prior to introduction to test chambers, sediments were homogenized and sieved to < 2.0 mm to remove shell hash and other indigenous material that might potentially interfere with the laboratory bioassays. Sediments used in the study were verified for PCB or metal concentration, total organic carbon (TOC), percent solids, and grain size.

Control Sediments (YB or DB): Control sediments were collected from two uncontaminated sites – Yaquina Bay, OR (referred to as YB) and from Discovery Bay, OR (referred to as DB). YB sediment was obtained from Northwestern Aquatic Sciences (Newport, OR) at the collection site for the marine amphipod and the polychaete. The DB sediment was obtained from J&G Gunstone Clams, Inc. (Port Townsend, WA). The sediment from Discovery Bay was used as the control sediment for the clam as it was obtained from the clam collection site and was deemed more appropriate to ensure the clams had enough food (higher TOC content relative to YB sediment).

Metals Contaminated Sediment (MS): Naturally metal contaminated (copper and zinc of significant interest) fine-grained (75.5% silt and clay) sediment was obtained from an undisclosed (proprietary) site (referred to as MS), and used for sediment toxicity testing.

PCB Contaminated Sediment (PSNS): A medium-fine grained (48.9% silt and clay) field sediment sample from the Puget Sound Naval Shipyard in Bremerton, WA (referred to as PSNS) was used for sediment toxicity and bioaccumulation testing, and is known to be elevated for numerous classes of chemicals, including PCBs.

Laboratory Seawater: The laboratory seawater used for all bioassays was 0.45 µm filtered seawater (FSW) collected from near the mouth of San Diego Bay on an incoming high tide. This water has been used successfully to conduct similar toxicity testing that regularly meets test acceptability criteria (TAC) for a number of different standardized laboratory tests. The FSW was used as the overlying water for the sediment tests and as the dilution water for the aqueous toxicity tests.

Test Organisms: For sediment tests, three organisms were used: a free burrowing deposit feeder (the marine amphipod), a deposit feeding tube building organism (polychaete), and a facultative filter feeding clam (the bent-nosed clam). For the aqueous tests, two common west coast marine test organisms were used: mysid shrimp and Pacific topsmelt.

The age/size and source information for the test organisms are provided in Tables 3.1 through 3.5. All test organisms were received at least 3 days prior to use, during which they were acclimated to appropriate test conditions (salinity, temperature and lighting). During the acclimation period, water quality measurements of temperature, salinity, DO, and pH were recorded daily. Observations of abnormal behavior and mortality of each batch of organisms were taken and noted. Mortality was less than 5% for each organism type, which ensured high quality organisms were being used. All organisms were visually inspected to confirm that they were of the proper size, and in good health, prior to use in toxicity testing.

Table 3.1. Toxicity test Methodology and QA/QC Requirements for Water Column Toxicity Tests Using the Mysid Shrimp *Americamysis bahia*

Test organism	Mysid shrimp - *Americamysis bahia*
Test organism source	Aquatic BioSystems – Laboratory culture (Fort Collins, CO)
Test organism age at initiation	5 days post-hatch; less than or equal to 24-h range in age (required)
Test period	Round 1: 12/3/2012 – 12/7/2012 Round 2: 3/25/2013 – 3/29/2013
Test duration; endpoint	96-hour; survival
Test solution renewal	80% volume renewal one time (48 hours)
Feeding	*Artemia* nauplii, twice daily
Test chamber	0.5-L plastic cup (laboratory); 5 inch cellulose acetate buyrate (CAB) core tube (SEA Ring)
Test solution volume	Approximately 500 mL (laboratory and SEA Ring)
Test temperature	20 ± 1°C test-wide mean, 20 ± 3°C instantaneous
Dilution water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SPAWAR
Salinity	32 ± 2% ppt
Test concentrations	0 (control), 100, 200, 400 µg/L copper (Cu)
Number of organisms/chamber	10
Number of replicates	5
Photoperiod	16 hours light/8 hours dark, ambient laboratory lighting
Aeration	None, unless DO < 4 mg/L
Test Protocol	EPA-821-R-02-012 (EPA, 2002)
Test acceptability objective	≥ 90% mean survival in natural seawater control
Reference toxicant	Copper sulfate (Standard EPA laboratory method only); five concentrations (five replicates each)

Table 3.2. Toxicity Test Methodology and QA/QC Requirements for Water Column Toxicity Tests Using Topsmelt *Atherinops affinis*

Test organism	Pacific Topsmelt – *Atherinops affinis*
Test organism source	Aquatic BioSystems - Laboratory culture (Fort Collins, CO)
Test organism age at initiation	12 days post-hatch (Round 1); 15 days post-hatch (Round 2)
Test period	Round 1: 12/3/2012 – 12/7/2012 Round 2: 3/25/2013 – 3/29/2013
Test duration; endpoint	96-hour; survival
Test solution renewal	80% volume renewal at 48 hours
Feeding	*Artemia* nauplii, twice daily
Test chamber	0.5-L plastic cup (laboratory); 5 inch CAB core tube (SEA Ring)
Test solution volume	Approximately 500 mL (laboratory and SEA Ring)
Test temperature	20 ± 1°C test-wide mean, 20 ± 3°C instantaneous
Dilution water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SPAWAR
Salinity	32 ± 2% ppt
Test concentrations	0 (control), 100, 200, 400 µg/L Cu
Number of organisms/chamber	5
Number of replicates	5
Photoperiod	16 hours light/8 hours dark, ambient laboratory lighting
Aeration	None, unless DO < 4 mg/L
Test Protocol	EPA-821-R-02-012 (EPA, 2002)
Test acceptability objective	≥ 90% mean survival in natural seawater control
Reference toxicant	Copper sulfate (standard EPA laboratory method only); 96 hours, 48-hr renewal/five concentrations (5 replicates each)

Table 3.3. Toxicity Test Methodology and QA/QC Requirements for Solid-Phase Toxicity Tests Using the Marine Amphipod *Eohaustorius estuarius*

Test organism	Marine amphipod – *Eohaustorius estuarius*
Test organism source	Northwestern Aquatic Sciences (Newport, OR)
Test organism age at initiation	NA - Field collected (3-5 mm adult)
Test period	11/16/2012 – 11/26/2012
Test duration; endpoint	10 days; survival
Test solution renewal	None
Feeding	None
Test chamber	1-L glass jar (laboratory), 10 inch CAB core tube (SEA Ring)
Control sediment source	Sediment from amphipod collection site, YB
Test sediment depth	2 cm (laboratory and SEA Ring)
Overlying water volume	750 ml (laboratory and SEA Ring)
Test temperature	18 ± 1ºC test-wide mean, 18 ± 3ºC instantaneous
Overlying water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SSC Pacific Laboratory
Salinity	32 ± 2% ppt
Test concentrations	Undiluted sediment sieved to < 2.0 mm
Number of organisms/chamber	20
Number of replicates	5 (laboratory and SEA Ring, each)
Photoperiod	Continuous light (24 hr), ambient laboratory lighting
Aeration	Laboratory filtered air, continuous (1-2 bubbles per second) delivered through a Pasteur pipette in laboratory beaker, 1-2 bubbles per second from three Pasteur pipettes in SEA Ring Chemtainer (outside exposure chambers)
Test Protocol	EPA 600-R-94-025 (EPA, 1994)
Test acceptability objective	≥ 90% mean survival in control
Reference toxicant	Cadmium chloride (standard EPA laboratory method only); 96-h water only exposure; five concentrations (3 replicates each)

Table 3.4. Toxicity Test Methodology and QA/QC Requirements for Solid-Phase Toxicity and Bioaccumulation Tests Using the Marine Polychaete *Neanthes arenaceodentata*

Test organism	Marine polychaete, *Neanthes arenaceodentata*
Test organism source	Dr. Mary Ann Rempel Hester, Aquatic Toxicity Support, Inc. (Bremerton, WA)
Test organism age at initiation	2 weeks
Test period	Round 1: 11/16/2012 – 12/14/2012 Round 2: 2/6/2013 – 2/26/2013
Test duration; endpoint(s)	Round 1: 28 days; survival, growth, bioaccumulation Round 2: 20 days; survival, growth, bioaccumulation
Test solution renewal	Twice-weekly with filtered seawater
Feeding	1 ml of flake food slurry twice weekly after test solution renewal (slurry comprised of 100 mL seawater: 1 g Tetramin® fish feed)
Test chamber	1-L glass jar (laboratory), 10 inch CAB core tube (SEA Ring)
Control sediment source	Sediment from the amphipod collection site, YB
Test sediment depth	5 cm (laboratory and SEA Ring)
Overlying water volume	750 ml (laboratory and SEA Ring)
Test temperature	18 ± 1°C test-wide mean, 18 ± 3°C instantaneous
Overlying water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SPAWAR
Salinity	32 ± 2% ppt
Test concentrations	Undiluted sediment sieved to < 2.0 mm
Number of organisms/chamber	20
Number of replicates	5 (laboratory and SEA Ring, each)
Photoperiod	16 hours light/8 hours dark, ambient laboratory lighting
Aeration	Laboratory filtered air, continuous (1-2 bubbles per second) delivered through a Pasteur pipette in laboratory beaker, 1-2 bubbles per second from three Pasteur pipettes in SEA Ring Chemtainer (outside exposure chambers)
Test Protocol	E1611-00 (ASTM, 2000)
Test acceptability objective	≥ 90% mean survival in control
Reference toxicant	Copper sulfate (standard ASTM laboratory method only); 96-hr water only exposure; five concentrations (3 replicates each)

Table 3.5. Test Methodology and QA/QC Requirements for 28-Day Bioaccumulation Tests Using the Marine Clam *Macoma nasuta*

Test organisms	Bent-nosed clam, *Macoma nasuta*
Test organism source	J&G Gunstone Clams, Inc. (Port Townsend, WA)
Test organism age at initiation	~1 inch Small Adult (field collected)
Test period	Round 1: 11/16/2012 – 12/14/2012 Round 2: 2/6/2013 – 2/20/2013
Test duration; endpoint(s)	Round 1: 28 days; survival, bioaccumulation Round 2: 14 days; survival, bioaccumulation
Test solution renewal	Three-times weekly with filtered seawater
Feeding	None
Test chamber	5 1-L glass beakers; 5 1-L CAB core tubes in Chemtainer (SEA Ring)
Control sediment source	Sediment collected from clam collection site, DB
Test sediment depth	5 cm (laboratory and SEA Ring chambers)
Overlying water volume	750 mL (laboratory and SEA Ring)
Test temperature	18 ± 3 °C instantaneous
Overlying water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SPAWAR
Salinity	32 ± 2% ppt
Test concentrations	Undiluted sediment sieved to <2.0 mm
Number of organisms/chamber	Round 1: 4 Round 2: 3
Number of replicates	5 (laboratory and SEA Ring, each)
Photoperiod	16 hours light/8 hours dark, ambient laboratory lighting
Aeration	Laboratory filtered air, continuous (1-2 bubbles per second) delivered through a Pasteur pipette in laboratory beaker, 1-2 bubbles per second from three Pasteur pipettes in SEA Ring Chemtainer (outside exposure chambers)
Test Protocol	EPA 503/8-91/001, ASTM E-1688-10
Test acceptability objective	≥ 90% mean survival in controls
Reference toxicant	None

3.3.2 Equipment Preparation

All SEA Ring hardware was cleaned first by soaking in a dilute (2%) detergent (Liquinox) overnight, followed by an overnight conditioning in FSW, and then rinsed with flowing deionized water. All disposable parts were new upon initiation of all toxicity tests, but were also conditioned with FSW and rinsed with deionized water prior to use. All SEA Rings were fully charged prior to programming and subsequent initiation of toxicity tests. SEA Rings were programmed to the desired turnover rate (full exchange of water between the inner exposure chamber and the water in the Chemtainer per day) appropriate for each test type (Table 3.6). It should be noted that although each SEA Ring was programmed to circulate the overlying water inside the Chemtainer, as this is how the SEA Ring operates (no exchange of seawater would result in stagnant conditions inside the exposure chambers), no actual replacement of water from the system was made until the scheduled water renewal was conducted per the relevant laboratory-based protocol. This was done to maximize comparability between the laboratory and SEA Ring water exchange rates, and subsequently, the test results. The pumping regime was adjusted for the Round 2 experiments to increase water flow/exchanges of water within the inner exposure chambers.

Table 3.6. SEA Ring Pumping Regime

Round 1:	Test Type:	
	Sediment Exposure	Aqueous Exposure
Chamber flushing duration (min)	1	1
Chamber static duration (min)	13	5
Approximate number of chamber turnovers within Chemtainer per day	14	47
Round 2:	Test Type:	
	Sediment Exposure	Aqueous Exposure
Chamber flushing duration (min)	1	1
Chamber static duration (min)	3	4
Approximate number of chamber turnovers within Chemtainer per day	72	57

Note: Flow rate through the exposure chambers is approximately 100 mL/min of flushing. A WC chamber is 500 mL, therefore, 5 minutes of flushing is required for a chamber turnover. SED chambers typically have 300 to 500 mL sediment (site-specific); the same turnover rate is used.

All glass mason jars, serving as laboratory sediment test exposure chambers, were thoroughly cleaned with (2%) detergent (Liquinox) and then rinsed five times with deionized water. A 4 hr soak in 10% HNO_3 acid bath was followed by rinsing with acetone and five subsequent rinses with deionized water. WC exposure chambers for the bench tests were all new 0.5 L plastic (polyethylene) cups. All chambers were rinsed thoroughly with FSW prior to use.

All instruments used for water quality measurements were calibrated daily according to manufacturer specifications. For the SEA Rings, three In-Situ$^{©}$ Troll 9500 datasondes were calibrated according to manufacturer specifications prior to placement into flow-through cells for water quality monitoring of the overlying water quality of Round 1 sediment testing at 5 minute intervals. One Troll was included for each sediment type, by use of a flow-through cell in line with the last *N. arenaceodentata* replicate.

3.3.3 Sediment Toxicity Tests

Figure 3.1 illustrates the sediment test design. Approximately 200 g (Round 1) or 300 g (Round 2) of homogenized test sediment was added to each test chamber (1 L glass mason jar or SEA Ring exposure chamber), followed by gentle introduction of approximately 700 mL of FSW.

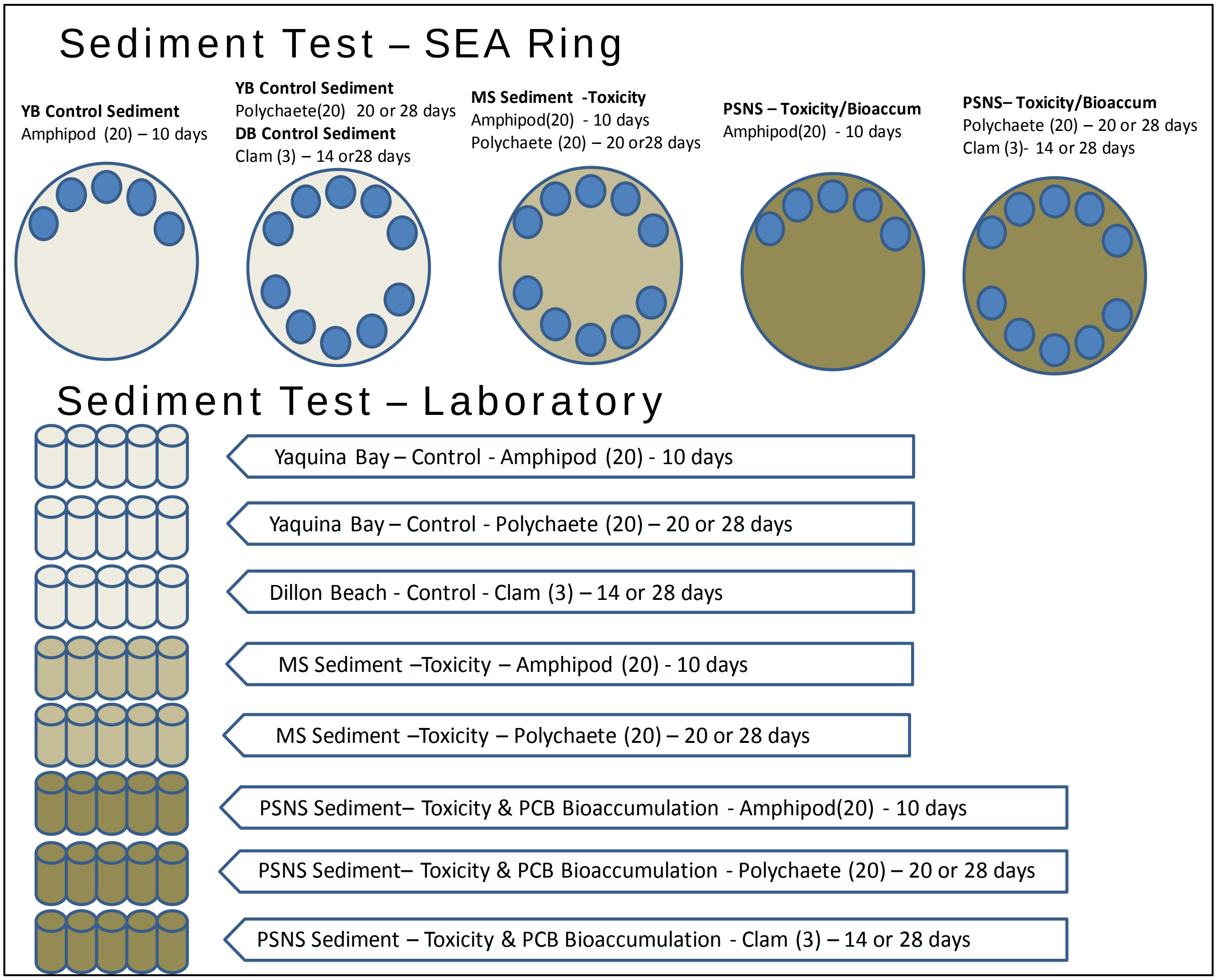

Figure 3.1. Overview of Sediment Toxicity and Bioaccumulation Testing Approach with Both SEA Ring and Standard Laboratory Tests (Note: multiple exposure times listed because exposure duration shortened for Round 2 experiments.)

Screens (500 µm) for the inlet and outlet of the SEA Ring exposure chambers were secured to prevent organism loss and the chamber tops or caps were secured in place with locking pins per the SEA Ring standard operating procedure (SOP), and each unit was placed into a Chemtainer with approximately 45 L FSW to completely submerge the unit (Fig. 3.2). Both the laboratory exposure chambers and SEA Rings were placed in a temperature controlled environmental chamber (18 ± 1˚C). Overlying water in all glass jar test chambers was continuously aerated with filtered laboratory air at a rate of approximately 100 bubbles per minute to maintain DO concentrations above the minimum threshold of 4 mg/L.

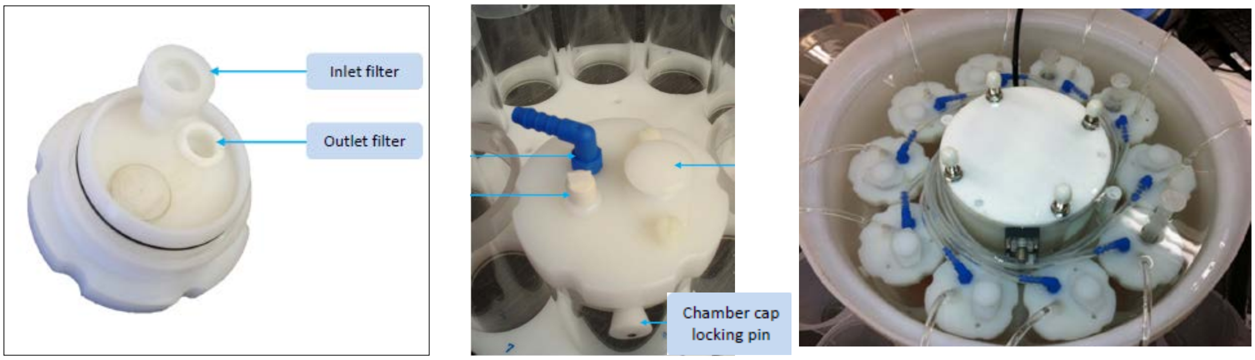

Figure 3.2. Views of the Chamber Cap Inlet and Outlet Filters (left), Chamber Cap Locking Pin and Intake and Outlet Fittings (center), and the Fully Assembled SEA Ring as Tested in a Chemtainer

The water in the Chemtainer outside of the SEA Ring was aerated continuously with air stones to allow the delivery of aerated water (> 4 mg/L) to the exposure chambers as the water was pumped from the Chemtainer. All sediment test chambers were allowed to settle overnight prior to the introduction of organisms on the following day. Subsamples of sediments were collected from each sediment type for chemical analysis and frozen until ready for shipment to the USACE ERDC Chemistry Laboratory. Sediment samples were analyzed for 18 PCB congeners (National Oceanic and Atmospheric Administration Status & Trend congeners) extracted using pressurized fluid extraction (EPA Method 3545), and analyzed using gas chromatography (GC) following EPA Method 8082B. PCB concentrations are expressed as the sum of the 18 targeted PCB congeners, or as the sum of PCB homologs.

3.3.4 Water Column Toxicity Tests

FSW was spiked with three concentrations of copper (Cu), bracketing the expected median lethal concentration (LC50) for each of the two WC test species. Concentrations of Cu tested were 100, 200, and 400 parts per billion (µg/L) as Cu. The appropriate amount of Cu was added to FSW using a 1,000 parts per million (ppm) verified stock solution made from reagent grade copper sulfate ($CuSO_4 \cdot 5H_2O$; Table 3.7). For Round 1, screens (500 µm) for the inlet and outlet of the inner exposure chamber were secured to prevent organism loss and the exposure chamber caps were placed on the exposure chambers. For the Round 2 experimental period, the inlet and outlet screens were 250 µm in size, as it was determined that the 500 µm sizing could potentially allow for the escape/loss of organisms from the exposure chambers. The SEA Ring exposure chambers were secured into the main device with a locking pin (Figure 2.2) and then the entire apparatus was placed into a Chemtainer with the appropriate Cu solution. The water in the Chemtainer outside of the SEA Ring was aerated continuously with air stones to allow the delivery of aerated water (> 4 mg/L DO) to the exposure chambers as the water was pumped from the Chemtainer. The entire Chemtainer with enclosed SEA Ring was placed in a temperature controlled environmental chamber (20 ± 1˚C). Figure 3.3 illustrates the WC test design. Subsamples of each concentration were collected for verification and analyzed at SPAWAR. Cu concentration in the exposure water was verified using a Perkin Elmer ELAN DRC II inductively coupled plasma mass spectrometry (ICP-MS). The lab used EPA Method 6020 for quantification.

Table 3.7. SEA Ring Cu Dilution Calculations – Water Column Tests

Test Concentration (µg/L)	**1000 mg/L Cu Stock (mL)**	**Filtered Sea Water (mL)**	**Total Volume (mL)**
0	0	49,000	49,000
100	4.9	48,995.1	49,000
200	9.8	48,990.2	49,000
400	19.7	48,980.3	49,000

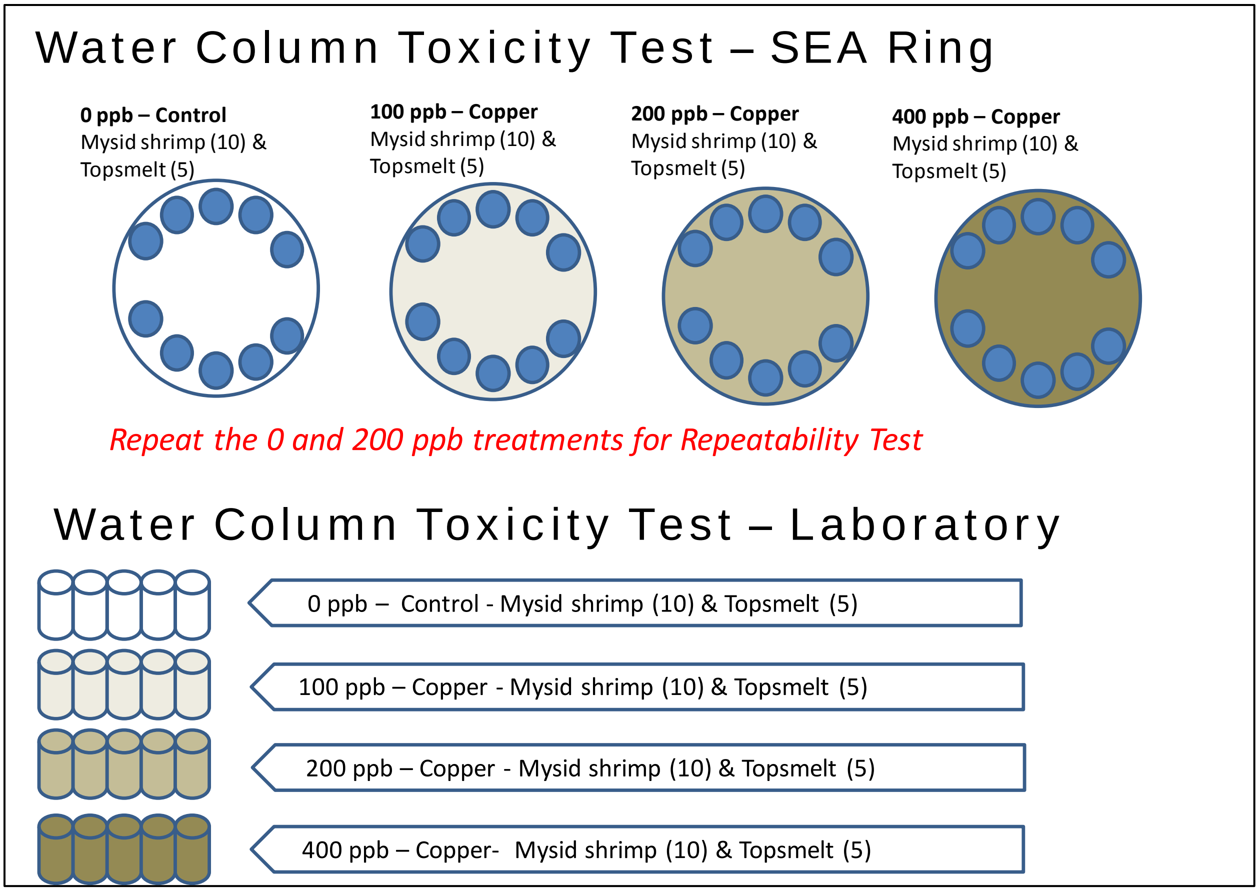

Figure 3.3. Overview of Water Column Toxicity Testing Approach with Both SEA Ring and Standard Laboratory Tests

3.3.5 Test Initiations and Maintenance

Ammonia (using HACH Method 10031), pH, DO, temperature, and salinity analysis of the overlying waters for each sample were made prior to introducing test organisms to ensure that conditions were within those tolerated. Organisms were arbitrarily selected and added to all SEA Ring test chambers through the organism delivery port in the exposure chamber cap. Laboratory bench tests were likewise initiated by arbitrarily selecting and carefully adding organisms to each exposure chamber. A subsample of organisms for the sediment exposures was collected, depurated overnight, and frozen without any exposure to assess time zero PCB tissue concentrations.

Daily water quality monitoring for all test types was conducted on aliquots collected from the SEA Ring chamber outlet valves and directly within the bench test chambers to ensure that acceptable test conditions were maintained. As indicated previously, Troll 9500 datasondes were used to continuously collect water quality parameters in SEA Ring chambers for some tests. During the exposure periods, observations were made daily of any mortality or unusual organism behavior. Any deviations from EPA and internal protocols that occurred during testing were noted on raw data sheets.

Water renewals were conducted according to the test method summaries in Tables 3.1 through 3.5. Approximately 80% of the overlying water was siphoned out of each test chamber and gently replaced with fresh FSW or Cu-spiked FSW, as appropriate, on water renewal days. The frequency of water renewals in the SEA Rings occurred with the same frequency as the concurrent traditional laboratory tests. For SEA Rings, water was removed from the Chemtainer and replaced, so as not to disturb the exposure chambers and also provide a renewal of approximately 80% of the total volume. All organisms were fed according to test conditions found in Tables 3.1 through 3.5.

3.3.6 Toxicity and Bioaccumulation Test Termination

Ammonia concentrations were determined in the overlying water immediately prior to test termination for the sediment toxicity and bioaccumulation tests (using HACH Method 10031). At test termination, the retaining pin holding each exposure chamber to the SEA Ring was removed and the chamber freed from the chamber holder (Figure 3.2). Test organisms from sediment tests using the SEA Ring exposure chambers and laboratory beakers were recovered by sieving sediment through a 500 µm mesh size stainless steel sieve, enumerated, and transferred to clean FSW to purge ingested sediment overnight. On the following day, whole amphipods and polychaetes, and soft body portions from clams from each replicate were quickly rinsed in deionized water, weighed (for wet weight/growth assessment), and frozen in glass scintillation vials until shipped to ERDC for chemistry analysis. Tissue analysis was conducted using a micro-extraction technique for use with small masses (150 to 500 mg wet weight; Jones et al., 2006). Tissue extracts were analyzed for PCB congeners by GC (EPA Method 8082B). PCB concentrations are expressed as the sum of all detected PCB congeners, or as the sum of PCB homologs. Tissue lipid analysis, also conducted by ERDC, was analyzed using a spectrophotometer at 490 nm following homogenization and chloroform/methanol extraction, and calibrated using stock solutions of soybean oil according to Van Handel (1985).

Test organisms from the WC exposures were transferred from individual SEA Ring exposure chambers to a Pyrex® dish placed over a light table for enumeration of survivors.

The SEA Rings were removed from their respective Chemtainers and programming data were off-loaded for later analysis to verify pump performance. The In-Situ© Troll water monitoring device was likewise removed from the flow-cell and data were downloaded for later analysis.

3.4 Reference Toxicant Test

Concurrent reference toxicant tests were conducted with each relevant batch of test organisms to ensure organism and laboratory technical quality. Reference toxicants for the selected test types were Cu or cadmium (Cd), depending on the species (Tables 3.1 through 3.5). Five concentrations and a control were prepared from verified stock solutions consisting of $CuSO_4•5H_2O$ (Tables 3.7 through 3.9) or cadmium chloride ($CdCl_2$) (Table 3.10). Organisms were arbitrarily added to each test chamber following initial water quality measurements. Daily water quality measurements and survival observations were recorded. Upon termination of the reference toxicant tests, final water quality measurements were made and final evaluations of survival of organisms were recorded. Data were summarized in Microsoft® Excel and LC50 calculations were determined through the use of CETIS (Tidepool Scientific) analytical software. LC50 values generated from the dose response curves for each species were within two standard deviations of the running mean historically observed for the laboratory (Appendix E).

Table 3.8. Laboratory Toxicity Test Cu Dilution Calculations – Mysid shrimp and Pacific Topsmelt Reference Toxicant Tests

Test Concentration (µg/L)	1000 mg/L Cu Stock (mL)	Filtered Sea Water (mL)	Total Volume (mL)
0	0	4,500	4,500
50	0.2	4,499.8	4,500
100	Combined with SEA Ring Dilutions		
200	Combined with SEA Ring Dilutions		
400	Combined with SEA Ring Dilutions		
800	3.6	4,496.4	4,500

Table 3.9. Bench Toxicity Test Cu Dilution Calculations – Polychaete Reference Toxicant Tests

Test Concentration (µg/L)	5 mg/L Cu Stock (mL)	Filtered Sea Water (mL)	Total Volume (mL)
0	0	1,500	1,500
25	7.5	1,492.5	1,500
50	15	1,485	1,500
100	30	1,470	1,500
200	60	1,440	1,500
400	120	1,380	1,500

Table 3.10. Bench Toxicity Test Cd Dilution Calculations – Amphipod Reference Toxicant Test

Test Concentration (µg/L)	1070 mg/L Cd Stock (mL)	Filtered Sea Water (mL)	Total Volume (mL)
0	0	1,500	1,500
1.25	1.8	1,498.2	1,500
2.5	3.5	1,496.5	1,500
5	7	1,493	1,500
10	14	1,486	1,500
20	28	1,472	1,500

3.5 Repeatability Tests

Variability in biological response was evaluated among the five replicate exposure chambers in the SEA Ring to provide a measure of repeatability within a single treatment. This measure of repeatability was assessed by quantifying biological responses at the end of the exposure period. See Section 6.4 for details on the statistical comparisons made.

3.5.1 Sediment Toxicity and Bioaccumulation Repeatability Test

The marine amphipod and the marine polychaete were used for the sediment toxicity repeatability test. The survival of all species tested and the growth of polychaetes was compared among replicates for each of the sediment types used. Bioaccumulation of total PCBs (as a sum of National Oceanic and Atmospheric Administration [NOAA] 18 PCB congeners) was evaluated in the amphipods, polychaetes, and clams that were exposed to PSNS sediments for both the SEA Ring and laboratory exposures. Time 0 and control treatments were also quantified for PCBs for comparison.

3.5.2 Water Column Toxicity Repeatability Test

For the WC toxicity repeatability test, the survival of both species, mysid and topsmelt, were evaluated across the five replicate chambers for each Cu concentration tested.

3.6 Comparability Tests

Using results derived from the repeatability tests (Section 3.5) conducted, comparisons between survival, growth and bioaccumulation results obtained from tests in the SEA Ring and traditional EPA and ASTM laboratory methods were evaluated. Since both exposures occurred under controlled laboratory conditions, a goal of comparability within 25%, in addition to no statistical difference, was targeted. See Section 6.5 for detailed statistical analyses used for this evaluation.

3.7 Reproducibility Test

To determine if different SEA Rings are capable of producing the same results, the 0 µg/L (control) and the 200 µg/L concentrations for the WC tests were set up in duplicate (as described in Section 3.3.4.). The duplicates were conducted concurrently with the same batch of test organisms, Cu stock solutions, dilution water batch, and test conditions to minimize potential confounding factors. Using results derived from the repeatability tests (Section 6.4), the mean survival for each SEA Ring was determined, with a goal of less than 25% difference, and no statistical difference, between the two SEA Rings tested. Detailed statistical analyses for this evaluation can be found in Section 6.6.

Section 4: Quality Assurance/Quality Control

QA/quality control (QC) procedures were performed in accordance with the QMP for the AMS Center (Battelle, 2011) and the QAPP for this verification test (Battelle, 2012). QA/QC procedures and results are described in the following subsections.

4.1 Reference Method Quality Control

Table 4.1 presents a list of parameters that were proposed to be measured during the ETV tests and the TAC established for them in the QAPP. Some deviations to these specified procedures were observed during testing and noted during audits of the test. Further discussion of this aspect of the ETV test is provided below.

Table 4.1. QAPP Quality Control Measures and Acceptance Criteria

Test Activity	Quality Control Measure	Test Acceptance Criteria (TAC)
Water Column Toxicity: Mysid Shrimp & Topsmelt	Seawater control survival	≥ 90% mean survival
Solid-Phase Toxicity: Amphipod	Uncontaminated sediment control survival	≥ 90% mean survival
Solid-Phase Toxicity and Bioaccumulation: Polychaete	Uncontaminated sediment control survival	≥ 90% mean survival
Solid-Phase Bioaccumulation: Clam	Uncontaminated sediment control survival	Target[a] of ≥ 90 % mean survival
Reference Toxicants	LC50	± two standard deviations of the running mean for the testing laboratory
Measurement of metals in sediment and water	Initial Calibration (ICC)	r ≥ 0.995
	Continuing Calibration Verification (CCV)	±10% of true value
	Method blank	No target analyte detected at > detection limit
	Laboratory control sample	Recovery: 80 to 120%
	Matrix spike sample	Recovery within laboratory control limits or 25 to 145%

Table 4.1. QAPP Quality Control Measures and Acceptance Criteria (Continued)

Test Activity	Quality Control Measure	Test Acceptance Criteria (TAC)
Measurement of PCBs in sediment and tissue	ICC	r ≥ 0.995
	Independent calibration verification (ICV)	±20% of expected value
	CCV	±20% of expected value
	Performance Evaluation Audit	25 to 145%
	Method blank	No target analyte detected at > detection limit
	Laboratory control sample	Recovery: 80 to 120%
	Matrix spike sample	Recovery within laboratory control limits or 25 to 145%
	Surrogate recover - Sediment	TMX[b], 40 to 125%, decachlorobiphenyl, 50 to 125%
	Surrogate recover - Tissue	TMX, 45 to 125% and decachlorobiphenyl, 45 to 125%.

[a] There is no standard test acceptability criterion for clam survival, therefore, this criterion is expressed as a goal, not a requirement.

[b] TMX 2-(3-cyano-4-isobutoxyphenyl)-4-methylthiazole-5-carboxylic acid

The amphipod survival data for Round 1 testing was acceptable but the TAC for several other tests was not achieved during Round 1 testing:

- Mysid SEA Ring control survival/recovery was 82% and 80% rather than ≥ 90% for Controls A and B, respectively;
- Topsmelt SEA Ring control survival/recovery was 88% and 80% rather than ≥ 90% for Controls A and B, respectively;
- Clam laboratory test control survival was 65% rather than ≥ the target 90%;
- Clam SEA Ring control survival was 0% rather than ≥ 90%;
- Polychaete SEA Ring control survival was 1% rather than ≥ 90%.

The SPAWAR Principle Investigator and the verification test coordinator (VTC) determined that testing would be repeated based on realized concerns with respect to the conduct of the in situ SEA Ring design/exposure under laboratory conditions. Concerns included poor clam health (also observed in the laboratory test beakers), insufficient exchange of seawater between the SEA Ring Chemtainer and SEA Ring exposure chambers in the presence of sediment with high oxygen demand, one critical technician error that resulted in temporary loss of air to one Chemtainer, and use of a mesh size (500 µm) that was too large for some of the aqueous test organisms, allowing them to escape.

With a second clam test batch, an increased seawater exchange rate between the Chemtainer and exposure chamber (see Table 3.6), and use of smaller mesh size (250 µm), resulted in the TACs for all tests being achieved for all verification tests during Round 2; results are reported in detail in this report.

The TACs were achieved by the analytical chemistry laboratories, although the suite of QC samples analyzed differed from the QAPP. The Round 2 samples for copper analysis were analyzed in three laboratory batches. The QC results were acceptable, with the following notations.

- Method blank values were at or slightly higher than the limit of detection in most cases.
- The matrix spike sample recoveries met the TAC.
- Laboratory control samples were not analyzed as specified in the QAPP. Instead, sample duplicates and standard reference materials (SRMs) were analyzed. No TACs were defined in the QAPP for SRMs but the results (>88% recovery) met the laboratory control sample TAC (Table 4.1). SRMs are an appropriate substitute for laboratory control samples because they represent extraction efficiency for the analytical batch using the spiking and extraction materials and procedures applied to the test samples. No TAC was defined in the QAPP for sample duplicates but the results were acceptable with less than 10% differences. These results demonstrate that sampling processing and analysis was consistent between samples.

The samples for Round 2 PCB congener analysis were analyzed in four laboratory batches. The QC results were acceptable, with the following notations:

- Method blank values were less than the detection limit for all sample batches.
- Laboratory control (blank spike) and laboratory control duplicate sample recoveries for sediment and tissue samples were within or only slightly below the TAC for most congeners. Given the number of congeners included in the analyses, slightly lower recovery of a few congeners would not likely impact the total PCB concentrations.

- The recovery of surrogate TMX met the TAC for three of the four batches. The TMX recoveries were less than the TAC limits for all samples in a fourth batch containing one sample (PSNS 3022201-01) and a full suite of QC samples. For this same batch, all blank spike and blank spike duplicate recoveries met the TAC. This indicates acceptable sample extraction efficiency and that there may have been a problem with the TMX spike.
- Matrix spike sample recoveries for sediment and tissue samples were within the TAC for all sample batches with one exception, Sample 3022201-01. For this sample, PCBs 170 and 180 were acceptable in the matrix spike sample but over-recovered in the matrix spike duplicate sample. The results indicate sample heterogeneity but since these two PCB congeners constituted less than 2% of the PCB total for Sample 3022201-01, the over-recovery did not impact test results.
- The QC samples analyzed with the PCB samples varied from the QAPP requirements. The surrogate TMX, rather than decachlorobiphenyl, was spiked into the PCB samples. Laboratory control sample duplicates were analyzed with all batches. A matrix spike duplicate was run with one batch. These QC deviations do not impact the test results but results of the QC duplicate samples cannot be evaluated because no TAC was defined in the QAPP.

4.2 Reference Toxicant Tests

Standard reference toxicant (SRT) tests are a means of assessing test precision and the health and sensitivity of each batch of test organisms. The reference toxicant is Cu for most test species used at SPAWAR, but Cd is typically used for amphipod reference toxicant tests. By exposing different batches of the test organism to the same concentrations of the reference toxicant in the same dilution water, under identical testing conditions, the lab can assess repeatability via comparison of LC50 or effective concentration (EC50) values over time for a given species. The LC50 value represents the concentration at which 50% mortality of test organisms is observed. In general, reference toxicant test results that fall within two standard deviations above or below the running mean are an indication of acceptable test performance. In addition to the mean and standard deviation, the coefficient of variation (CV) may also be used to demonstrate the lab’s precision. Actual tested concentrations in reference toxicant tests are dependent on the test method due to differences in sensitivity among species and endpoints.

Table 4.2 shows the LC50 values for all of the SRT tests performed for this study and the mean LC50 values of historical SRT tests performed. Although the LC50 values from SRT tests for topsmelt and mysid shrimp were below the mean LC50 value for SRT tests historically performed by the laboratory (Table 4.2), they were within two standard deviations of the mean, indicating that the health and sensitivity of organisms used for the toxicity tests were acceptable. The LC50 value for the amphipod *E. estuarius* was higher than the mean LC50 value for SRT tests historically performed by the laboratory but was also within two standard deviations of the mean. Because the toxicity testing laboratory did not have sufficient historical SRT data for the polychaete to develop a control chart, data from a review article published by Reish and Gerlinger (1997) was used for comparison. The article reported 96 hr LC50 values for *N. arenaceodentata* which ranged from 80 to 570 µg Cu/L based on the results of several studies conducted between 1976 and 1991. The LC50 for the SRT test conducted for this study fell within the range of those values, suggesting that the health and sensitivity of the test organisms used for this study are acceptable. Although Reish and Gerlinger (1997) indicated that the studies cited could have used a variety of test methods, the most common method used for the 96 hr LC50 tests were static aqueous exposures with at least three replicates and 10 organisms per replicate.

Table 4.2. Results of Standard Reference Toxicant Tests versus Historical Laboratory Values

Test Species	**Test LC50 Results**	**Historical Laboratory LC50 ± 2SD** (Values in parentheses are the ranges of acceptable LC50 results)	**Units for LC50 Values**
Topsmelt[a]	83.00	176.54 ± 116.7 (59.84 - 293.24)	**(µg/L)**
Mysid[b]	229.74	285.78 ± 133.4 (152.38 - 419.18)	**(µg/L)**
Amphipod	8.62	6.1 ± 4.3 (1.8 - 10.4)	**(mg/L)**
Polychaete	141.42	80 - 570[c]	**(µg/L)**

Analyses for historical values are based on nominal concentrations.

a - Linear regression (Probit analysis) conducted for point estimates.
b - Trimmed Spearman-Kärber conducted for point estimates.
c - Based on Reish and Gerlinger (1997).

4.3 Audits

Three types of audits were performed during the verification test: a performance evaluation audit (PEA) of the analytical methods, a technical systems audit (TSA) of the verification test procedures, and a data quality audit. Audit procedures are described further below.

4.3.1 Performance Evaluation Audit

A PEA was conducted to assess the quality of the analytical measurements made for this verification test. National Institute of Standards and Technology (NIST) SRM 1974b, Organics in Mussel Tissue (Appendix C), was delivered to the ERDC laboratory as a blind sample for extraction and analysis of certified PCB congeners. The results were submitted to Battelle for assessment. The data were acceptable for all parameters (Table 4.3). The PEA was completed prior to analysis of test samples and thus demonstrated the laboratory's ability to accurately identify and quantify PCB congeners.

Table 4.3. Laboratory Results for Tissue Performance Evaluation Audit

PCB#	Laboratory Result	SRM 1974b	Percent Recovery	Acceptable versus QAPP
18	7.7	8.3	93	Yes
28/31	55.1	NC	-	-
44	45.5	38	120	Yes
49	37.3	55.9	67	Yes
52	61.9	61.8	100.2	Yes
66/84	90.7	NC	-	-
70	45.2	59.3	76	Yes
74	28.9	35	83	Yes
82	9.5	11.5	83	Yes
87	36.4	42.7	85.2	Yes
90/101	68.3	NC	-	-
95	59.9	59.6	100.4	Yes
99	42.0	58.4	72	Yes
105/146	66.5	NC	-	-
107	7.7	10.2	75	Yes
110/115	90.8	NC	-	-
118	105.7	102	103.6	Yes
128	14.0	17.7	79	Yes
132	31.2	24	129.9	Yes
138/163	99.9	NC	-	-
146	16.3	19	86	Yes
149	53.5	69.2	77	Yes
153	112.4	121	92.9	Yes

Table 4.3. Laboratory Results for Tissue Performance Evaluation Audit (Continued)

PCB#	Laboratory Result	SRM 1974b	Percent Recovery	Acceptable versus QAPP
156	7.9	7.09	112	Yes
158	9.1	9.86	92	Yes
170	2.3	2.66	86	Yes
180	12.7	11.5	110.4	Yes
183	11.6	12.3	94	Yes
187	26.2	29	90	Yes

Bold indicates QAPP parameter (Section B4.1).
NC - Co-eluting PCBs could not be assessed.

4.3.2 Technical Systems Audit

Concurrent with Round 1 testing, a series of TSAs of the SEA Ring technology were conducted between November 16 and December 7, 2012 at SPAWAR in San Diego, CA. The TSAs were conducted by Ms. Pamela Chang (Battelle) and Adrienne Cibor (AMEC) using an audit checklist based on the QAPP. Five observations were noted during the audit, none of which impacted testing:

- Four, rather than three, clams were placed in each replicate container to ensure adequate tissue mass for analysis. This deviation was documented as Deviation #1.
- The copper concentrations for the WC reproducibility test were 0 µg/L and 200 µg/L rather than 0 µg/L and 400 µg/L because preliminary tests indicated that sufficient numbers of organisms might not survive at the higher concentration, providing insufficient data for the statistical analysis. This deviation was documented as Deviation #3.
- Five replicates of five organisms each were used for the reference toxicant tests with mysid shrimp and topsmelt, which is the test standard (EPA, 2002). The QAPP states in some places that three replicates would be used.
- Water quality during the aqueous tests was measured daily with individual meters rather than with a Troll 9500 datasonde.

In addition to the deviations noted above, the Principle Investigator noted the following deviations:

- Two SEA Rings were used for the reproducibility test for each Cu concentration rather than three because a third SEA Ring was not available due to limitations on the production of SEA Rings. This deviation decreased the robustness of the statistical analysis for reproducibility, but was discussed with the verification test coordinator early in the QAPP process as a potential risk. Rather than conducting an analysis of variance to compare the mean survival from three SEA Rings, a two-sample t-test was conducted comparing the mean survival from two SEA Rings. In both analyses, the risk of making a type I error (α) (probability of incorrectly rejecting our null hypothesis that there is no significant difference) is 0.05. Since the α-level is retained at 0.05 with using a t-test, confidence in the results and subsequent analyses of the reproducibility test was retained. This deviation was documented as Deviation #2.

- The reproducibility water toxicity test was conducted with five topsmelt in each chamber rather than 10. Due to the size of the organisms and the containers, it was determined that 10 topsmelt in each chamber could cause crowding and potentially affect the health of the organisms. Using fewer topsmelt, however, reduces the range counts of surviving topsmelt per chamber, and reduces the power to detect differences in the reproducibility test and thus changes the robustness of the statistics. However, using five organisms per chamber is standard for these toxicity tests (EPA, 1995). This deviation was documented as Deviation #4.
- The organism exposure time for the sediment toxicity tests was reduced from 28 to 14 days (for clams) and 20 days (for polychaetes) for the second round of testing. For clams, the 14-day exposure was recommended by the SPAWAR research team to reflect the expected use of the SEA Ring for in situ sediment toxicity testing. These shorter exposure periods are also employed in sediment toxicity testing guidelines (ASTM, 2000) and/or recent peer-reviewed literature (e.g., Burton et al., 2005; Janssen et al., 2010; Burton et al., 2012; Rosen et al., 2012). The polychaete exposure period did not mirror the clam exposure time because additional time was required for the polychaete to grow to ensure that sufficient tissue was obtained for determining both bioaccumulation and growth endpoints, and because it met the requirements for standard polychaete testing (ASTM, 2000). This deviation was documented as Deviation #5. As stated in the deviation, shorter exposure time was proposed for the repeat test for several reasons:
    - The intent of the ETV is not to achieve steady-state tissue concentrations for non-polar organics, but rather to compare tissue concentrations in the SEA Ring and laboratory bench tests to determine if uptake is comparable. If the tissue

concentrations are similar between the two test methods, it will indicate that the rate of uptake is similar.

  - The intended use of the SEA Ring is for in situ exposures ranging from 4 to 14 days, with multiple sites currently employing the technology within these timeframes;
  - SEA Rings were not designed to be used in a laboratory environment in a static system, and the test staff advised that relatively long-term exposures under such conditions are sub-optimal for organism health and not reflective of the way the SEA Rings will be used in the field;
  - Multiple peer-reviewed publications indicate the growing use of in situ bioassays for multiple purposes, with relatively short-term exposures of 14-days or less (e.g., Burton et al., 2005; Janssen et al., 2010; Burton et al., 2012; Rosen et al., 2012).

Concurrent with Round 2 testing, a TSA was conducted on March 25, 2013 at the SPAWAR facility in San Diego, CA. The TSA was conducted by Ms. Adrienne Cibor (AMEC) using an audit checklist based on the QAPP and test modifications defined in QAPP Deviations 1 through 5. No findings or observations were identified during the audit.

4.3.3 Data Quality Audit

Two audits of data quality (ADQs) were performed for acute aquatic tests and solid phase bioaccumulation tests. As specified in the QAPP, 100% of the verification test data were reviewed for quality by the VTC prior to the ADQ, and at least 10% of the data acquired during the verification test and 100% of the laboratory calibration and QC data were included in the ADQ.

The ADQs:

- Assessed test compliance with the QAPP and Deviations 1 through 5 testing requirements based on test bench sheets and supporting documentation.
- Verified that the required documentation was complete and maintained according to QAPP requirements.
- Verified the accuracy and completeness of data transcribed from bench sheets to spreadsheets; calculations and spreadsheet formulae, and the data input to the Comprehensive Environmental Toxicity Information System (CETIS) software used to calculate LC50s.

- Traced data from the bench sheets, through reduction and statistical analysis, to final reporting to ensure the integrity of the reported results.

The first ADQ was conducted for Round 1 test data by Rosanna Buhl, Battelle AMS Center Quality Manager and Kristen Nichols, Battelle QA Specialist. Test records and spreadsheets were reviewed but no chemical data were audited due to poor clam and polychaete survival during testing, preventing need for tissue samples to be analyzed. The results of the audit identified three findings and eight observations related to discrepancies between QAPP test criteria and test procedures, missing records, and transcription errors.

The second ADQ consisted of a review of Round 2 test results. The audit verified

- Spreadsheets and CETIS data input versus laboratory bench sheets and supporting documentation.
- Test conditions versus the QAPP requirements as modified by the deviations.
- Analytical chemistry QC results based on laboratory spreadsheets.
- Report text, tables, and figures.

It was not possible to audit the trace metals and PCB laboratory calibration data nor the QC results using the laboratory raw data because comprehensive data packages containing these data were not received from the laboratories.

Audit results were communicated directly to the VTC via spreadsheets with comment inserts and report text with corrections, questions and comments inserted in edit mode. A final ADQ report was prepared at the conclusion of the audit.

Section 5: Test Results

5.1 Repeatability Tests

Repeatability tests the variability among five replicates within a SEA Ring. Repeatability tests were conducted for sediment toxicity, WC toxicity and sediment bioaccumulation tests. Before statistically evaluating the repeatability within the SEA Ring, the percent survival of the organisms in each control chamber must pass the TAC of 90% (targeted for most tests). During the ETV testing of the SEA Ring, both the sediment and WC toxicity tests were repeated due to initially low percent survival in some replicates. During the repeat exposure (Round 2), the percent survival passed the TAC, likely due to modifications made to optimize SEA Ring application under laboratory-based exposure conditions. Modifications included increasing frequency of exchange of water between the Chemtainer and individual exposure chambers (this did not alter renewal of overlying water frequency), increasing aeration in the Chemtainer to be more proportional to that being received by laboratory tests (100 bubbles/minute in beakers), ensuring no disruptions in air provided to the Chemtainer, and reducing the size of mesh for aquatic tests from 500 µm to 250 µm (to minimize risk of loss/escape of individuals from the exposure chambers). During the discussion of the results, the initial exposure will be referred to as Round 1 and the repeat exposure will be referred to as Round 2. A summary of the test procedure is presented in Section 3. This section on repeatability presents only the SEA Ring results because repeatability was evaluated only in the SEA Ring. Although concurrent laboratory tests were conducted, those results are evaluated in the section on comparability.

5.1.1 Sediment Toxicity and Bioaccumulation Repeatability Test

For both the Round 1 and Round 2 sediment toxicity tests, three different test sediments (control [YB or DB], MS and PSNS) and three different organisms (amphipod, clam, and polychaete) were used as discussed in Section 3. Because the focus of the clam exposures was on PCB bioaccumulation, clams were exposed only to the control and PSNS sediment (not MS sediment). As discussed in Section 3, the sediment toxicity tests were conducted with five replicates, however tissues were analyzed from only three of the replicates for the bioaccumulation testing. For the Round 2 testing, only the clam and polychaete were tested as the Round 1 amphipod sediment toxicity test passed the TAC. The exposure period for the

Round 1 test was 10 days for the amphipod and 28 days for the polychaete and clam. For Round 2, the exposure period was reduced to 14 days for the clam and 20 days for the polychaete. These reduced exposure times are a viable option in the published ASTM and EPA methods, and are also more meaningful for intended SEA Ring use. A deviation report was approved by EPA for this change; this deviation was documented as Deviation #5.

5.1.1.1 Round 1 Sediment Toxicity and Bioaccumulation Test

The first round of sediment and bioaccumulation toxicity tests were conducted from November to December 2012. Prior to the sediment toxicity test, the organisms were acclimatized for one week in filtered sea water. This took place from November 9, 2012 to November 16, 2012. During the acclimation period, water quality parameters (pH, DO, temperature and salinity) were measured to ensure that they were within and remained within the TAC for the each organism. The TAC for each parameter and details of the Round 1 sediment toxicity test is presented in Section 3.

During the 10 day (amphipod) and 28 day (polychaete and clam) sediment toxicity test exposure period, the water quality parameters (pH, salinity, DO and temperature) generally remained within the acceptance criteria. On Day 17, however, the DO in the SEA Ring for the clam control sediment (DB) dropped to 3.7 mg/L, below the TAC of 4 mg/L, due to technician error that resulted in removal of the air stone from the Chemtainer. Similarly, the DO dropped to 4.3 mg/L on Day 17 in the polychaete control sediment exposures (YB), just slightly above the low range of the TAC. The air stones were replaced in the SEA Ring, and the DO concentration returned to the average of 7.5 mg/L. Laboratory data sheets of the water quality parameter data can be found in Appendix A. Although no water renewal is required for the 10 day static exposure period for the amphipod, the water was renewed in three of the five beaker replicates on Day 7 of the amphipod 10 day exposure in YB sediment. This was done in error, yet had no apparent effect on the test results.

The mean percent survival for all replicates of each organism exposed during the Round 1 SEA Ring sediment toxicity tests are presented in Table 5.1. Shaded values are mean percent survival which did not pass the acceptance criterion of 90%. Detailed results for each of the chambers in the SEA Ring is provided in Appendix E. Several replicates showed decreased survival which led to mean percent survival that did not pass the TAC. The drop in DO concentration to below the acceptance criteria of 4 mg/L likely contributed to the mortality of both clams and polychaetes, which shared the same Chemtainer (and thus were both influenced by water quality aberrations), in their respective control sediments. The low DO condition was due in part to technician error, but also due to insufficient turnovers of aerated water in the Chemtainer with the overlying water in the SEA Ring exposure chambers. Therefore, the sediment toxicity test was repeated using a modified turnover rate and increased aeration between the outer and inner contents of the exposure chambers to better simulate the laboratory beaker tests.

Table 5.1. Percent Survival in the Replicates of the Round 1 SEA Ring Sediment Toxicity Tests

Sediment Type	Replicate	Amphipod % Survival	Clam % Survival[a]	Polychaete % Survival
Yaquina Bay - Control Sediment	A	100	0	0
	B	85	0	0
	C	100	0	5
	D	95	0	0
	E	100	0	0
Mean % Survival		96	0	1
MS Sediment	A	85	NA	80
	B	95		85
	C	80		95
	D	85		90
	E	85		80
Mean % Survival		86		86
PSNS Sediment	A	80	50	65
	B	75	0	50
	C	75	25	45
	D	80	50	40
	E	85	25	25
Mean % Survival		79	30	45

NA - Toxicity of copper contaminated MS sediment was not evaluated for the clam.

[a] Clams were exposed in DB control sediment.

Bioaccumulation of PCBs from the PSNS sediment in the clam and polychaete exposed during the Round 1 exposure was not evaluated due to the low survival. Bioaccumulation of PCBs in the amphipods was measured and is presented below.

5.1.1.2 Round 2 Sediment Toxicity and Bioaccumulation Repeatability Test

The second round of sediment toxicity and bioaccumulation tests was conducted in February 2013. The same four test sediments (YB and DB control sediment, MS and PSNS) were tested using sediments from the same batch as those used for the Round 1 experiments. Two organisms, the clam and the polychaete, were exposed for a period of 14 and 20 days, respectively, with the polychaete being exposed to all three sediment types and the clam being exposed to the control and PSNS sediment type for both toxicity and bioaccumulation evaluation. Prior to the toxicity and bioaccumulation testing, the organisms were again acclimated in filtered sea water from February 1, 2013 to February 6, 2013. The water quality parameters (DO, salinity, temperature and pH) were monitored daily and remained within the TAC for all test organisms for both the acclimation and exposure period. Laboratory data sheets of the water quality parameter data can be found in Appendix A. The mean percent survival for all replicates of each organism exposed during the Round 2 SEA Ring sediment toxicity tests are presented in Table 5.2. Both species had controls that met TAC for mean percent survival.

Table 5.2. Percent Survival in the Replicates of the Round 2 SEA Ring Sediment Toxicity Tests

Sediment Type	Replicate	Clam % Survival[a]	Polychaete % Survival
Yaquina Bay Control Sediment	A	100	100
	B	100	95
	C	100	*
	D	100	80
	E	100	100
Mean % Survival		100	93.8
MS Sediment	A	NA	80
	B		100
	C		100
	D		100
	E		95
Mean % Survival			95
PSNS Sediment	A	100	100
	B	100	100
	C	100	85
	D	100	100
	E	100	95
Mean % Survival		100	96

NA - Toxicity of copper contaminated MS sediment was not evaluated for the clam.

[a] Clams were exposed in DB control sediment.

* Replicate was dropped on termination and organisms were lost.

Since the percent survival of each of the treatments passed the TAC and sufficient tissue was obtained, the PCB concentration was measured in the clams and polychaetes exposed during the Round 2 testing and the amphipods exposed during the Round 1 testing. The details of the bioaccumulation measurements are discussed in Section 3 of this report. The PCB concentration was normalized to the percent lipid content of the organisms because PCBs accumulate in the lipid fraction of the organism. The total percent lipid was determined from all three replicates to give a single value for each species, whereas a total PCB concentration for each replicate was determined for each species. A single combined lipid concentratoin for all replicates was determined because individually sufficient tissue mass was not available for the lipid analysis.

For each organism and sediment type three PCB concentrations and one total percent lipid were reported. The PCB content of each replicate was divided by the percent lipid determined for each treatment. PCBs accumulated in the tissue of the organisms exposed to the PSNS sediment; however, no PCBs were detected in the organisms exposed to the control sediments. Table 5.3 provides the PCB content normalized to percent lipid for the PSNS exposures.

Table 5.3. PCB Content for the Treatments in the SEA Ring Bioaccumulation Test

Organism	PCB (µg/kg)	% lipid	PCB normalized to % lipid (mg/kg)
Amphipod	718	1.27	56.6
	5,051		397.7
	3,685		290.2
Clam	66.7	0.36	18.5
	113.4		31.5
	80.5		22.4
Polychaete	390.5	1.94	20.1
	374.1		19.3
	373.4		19.2

Data shown for PSNS sediment which was used for bioaccumulation. Data not shown for control sediment because PCB concentration was below detection limits for all organisms tested.

5.1.2 Water Column Toxicity Repeatability Test

For both Round 1 and Round 2 WC toxicity tests, two organisms were used (topsmelt and mysid shrimp) and each organism was exposed to four different copper concentrations (0 [Control], 100, 200 and 400 µg/L). As discussed in Section 3, each treatment was run in five replicates. This discussion of the repeatability for the WC toxicity test will present the survival in the SEA Ring. Simultaneous tests were conducted in laboratory beakers and will be presented during the discussion of comparability. The WC toxicity tests were initially conducted in November 2012, but due to the controls not meeting TAC, the tests were repeated in March 2013. In the Round 1 test, percent survival was slightly below the required 90% (Table 5.4) due to the escape of the organisms through the 500 µm mesh screen that covered the outlet valve in the chamber cap. Organisms were observed in the Chemtainer that held the SEA Ring, but it was not possible to determine from which SEA Ring exposure chamber the organisms originated. For the Round 2 test, the mesh in the outlet was replaced with a smaller screen size of 250 µm. In the Round 2 WC toxicity tests, all controls passed the TAC of 90% survival. The percent suvival in the SEA Ring WC toxicity tests are presented in Table 5.4.

Table 5.4. Percent Survival in Replicates from the SEA Ring Water Column Toxicity Test

Concentration (mg/L Cu)	% Survival			
	Round 1		Round 2	
	Mysid	Topsmelt	Mysid	Topsmelt
Control	90	100	100	100
	60	80	100	100
	100	80	100	100
	100	80	90	100
	60	100	100	100
Mean % Survival	82	88	98	100
100	80	80	90	20
	80	60	100	20
	70	20	90	20
	90	60	100	80
	80	100	100	20
200	30	0	90	0
	20	60	80	0
	30	60	60	20
	20	40	50	0
	40	20	30	0
400	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0
	20	0	10	0

Grey shading indicates control treatments that did not meet the acceptability criteria during Round 1.
Copper concentrations are nominal not measured concentrations.

5.2 Comparability Tests

Comparability compares the results obtained from tests in the SEA Ring to traditional EPA and ASTM laboratory methods. This comparison was performed for both sediment and WC toxicity tests. Survival, growth (polychaete only), and bioaccumulation were measured and compared in the sediment toxicity tests, and survival was compared in the WC toxicity test. Water quality was also measured daily during both the sediment and WC toxicity tests in the laboratory beakers. The water quality parameters (DO, salinity, pH and temperature) in the SEA Ring and laboratory EPA and ASTM tests were compared. These results are presented in Appendix D.

5.2.1 Sediment Toxicity and Bioaccumulation Comparability Tests

The data used to evaluate the repeatability among the sediment toxicity tests within a SEA Ring were compared to identical tests conducted simultaneously in the laboratory for the comparability measurements. For the sediment toxicity test, the clam and polychaete results from the Round 2 tests were used and the data from the Round 1 amphipod tests were used for the comparison.

During the exposure period for the laboratory sediment toxicity test, the same number of organisms and replicates were used as was used for the repeatability tests in the SEA Ring. The water quality was also measured daily and was within the TAC for the duration of the test. Appendix D compares the values for each water quality parameter measured in the SEA Ring to the values obtained from the identical laboratory sediment toxicity tests for all three organisms and test sediments.

In order to compare the survival of the organisms in the SEA Ring to the laboratory tests, mean percent survival was calculated for each treatment. Table 5.5 shows the mean percent survival of organisms in the sediment toxicity tests. Survival for all three sediment test organisms passed TAC for both the SEA Ring and laboratory exposures (Figures 5.1 through 5.3).

Table 5.5. Comparision of Mean Percent Survival from SEA Ring and Laboratory Test for Round 2 Sediment Toxicity Tests

		Mean % Survival	
Sediment Type	**Organism**	**Laboratory Test**	**SEA Ring**
Control Sediment	Amphipod	94	96
	Clam	100	100
	Polychaete	95	93.8
MS Sediment	Amphipod	90	86
	Clam	NA[1]	NA[1]
	Polychaete	94	95
PSNS Sediment	Amphipod	76	79
	Clam	100	100
	Polychaete	98	96

The amphipod and polychaete were exposed to Yaquina Bay Control sediment.
The clam was exposed to Discovery Bay Control sediment.
[1] Clams were not exposed to MS sediment.

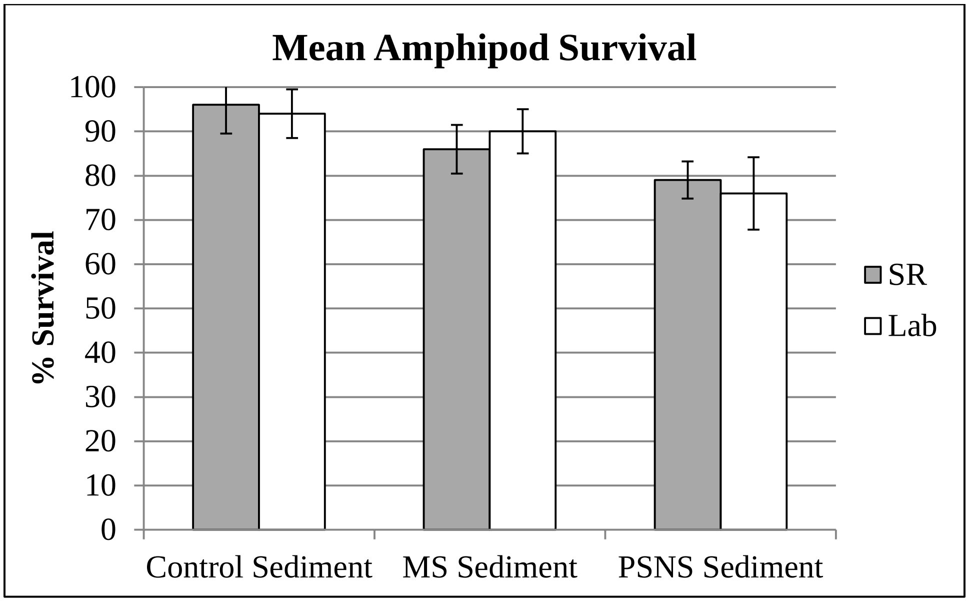

Figure 5.1. Comparison of Amphipod Mean Percent Survival (± standard deviation) for SEA Ring and Laboratory Exposures (Lab = Laboratory exposure, SR = SEA Ring) Test Acceptability Criteria = 90% Survival.

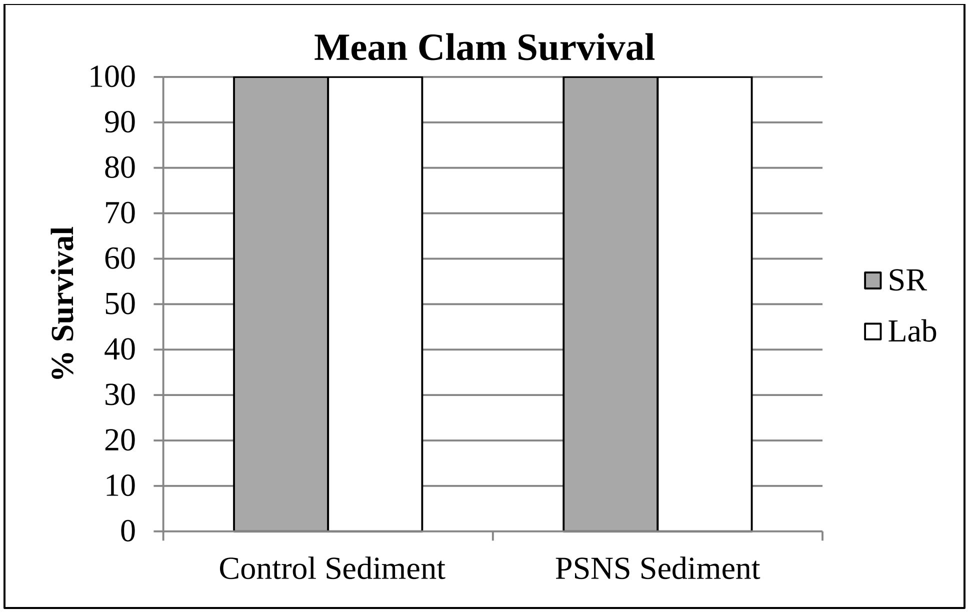

Figure 5.2. Comparison of Clam Mean Percent Survival for SEA Ring and Laboratory Exposures, (Lab = Laboratory exposure, SR = SEA Ring) Test Acceptability Criteria = 90% Survival.

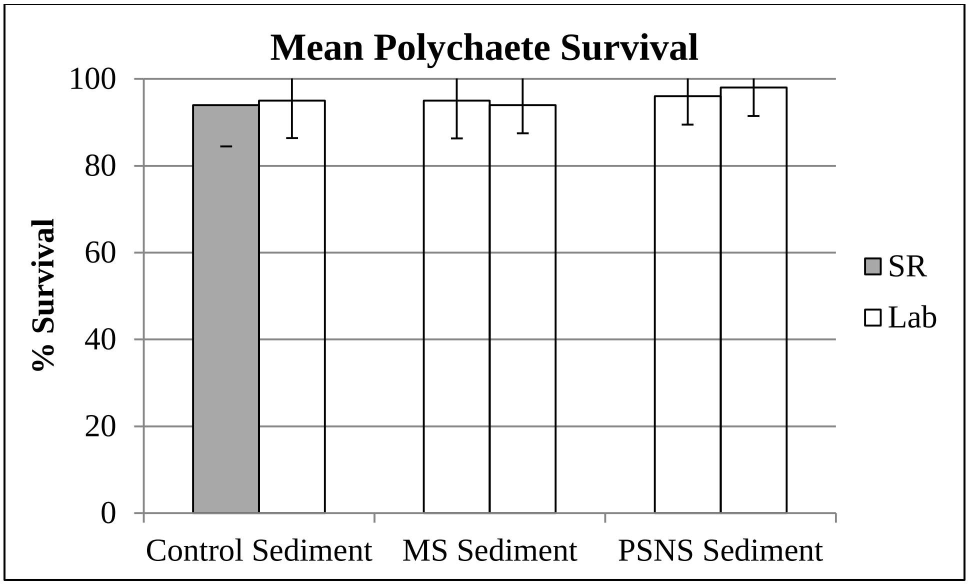

Figure 5.3. Comparison of Polychaete Mean Percent Survival (± standard deviation) for SEA Ring and Laboratory Exposures. (Lab = Laboratory exposure, SR = SEA Ring) Test Acceptability Criteria = 90% survival.

Growth of the polychaetes was determined by measuring the wet weight collectively of the organisms in each replicate after the exposure period. A mean wet weight was calculated for all of the replicates in each exposure scenario. The mean individual wet weight for control and PSNS sediments was compared. Figure 5.4 shows the growth results for polychaetes exposed to control (YB) and PSNS sediment, respectively. These data are further analyzed statistically in Section 6. Growth is typically not evaluated for amphipods and clams as a toxicity endpoint, and was not included as part of this test.

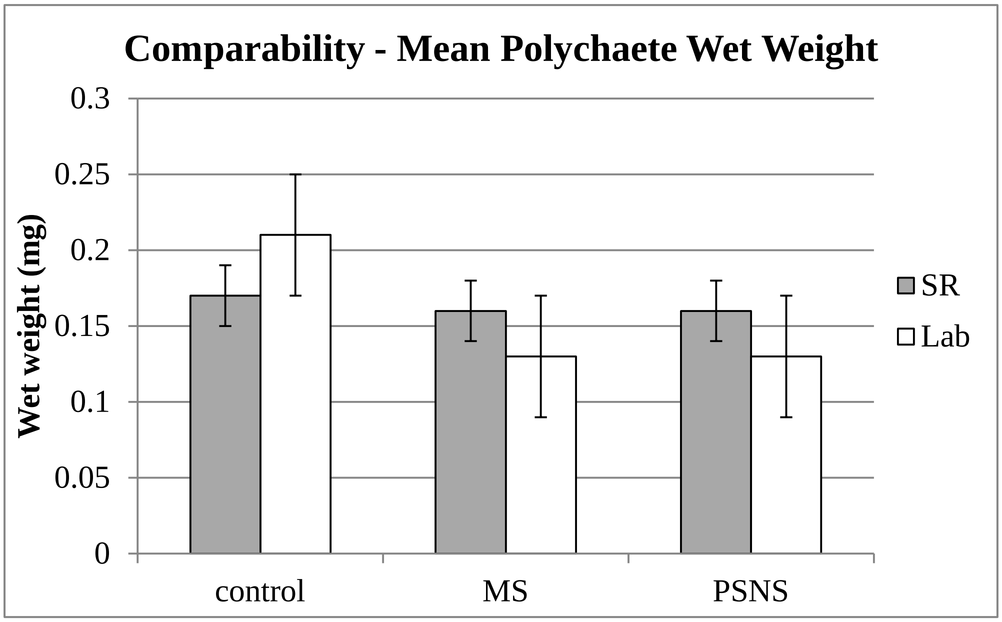

Figure 5.4. Comparison of Mean Wet Weight of the Marine Polychaete (± standard deviation) for SEA Ring and Laboratory Exposures (Lab = Laboratory exposure, SR = SEA Ring)

PCB (sum of 18 NOAA congeners) content within the organisms exposed to their respective control sediments and to the PSNS sediment was quantified and normalized to the mean percent lipid content of the organisms in that treatment. The mean organism PCB concentration for the SEA Ring and laboratory tests is presented in Table 5.6. The PCB content of the PSNS sediment was 60 mg/kg (sum of 18 NOAA congeners) when normalized to the TOC content of the sediment (1.9%). These data are further analyzed statistically in Section 6.

Table 5.6. Mean PCB Concentration Normalized to Percent Lipid Content for SEA Ring and Laboratory Exposures

	SEA Ring				Laboratory Test			
Species	**PCB (µg/kg)**	**SD**	**% lipid**	**PCB normalized to % lipid (mg/kg)**	**PCB (µg/kg)**	**SD**	**% lipid**	**PCB normalized to % lipid (mg/kg)**
Amphipod	3,151	2,215	1.27	248	5,644	5,373	1.21	466
Clam	87	24	0.36	24	85	2	0.34	25
Polychaete	379	10	1.94	20	367	82	1.94	19

Data shown for PSNS sediment which was used for bioaccumulation.
Data not shown for control sediment because PCB concentration was zero for all.
The amphipod and polychaete were exposed to Yaquina Bay Control sediment.
The clam was exposed to Discovery Bay Control sediment.

5.2.2 Water Column Comparability Tests

The data collected during the Round 2 water toxicity tests were used to evaluate the comparability between the SEA Ring and EPA/ASTM laboratory tests. To compare the survival in the SEA Ring to the laboratory tests, the mean percent survival for the replicates for each exposure treatment was calculated (Table 5.7). Figures 5.5 and 5.6 show a comparison between the SEA Ring and laboratory test for the mysid and topsmelt WC toxicity tests. The survival in all control exposures met TAC.

Table 5.7. Comparison of Mean Percent Survival from SEA Ring and Laboratory Tests for Round 2 Water Column Toxicity Tests

		Mean % Survival	
Concentration (µg/L Cu)	**Organism**	**Laboratory Exposure**	**SEA Ring**
Control	Mysid	100	98
	Topsmelt	100	100
100	Mysid	98	96
	Topsmelt	20	32
200	Mysid	72	62
	Topsmelt	4	4
400	Mysid	0	2
	Topsmelt	0	0

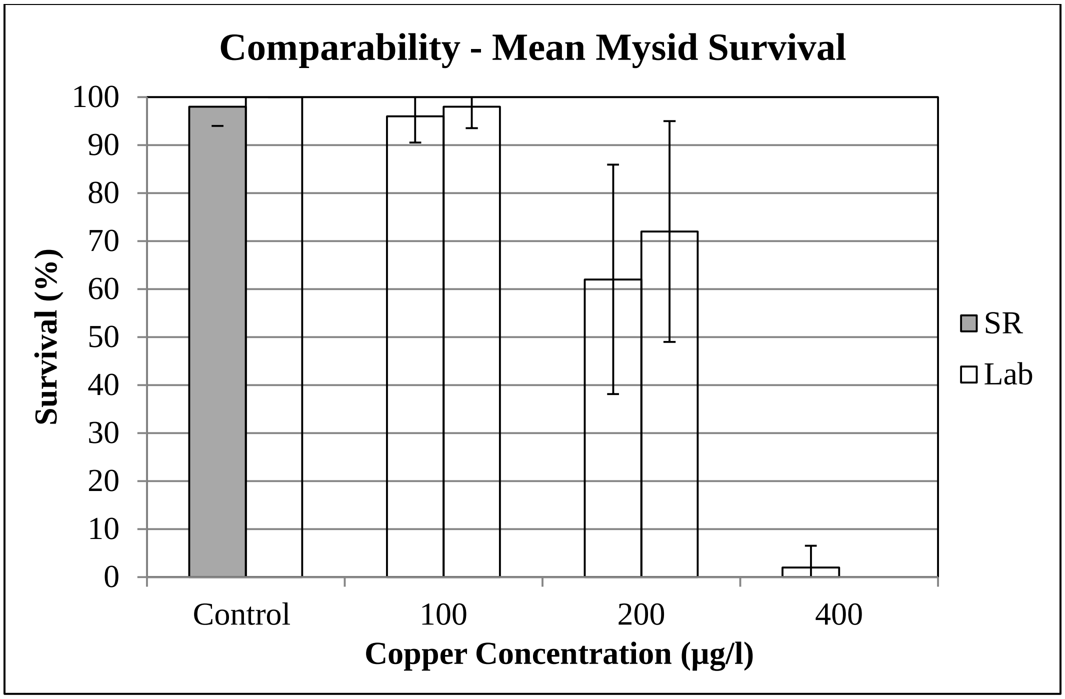

Figure 5.5. Comparison of Mysid Mean Percent Survival (± standard deviation) for SEA Ring and Laboratory Exposures. (Lab = Laboratory exposure, SR = SEA Ring) Test Acceptability Criteria = 90% survival.

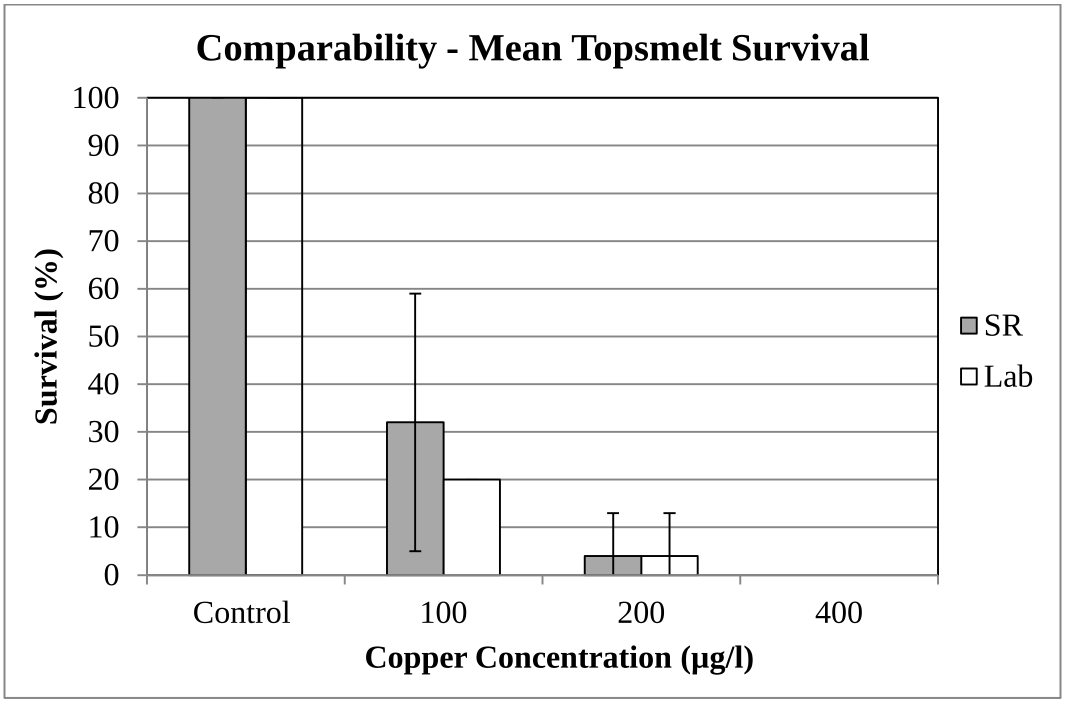

Figure 5.6. Comparison of Topsmelt Mean Percent Survival (± Standard deviation) For SEA Ring and Laboratory Exposures. (Lab = Laboratory exposure, SR = SEA Ring) Test Acceptability Criteria = 90% survival.

To compare the effects of concentrations for test organisms exposed in the SEA Ring with those exposed in standard laboratory tests, LC50 values and 95% confidence intervals were calculated for topsmelt and mysid shrimp for each test treatment (Table 5.8). Point estimates for the standard beaker exposures for both the mysid and topsmelt were conducted using the SRT test data by excluding both the 50 and 800 µg/L test concentrations so that there would be a more direct comparison of concentrations to those also tested with the SEA Rings. Figure 5.7 shows the LC50 values for test organisms exposed using standard laboratory procedures and organisms exposed in the SEA Ring. The LC50 values for mysid shrimp and topsmelt were similar for both the SEA Ring exposures and exposures using standard protocols when calculated from the verified concentrations (Figure 5.7). The results of the water quality parameters in the SEA Ring and Laboratory water toxicity are shown in Appendix D. All water quality parameters were monitored daily in each test concentration unless there was complete mortality observed across all replicates within a given concentration. For example, water quality measurements ceased after 72 hrs in the mysid Laboratory toxicity tests at the 400 and 800 µg/L concentrations due to complete mortality across all replicates. Additionally, water quality measurements were ceased after 24 hrs for the topsmelt Laboratory toxicity tests at the 400 and 800 µg/L test concetrations due to complete mortality across all replicates. Water quality parameters were measured in the SEA Rings daily throughout the test period to ensure that these measurements fell within test acceptability parameters. Survival counts were only conducted at the termination of the exposure period in the SEA Rings due to the nature of the experimental setup.

Table 5.8. Comparison of LC50 Values between SEA Ring and Laboratory Tests for Water Column Toxicity Tests

Treatment	**Topsmelt[a]**			**Mysid[b]**		
	LC50	**95%LCL**	**95%UCL**	**LC50**	**95%LCL**	**95%UCL**
Beaker Exposure Verified Concentrations - adjusted*	64.35	55.29	74.66	178.79	154.71	301.16
SEA Ring Exposure – Verified Concentrations	62.47	19.40	79.73	167.79	147.94	189.14

*LC50 point estimates excludes the 50 & 800 µg/L concentrations for comparability.

[a] Linear regression (Probit analysis) conducted for point estimates.

[b] Trimmed Spearman-Kärber conducted for point estimates.

LCL= lower confidence limit. UCL= upper confidence limit.

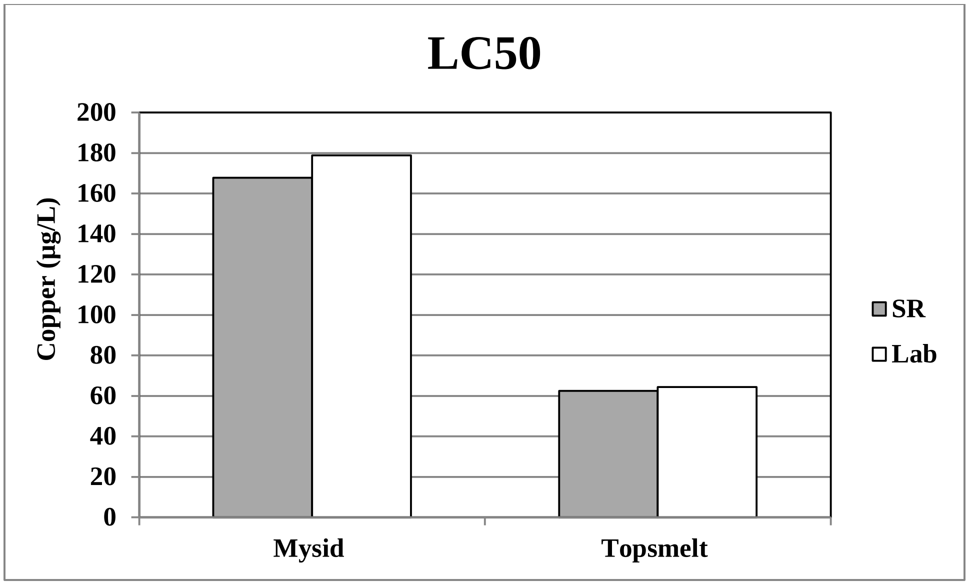

**Figure 5.7. Comparison of LC50 Values for Mysid and Topsmelt Between SEA Ring and Laboratory Water Column Toxicity Tests
(Lab = Laboratory exposure, SR = SEA Ring)**

5.3 Reproducibility Tests

Reproducibility tests were conducted to determine if different SEA Rings are capable of producing the same results. Identical exposures were conducted in two SEA Rings simultaneously. The two SEA Rings will be referred to as SEA Ring A and B. WC toxicity tests were selected for the reproducibility tests. Five replicates of 200 µg/L Cu as well as a control with no Cu were used for the WC toxicity reproducibility test. Survival was used as the parameter to measure the reproducibility between the two SEA Rings.

Within each SEA Ring, the exposures were conducted in five replicates and with the same number of organisms as was previously used for the repeatability and comparability tests. For Sea Ring A, one of the Mysid control replicates was accidentally lost during test termination, therefore, percent survival data were only collected for four replicates. For all other treatments, survival data from five replicates were collected. The water quality parameters (DO, temperature, salinity and pH) remained within the TAC for all exposures. A comparison of the water quality parameters in SEA Ring A and B for the control and 200 µg/L water toxicity tests is shown in Appendix D.

Figures 5.8 and 5.9 show a comparison of the mean percent survival for mysid shrimp and topsmelt in both the control and 200 µg/L. Mysid and topsmelt survival in the control for both SEA Ring A and B passed TAC (Tables 3.1 and 3.2).

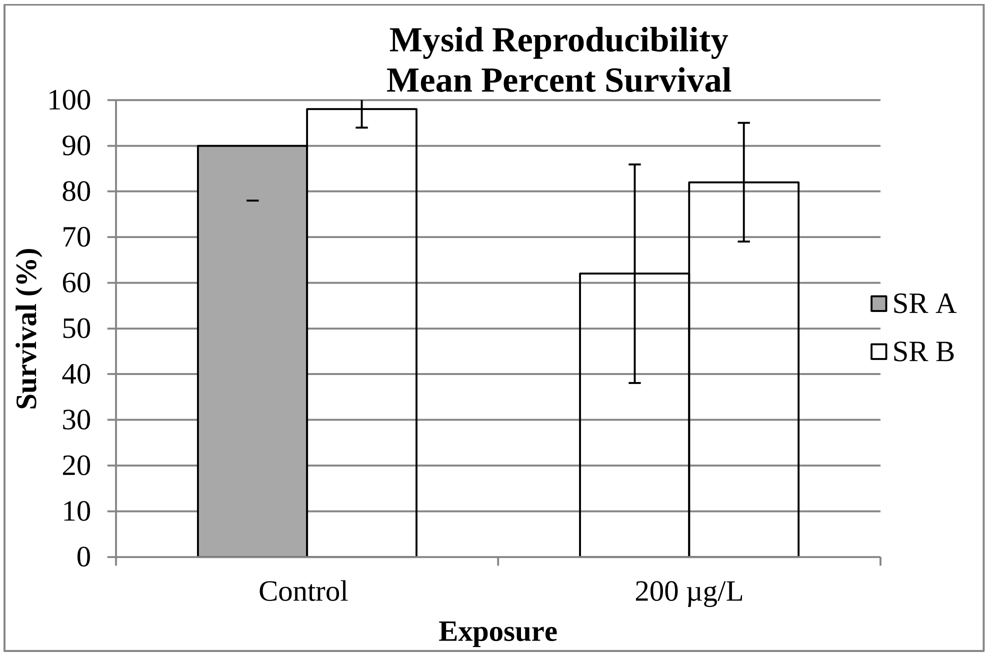

Figure 5.8. Reproducibility in Mysid Mean Percent Survival within SEA Rings (± standard deviation) (SR = SEA Ring)

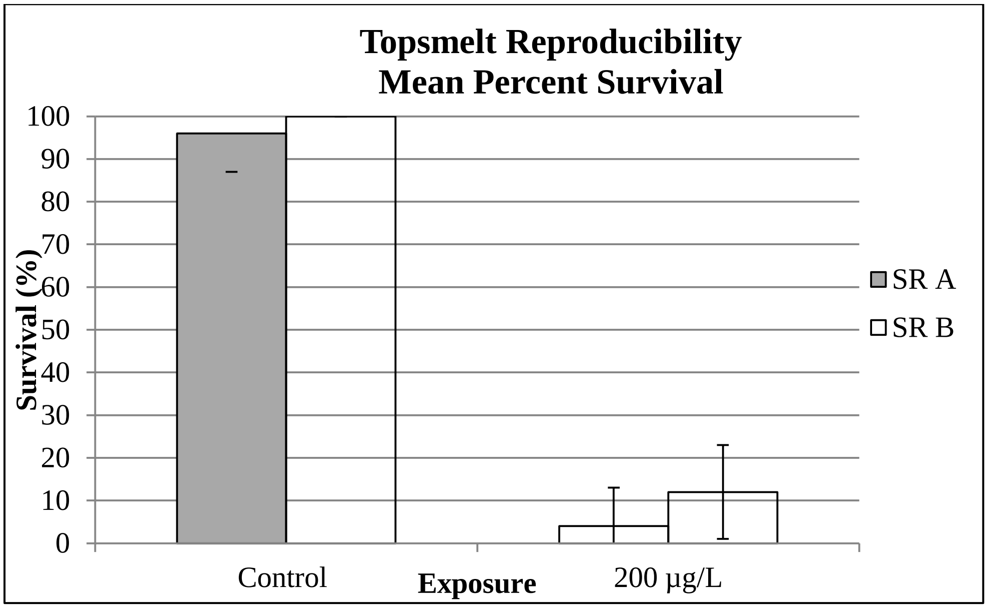

Figure 5.9. Reproducibility in Topsmelt Mean Percent Survival in SEA Rings (± standard deviation) (SR = SEA Ring)

5.4 Operational Factors

The operational factors analyzed were ease of use, training, and sustainability (sampling time, waste produced, and the amount of protective equipment required by the individual operating the instrument). The Battelle representative was trained in the SPAWAR laboratory by Gunther Rosen and Marienne Colvin to set up and use the SEA Ring chambers, pump, control module, and download data. The Battelle representative found that the SEA Ring was easy to use. The SEA Rings were assembled in the laboratory and powered on prior to initiation. The SEA Ring pumps are powered by an on-board battery pack. The control switch used to turn the SEA Ring on and off is easy to locate and read. The control module has two status indicator light emitting diodes that blink every 15 seconds to indicate battery status (e.g., ok, low, or battery shutdown) as well as operation mode (e.g., on, off, or delayed start countdown). Laboratory filtered air was required when operating the SEA Ring in the laboratory. An electrical source from the laboratory building was used to power a compressor that provided air to the SEA Ring. During field use, each exposure chamber in the SEA Ring is provided with ambient seawater delivered by the peristaltic pump that is housed in the center of the device. The pump is programmable to provide variable chamber water volume exchanges depending on site- or project-specific preferences.

Following four hours of training, the Battelle representative was comfortable quickly and easily setting up, operating, loading, and maintaining (e.g., collecting scheduled water quality readings) the SEA Rings. The Battelle representative noted that care must be taken when handling the organisms as to not affect their health (e.g., slow acclimation of temperature and salinity to testing conditions, and use of wide bore plastic pipettes or paintbrushes to gently transfer organisms to test containers). Also due to the minute size of the mysid shrimp, care must be taken that the correct number of shrimp are loaded into the chambers. Collection of water quality readings was completed by the use of an Oakton pH meter that measured pH and temperature, an Orion 830A DO meter, and an Orion A plus conductivity meter that measured conductivity and salinity. The probes were placed in the water in the Chemtainer surrounding the SEA Ring for measurement of overall water quality associated with the SEA Ring treatments. Since this water is pumped through the SEA Ring chambers, it is assumed that the water quality is the same both within and outside of the SEA Ring chambers, although discrete water quality samples were measured to verify. During field use, a field-based water quality data logging device can be attached in-line to one of the chambers to record water quality parameters directly inside the exposure chambers. The SEA Ring also has an on-board data logger that records data such as the frequency, timing, and number of pump cycles. This data can then be downloaded to a computer for analysis. The Chemtainers that housed the SEA Rings are approximately 24 inches in diameter and 20 inches tall and, when empty, can be carried by one person. When Chemtainers and SEA Ring test chambers are filled with seawater, they are heavy, but not too heavy, for one person to carry a short distance. Depending on the site- or project-specific use of the SEA Rings, a Chemtainer may or may not be used for transport of the SEA Rings. Chemtainers are typically used to protect the equipment and for assurance that pre-loaded organisms are acclimated to the device and expected site conditions. For most field applications, it is expected that two or more people are appropriate safety concerns for operating the SEA Rings in the field.

Minimal waste was produced when setting up, operating, and breaking down the SEA Rings. The main waste material was small plastic cups and disposable pipettes to count and load organisms into the test chambers. Although personal protective equipment (PPE) is not required when using the SEA Rings, PPE such as eye protection, nitrile gloves, and laboratory coats were used and are recommended.

Section 6: Statistical Analysis

Both descriptive statistics and parametric statistics were conducted on the data to evaluate the parameters of repeatability, comparability and reproducibility. Descriptive statistics include mean, standard deviation, minimum, maximum and CV. In this section, the sediment toxicity test, WC toxicity tests, and bioaccumulation tests were evaluated statistically. This was followed by a statistical analysis of the repeatability, comparability and reproducibility tests to verify that the SEA Ring met the evaluation criteria. For all statistical tests performed, the threshold of significance (alpha level – α) was 0.05. Null hypotheses for all tests performed were no significant differences between the treatments/groups tested. The alternative hypotheses were that a significant difference was present between the treatments/groups tested. If the calculated *p*-value was greater than the alpha level of 0.05, then the null hypothesis was not rejected and it was assumed there was no significant differences between the treatments/groups tested. If the calculated *p*-value was less than the alpha level of 0.05, then the null hypotheses was rejected and it was assumed there was a significant difference between the treatments/groups tested. All tests were performed using student’s two sample *t*-tests assuming unequal variances.

6.1 Sediment Toxicity Data Analysis

6.1.1 Survival Data Analysis

For the statistical analysis of the sediment toxicity test, eight groups (two organisms in three sediment types and one organism in two sediment types) were assessed. Table 6.1 provides descriptive statistics for each group for tests conducted using the SEA Ring. Individual chamber data are provided in Appendix E. For both DB control and PSNS sediment conditions, all clams survived the test period. Data from only four chambers were available for the YB control sediment for the polychaete. The proportion of polychaetes that survived the test period was highest under the PSNS sediment (96%) compared to 94% for the YB control sediment and 95% for the MS sediment. The proportion of amphipods that survived the test period was highest under the YB control sediment (96%) compared to 86% for the MS sediment and 79% for the PSNS sediment. All CVs are less than 25%, a goal set in the QAPP for this data. Mean mortality was less than 10% for all control sediments, meeting TAC. Comparing organism survival among chamber replicates within a SEA Ring (repeatability) is explored and discussed in Section 6.4.

Table 6.1. SEA Ring Sediment Toxicity Test Descriptive Statistics

Species	Sediment Type	Mean Percent survived	Initial # organisms per chamber	Mean # survived	SD	SE	Min	Max	Coefficient of variation (%)
Amphipod	Control	96	20	19	1.3	0.58	17	20	6.8
	MS	86	20	17	1.1	0.49	16	19	6.4
	PSNS	79	20	16	0.8	0.37	15	17	5.3
Clam	Control	100	3	3	0	0	3	3	0.0
	PSNS	100	3	3	0	0	3	3	0.0
Polychaete	Control	94	20	19	1.9	0.95	16	20	10.1
	MS	95	20	19	1.7	0.77	16	20	9.1
	PSNS	96	20	19	1.3	0.58	17	20	6.8

SD = Standard deviation of the mean number survived; SE = Standard error of the mean number survived

Table 6.2 provides descriptive statistics for survival in each group for sediment toxicity tests conducted under controlled laboratory conditions. Individual chamber data are provided in Appendix E. For both DB control and PSNS sediment conditions, all clams survived the test period. The proportion of polychaetes that survived the test period was highest under the PSNS sediment (98%) compared to 95% for the YB control sediment and 94% for the MS sediment. The mean percent of amphipods that survived the test period was highest under the YB control sediment (94%) compared to 90% for the MS sediment and 76% for the PSNS sediment. The CV was less than 25% for all exposures, which is acceptable for this test. Comparing organism survival between SEA Ring and controlled laboratory conditions is explored and discussed in Section 6.5.

Table 6.2. Laboratory Sediment Toxicity Test Descriptive Statistics

Species	Sediment Type	Mean Percent survived	Initial # organisms per chamber	Mean # survived	SD	SE	Min	Max	Coefficient of variation (%)
Amphipod	Control	94	20	19	1.1	0.11	17	20	5.8
	MS	90	20	18	1.0	0.10	17	19	5.6
	PSNS	76	20	15	1.6	0.19	13	17	11
Clam	Control	100	3	3	0	0	3	3	0.0
	PSNS	100	3	3	0	0	3	3	0.0
Polychaete	Control	95	20	19	1.7	0.17	16	20	9.1
	MS	94	20	19	1.3	0.13	17	20	6.9
	PSNS	98	20	20	0.9	0.09	18	20	4.6

SD = Standard deviation of the mean number survived; SE = Standard error of the mean number survived

For each species, the number surviving in the sediment control group was compared to the number surviving in each of the other test groups. For the clam, the PSNS sediment results were compared against the DB control sediment results. For polychaetes and amphipods, both the MS and PSNS sediment results were compared against the YB control sediment results. Comparisons were made based on a two-sample t-test, assuming unequal variances. Tests were performed and analyzed separately for data obtained from the SEA Ring and the laboratory tests. Results are shown in Table 6.3; shaded values indicate statistically significant differences.

Table 6.3. *p*-values for Survival in the Sediment Toxicity Tests for the Control Sediment Compared to the MS and PSNS Sediment

Sediment Type	Polychaete		Amphipod	
	SEA Ring	Lab	SEA Ring	Lab
MS	0.84	0.84	0.03	0.26
PSNS	0.70	0.52	0.002	0.005

Grey shading indicates a significant difference compared to the control sediment (Lab=laboratory exposure).

Statistical tests were not performed on the clam data for either the SEA Ring or the laboratory exposure, as there was no variation among the number of surviving clams for any of the treatments tested (100% survival in all treatments). There was no statistically significant difference in survival between the control and the MS or PSNS sediments for polychaetes for both the SEA Ring and laboratory tests (Table 6.3). Results for the amphipod data showed a statistically significant difference between survival in the YB control sediment to both the MS and PSNS sediments for the SEA Ring. In the laboratory exposures, there also was a statistically significant difference in survival of the amphipods between the control and the PSNS sediment, but not for the MS sediment (Table 6.3). For either laboratory or SEA Ring dataset for MS sediment, however, it is highly unlikely that a regulatory program evaluation of sediment toxicity would have designated MS sediment as 'toxic' for either the SEA Ring or laboratory exposure due to incorporation of more biologically meaningful criteria (i.e., detectable minimum significant differences [MSDs] based on historical datasets for the individual test type) in addition to t-tests, which can result in statistical differences when very low variability among treatments is observed (e.g., Phillips et al. 2001). The MSD threshold is a performance criterion designated to individual toxicity tests based on long-term variability associated with the individual test types. MSD thresholds are based on a percentage of the control, and range from as low as 44% to 90% of the control for relevant test types (Phillips et al., 2001). The MSD thresholds for *E. estuarius* (amphipod) survival and *N. arenaceodentata* (polychaete) growth were 75 and 44% of the control, respectively, based on 720 data points presented by Phillips et al. (2001). The primary value associated with the use of a MSD is for improved interpretation of sediment toxicity data when statistical significance may suggest sample toxicity in the event of very low among-replicate variability.

6.1.2 Polychaete Growth Data Analysis

Table 6.4 provides descriptive statistics for polychaete growth within both the SEA Ring and laboratory beakers during the sediment toxicity test. Growth was measured as wet weight except for the MS sediment, where dry weight was also determined as polychaetes exposed to this sediment were not required for tissue analysis and could be dried. The CVs were less than 25% for growth in both the control and contaminated sediments.

Table 6.4. SEA Ring and Laboratory Polychaete Growth Descriptive Statistics

Test	Sediment Type	Mean Dry Weight (mg)	Mean Wet Weight (mg)	SD	SE	Min	Max	Coefficient of variation (%)
SEA Ring	Control	-	8.98	1.56	0.78	6.81	10.5	17
	MS	1.87	8.71	1.01	0.45	7.88	10.38	11.6
	PSNS	-	10.87	0.82	0.37	9.58	11.84	7.5
Lab	Control	-	8.235	2.04	0.91	6.69	11.7	24
	MS	1.59	6.779	0.39	0.17	6.14	7.18	5.7
	PSNS	-	6.767	0.37	0.17	6.19	7.22	5.5

SD = Standard deviation of the mean individual wet weight; SE = Standard Error of the mean individual wet weight. (Lab = laboratory exposure).
Note: Dry weight data available for MS sediment only due to bioaccumulation measurements made for control and PSNS tissue samples, which required wet tissue mass.

There were no statistically significant differences in wet weights between the control and the MS or PSNS sediment for polychaetes for either the SEA Ring or laboratory tests (Table 6.5).

Table 6.5. *p*-values for Wet Weights in the Sediment Toxicity Tests for the Control Sediment Compared to the MS and PSNS Sediment

Sediment Type	Polychaete	
	SEA Ring	Lab
MS	0.77	0.19
PSNS	0.09	0.18

6.2 Water Column Toxicity Data Analysis

For the WC toxicity test, two organisms and four Cu concentrations were assessed. Table 6.6 provides descriptive statistics for each group for tests conducted using the SEA Ring. Individual chamber data are provided in Appendix E. Data from only four chambers were available for the first control test for Mysids. In general, as the Cu level increased, the proportion of organisms that survived the test period decreased. Further analysis between the replicate tests at 0 and 200 µg/L Cu are described in Section 6.6. The CV for the control group was less than 25%, a goal set in the QAPP for these data. Mean mortality was less than or equal to 10% for all control groups, indicating acceptability of the test. Comparing organism survival among chamber replicates within a SEA Ring (repeatability) is explored and discussed in Section 6.4.

Table 6.6. SEA Ring WC Toxicity Test Descriptive Statistics

Species	Copper Conc. (µg/L)	Mean Percent survived	Initial # organisms per chamber	Mean # survived	SD	SE	Min	Max	Coefficient of variation (%)
Mysid	0	90	10	9	1.2	0.58	8	10	12.8
	100	96	10	10	0.5	0.24	9	10	6
	200	62	10	6	2.4	1.07	3	9	39
	400	2	10	0	0.4	0.20	0	1	224
Topsmelt	0	96	5	5	0.4	0.20	4	5	9
	100	32	5	2	1.3	0.60	1	4	84
	200	4	5	0	0.4	0.20	0	1	224
	400	0	5	0	0.0	0.00	0	0	-

SD = Standard deviation of the mean number survived; SE = Standard error of the mean number survived.
Dash indicates not applicable.

Table 6.7 provides descriptive statistics for each group for WC toxicity tests conducted in laboratory beakers. Individual chamber data are provided in Appendix E. In general, as the Cu level increased, the proportion of organisms that survived the test period decreased. Comparing organism survival between SEA Ring and lab tests are explored and discussed in Section 6.5.

Table 6.7. Laboratory WC Toxicity Test Descriptive Statistics

Species	Copper Conc. (µg/L)	Mean Percent survived	Initial # organisms per chamber	Mean # survived	SD	SE	Min	Max	Coefficient of variation (%)
Mysid	0	100	10	10	0.0	0	10	10	0
	100	98	10	10	0.4	0.2	9	10	5
	200	72	10	7	2.3	1.0	4	10	32
	400	0	10	0	0.0	0	0	0	-
Topsmelt	0	100	5	5	0.0	0	5	5	0
	100	20	5	1	0.0	0	1	1	0
	200	4	5	0	0.4	0.2	0	1	224
	400	0	5	0	0.0	0	0	0	-

SD = Standard deviation of the mean number survived; SE = Standard error of the mean number survived.
Dash indicates not applicable.

For each species, the number surviving in the WC control group was compared to the number surviving at each of the different Cu concentrations. For the topsmelt survival WC test in the SEA Ring, all three Cu concentrations were statistically significantly different from the control sample. In the lab test, however, the 200 µg/L concentration was statistically significantly different but since both the 100 and 400 µg/L concentrations as well as the controls had no variation among the replicates, a *p*-value could not be obtained. For the mysid WC toxicity test, only the 400 µg/L concentration was statistically significantly different from the control. The inability to detect statistical differences in some cases for the lab tests appears to be more a result of the limitations of the statistical method used. Results are shown in Table 6.8.

Table 6.8. *p*-values for Survival in the WC Toxicity for the Control Compared to the Copper Treatments

Copper (µg/L)	Topsmelt		Mysid	
	SEA Ring	Lab	SEA Ring	Lab Test
100	0.004	ND	0.39	0.37
200	<0.001	<0.001	0.06	0.05
400	<0.001	ND	<0.001	ND

Grey shading indicates a significant difference compared to the control sediment
ND = there was no variability among replicates, so the statistical test could not be run.

6.3 Bioaccumulation Data Analysis

Six groups (three organisms in two sediment types each) were assessed in the bioaccumulation analysis. Bioaccumulation data are represented as PCB tissue concentrations normalized to percent lipid. Percent lipid was analyzed for each treatment combination, and the PCB concentration for each replicate was normalized to percent lipid using the percent lipid for the treatment. Table 6.9 provides descriptive statistics for each group of tests conducted using the SEA Ring. Individual chamber data are provided in Appendix E. There was no detected PCB bioaccumulation for any species under the control sediment treatment. Mean bioaccumulation for the amphipod was 248,143 µg/kg, on a wet weight basis, whereas the mean bioaccumulation for clam and polychaete was 24,127 µg/kg and 19,554 µg/kg, respectively (Table 6.9).

Table 6.9. SEA Ring Bioaccumulation Test Descriptive Statistics for PSNS sediment

Species	Mean PCB Accumulation (µg/kg lipid ww)	SD	SE	Min	Max	Coefficient of variation (%)
Amphipod	248,143	174,418	100,700	56,556	397,719	70
Clam	24,127	6,673	3,853	18,518	31,506	28
Polychaete	19,554	498	288	19,248	20,129	3

SD = Standard deviation of the mean; SE = Standard error of the mean.
PCB concentrations are based on wet weight (ww).

Table 6.10 provides descriptive statistics for each group of bioaccumulation tests conducted under controlled laboratory conditions. Individual chamber data are provided in Appendix E. Similar to the SEA Ring bioaccumulation data, there was no detectable bioaccumulation for any species under the control sediment treatment. Among the species tested, the mean bioaccumulation for amphipods was largest at 466,418 µg/kg, followed by the clams (24,885 µg/kg), and the polychaetes (18,907 µg/kg), on a wet weight basis.

Table 6.10. Laboratory Bioaccumulation Test Descriptive Statistics for PSNS Sediment

Species	Mean PCB Accumulation (µg/kg lipid ww)	SD	SE	Min	Max	Coefficient of variation (%)
Amphipod	466,418	444,090	256,395	180,837	978,055	95
Clam	24,885	566	327	24,423	25,516	2
Polychaete	18,907	4,244	2,450	14,976	23,406	22

SD = Standard deviation of the mean; SE = Standard error of the mean.
PCB concentrations are based on wet weight (ww).

6.4 Repeatability Analysis

Repeatability, measured as the chamber to chamber variability for a given SEA Ring for a given set of test conditions, was investigated for the sediment toxicity, WC toxicity, and bioaccumulation tests. The analysis was conducted as outlined in the statistical analysis section of the QAPP (B1.6). Briefly, using descriptive statistics to calculate standard deviation and standard error of the sample mean for a given set of treatments, the CV was calculated. A CV of less than 25% was set as a goal as described in the QAPP.

For the sediment toxicity tests, the CV was less than 25% for survival (Table 6.1) (and growth for the polychaete (Table 6.4) for all species and sediment types, indicating low variability across chambers within the SEA Ring for a given treatment.

For the WC toxicity tests in the SEA Rings, the CV was less than 25% for the control treatments for both the mysid and topsmelt tests (Table 6.6). For the mysid toxicity test, the 200 and 400 µg/L treatments had CVs greater than 25% (200 and 400 µg/L treatments were 39 and 224%, respectively), however, these were comparable to the CVs obtained for mysids exposed in the standard laboratory condition (32% for the 200 µg/L treatment, and not calculable for the 400 µg/L treatment due to no survival) (Table 6.7). For the topsmelt toxicity test in the SEA Ring, the 100 µg/L and 200 µg/L treatments had CVs of 84 and 224%, respectively (Table 6.6). The laboratory exposure with topsmelt resulted in CVs of 0 and 224%, for the 100 µg/L and 200 µg/L treatments, respectively (Table 6.7). With increasing Cu concentration, organism mortality increased and thus replicate variability increased. Typically, when evaluating the acceptability of toxicity tests, the response of the control treatment is subject to the criteria of low variability (EPA, 2001), and based on the low CV values obtained from the controls of both species tested in the SEA Rings, the chamber to chamber variability was deemed acceptable.

The CV is not a typical acceptability criterion for bioaccumulation testing. For informational purposes, however, the CVs (for the three replicates used for bioaccumulation testing for each treatment) are provided in Tables 6.9 and 6.10. For both the SEA Ring and laboratory tests, amphipod CVs were highest among the three species, with variability being relatively low for the polychaetes and clams. This may be due to sediment avoidance behavior of some of the amphipods, which tend to be more sensitive to contaminants than clams and polychaetes. In addition, other studies have shown higher variability in side-by-side comparisons of PCB bioaccumulation between amphipods and polychaetes (e.g., Millward et al., 2005). Regardless of the reason for higher variability for amphipods, both the SEA Ring and laboratory tests resulted in similar data.

6.5 Comparability Analysis

Comparability, measured as the ability of the SEA Ring to provide similar results to the traditional EPA/ASTM methods under controlled laboratory conditions, was investigated for the sediment toxicity, WC toxicity, and bioaccumulation tests. The analysis was conducted as outlined in the statistical analysis section of the QAPP (B1.6). For each test condition, the mean survival in the SEA Ring was compared to that observed using traditional EPA methods. Comparisons were made using two sample t-tests, assuming unequal variances. Table 6.11 shows the *p*-values for the sediment toxicity tests. Statistical analyses were not conducted for the clams as there was 100% survival in all replicates in both the SEA Ring and laboratory exposures. All *p*-values for the sediment toxicity test in the SEA Ring compared to the laboratory exposures were greater than the threshold significance level of 0.05, indicating that there was no statistically significant difference in the means. The SEA Ring results are, therefore, comparable with the EPA/ASTM methods for sediment toxicity.

Table 6.11. *p*-values for the Comparability in Survival in the Sediment Toxicity Tests between the SEA Rings and the Laboratory Tests

Sediment Type	Polychaete	Amphipod
	***p*-value**	***p*-value**
Control	0.845	0.614
MS Sediment	0.842	0.263
PSNS Sediment	0.589	0.495

Polychaete growth was also used as a variable to measure the ability of the SEA Ring to provide similar results to the traditional EPA/ASTM methods under controlled laboratory conditions. Wet weight of the polychaete was compared between SEA Ring and laboratory tests in the control, MS and PSNS sediments. Using the same two sample t-tests, significant differences in polychaete growth for the MS and PSNS sediments were observed (Table 6.12), with the SEA Ring exposures showing greater growth compared to the laboratory exposures (Table 6.4).

Table 6.12. *p*-values for the Comparability in Polychaete Growth in the Sediment Toxicity Tests between the SEA Rings and the Laboratory Tests

Sediment Type	Wet weight *p*-value	Dry weight *p*-value
Control	0.552	-
MS Sediment	0.010	0.166
PSNS Sediment	<0.01	-

Grey shading indicates a significant difference compared to the control sediment.
"-" indicates that statistical analyses were not conducted due to no sample.

The technology representative suggested that the adverse effect on growth was likely due to the presence of higher concentrations of dissolved metals in the overlying water in the laboratory beakers compared to the SEA Ring exposure chambers. Previous experiments with the MS sediment revealed appreciable, biologically relevant, metal concentrations in the overlying water (ranging from 10 to 76 µg/L for Cu; Colvin et al., 2011), which was a likely contaminant exposure route to this polychaete species, which build mucoid tubes in the sediment that vent to the sediment-water interface. There was no significant difference in the dry weights of the polychaetes for the MS sediment between the SEA Ring and the laboratory exposure.

For bioaccumulation, comparability between the SEA Ring and the laboratory tests revealed no significant differences for any of the species tested (amphipod: $p = 0.48$; clam: $p = 0.86$; polychaete; $p = 0.82$). This indicated that there were no significant differences between the means of PCB uptake (normalized to lipid content) between the SEA Ring and traditional laboratory exposures.

For the comparability between the SEA Rings and the laboratory exposures for the WC toxicity tests, each of the four concentrations tested were analyzed using a two-sample t-test, assuming unequal variances. Table 6.13 shows the *p*-values for the analyses for each concentration. For the WC toxicity tests, the *p*-value obtained for the comparisons was greater than the threshold significance level of 0.05, indicating there was no difference between the means for each treatment between the SEA Rings and laboratory exposures for either species tested. At the 400 µg/L concentration for topsmelt, a *p*-value could not be calculated because there was no variability in the replicates for both treatments. The SEA Ring results are, therefore, comparable with the EPA/ASTM methods for WC toxicity.

Table 6.13. *p*-values for the Comparability in Survivals in the WC Toxicity Tests between the SEA Ring and the Laboratory Tests

Copper Concentration (µg/L)	Topsmelt *p*-value	Mysid *p*-value
Control	0.37	0.18
100	0.37	0.54
200	1.00	0.51
400	-	0.37

6.6 Reproducibility Analysis

Reproducibility, measured as the ability of one SEA Ring to provide similar results to another SEA Ring, was investigated for select WC toxicity tests. For each test condition, the mean percent survival in a SEA Ring was compared to that observed for a different SEA Ring. Comparisons were made using a two sample t-test, assuming unequal variances. Comparisons were conducted with SEA Rings exposed at two concentrations: a control with no Cu and a Cu concentration of 200 µg/L for both the mysids and topsmelt. Neither species showed significant differences in the mean percent survival between the two SEA Rings (Table 6.14), indicating that the two SEA Rings tested under the same conditions provided reproducible results.

Table 6.14. *p*-values for the WC Toxicity Test for Reproducibility between Two SEA Rings

Species	Control	200 µg/L
	***p*-value**	***p*-value**
Topsmelt	0.37	0.24
Mysid	0.27	0.15

Section 7: Performance Summary

The performance of the SEA Ring was evaluated for its repeatability, comparability, reproducibility, and ease of operation. These parameters were evaluated using survival as well as bioaccumulation and growth (polychaete). Sediment toxicity, bioaccumulation, and WC toxicity tests were conducted to evaluate the performance of the SEA Ring. For the sediment tests, three organisms, including marine amphipods, clams, and polychaetes, were examined. The organisms were tested in three sediment types, control sediment (referred to as YB or DB, dependent on species), a metals contaminated sediment referred to as MS, and a PCB contaminated sediment referred to as PSNS. Survival of the amphipod and polychaete was evaluated for all three sediment types, whereas survival of the clam was evaluated for the control and PSNS sediment. Wet weight of the polychaete, an indicator of growth, was also evaluated across all sediment types. Bioaccumulation was evaluated in all three organisms for the control and PSNS sediments. The WC toxicity tests were conducted using two marine organisms, mysid shrimp and larval topsmelt. Four Cu concentrations were used for the WC toxicity test: a control without Cu, and 100, 200 and 400 µg/L Cu. All tests were conducted concurrently in both the SEA Ring and by traditional EPA and/or ASTM laboratory methods. In addition to the toxicity testing, SRT tests were conducted to assess the test precision and the health and sensitivity of the organisms. The SRT tests were conducted using the mysid shrimp, topsmelt, amphipods and polychaete. Tests were considered acceptable when survival was above the TAC of 90% with a CV of less than 25%.

General observations

Both the sediment and WC toxicity tests were repeated following the initial test because the TAC was lower than 90% for all organisms in SEA Ring exposures, except for the amphipod. The less than acceptable survival in the initial round of testing was primarily due to a drop in DO concentration in the water in the SEA Ring exposure chambers. This occurred because the SEA Ring, which was designed to be used in the field, was being verified under static-renewal laboratory conditions that were insufficient for the oxygen demand of the sediments. Field testing was not feasible for this test due to schedule, budgets, and agreement that the most comparable verification test would be alongside standard laboratory methods. Modifications made to the testing approach led to a subsequent test that met the test acceptability criteria. These modifications included increasing the frequency of water exchange and increased aeration in the container that held each SEA Ring. The mesh size on the SEA Ring chambers was also reduced from 500 µm to 250 µm to minimize risk of loss/escape of individuals from the exposure chambers. This modification will be applied in the field to optimize the deployment of the SEA Ring for toxicity testing with species affected. The CV was less than 25% for most of the toxicity tests except for the WC toxicity tests at 100, 200 and 400 µg/L. This was expected due to the lower survival at these Cu concentrations, which typically results in larger CVs in toxicity tests.

Repeatability

Repeatability tested the variability among five replicates within a SEA Ring using both the sediment and WC toxicity tests. To determine standard deviation and standard error of the sample mean for a given set of treatments, the CV was calculated. A CV of less than 25% was targeted. For the WC toxicity tests, the CV was less than 25% for the control treatments for both the mysid and topsmelt tests. For the mysid toxicity test, the 200 and 400 µg/L treatments had CV values greater than 25%. For the topsmelt toxicity test, all copper concentrations greater than 0 µg/L (control) had CVs greater than 25%. With increasing copper concentrations, organism mortality increased as did replicate variability, which was (and is typically) observed in the parallel standard laboratory tests. For the sediment toxicity tests, the CV was less than 25% for survival (and growth for the polychaete) for all species and all sediment types, indicating low variability across chambers within the SEA Ring for a given treatment. The CV was also less than 25% for growth of polychaete in both the control and contaminated sediments. Bioaccumulation was also determined and there was no detectable bioaccumulation for any species under the control sediment treatment.

Comparability

Comparability was measured as the ability of the SEA Ring to provide similar results to the traditional EPA/ASTM methods under controlled laboratory conditions. Comparability was evaluated for sediment toxicity, WC toxicity, and bioaccumulation tests by comparing the mean percent survival, growth and bioaccumulation for identical treatments in the SEA Ring to the laboratory tests. In both sediment and WC toxicity tests, there was no statistically significant difference in survival for any of the treatments indicating that the result obtained from the SEA Ring was no different from the results obtained by EPA and ASTM laboratory methods. Polychaete growth was determined by measuring the wet weight collectively of the organisms in each replicate after the exposure period. A statistical comparison of the growth of polychate between the SEA Ring and laboratory tests showed no statistically significant differencefor the control sediment exposures, but there were significant differences for both the MS and PSNS sediment exposures based on the wet weights. The technology representative suggested that the adverse effect on growth was likely due to the presence of higher concentrations of dissolved metals in the overlying water in the laboratory beakers relative to the SEA Ring exposure chambers. There was no significant difference between the SEA Ring and laboratory tests on the growth of the polychaete in the MS sediment exposure based on dry weight.. Comparability between the SEA Ring and laboratory tests for the bioaccumulation revealed no significant differences for any of the species tested.

Reproducibility

Reproducibility compared mean percent survival in two SEA Rings where identical tests were conducted. This was measured using the WC toxicity test with mysid and topsmelt at two Cu concentrations, the seawater control and 200 µg/L treatment. No statistically significant difference was found in comparisons between the mean percent survival obtained from the two SEA Rings.

Operational Factors

The SEA Ring was operated in the laboratory by the staff at SPAWAR, and also by a Battelle staff member. During a 4-hour period, the Battelle staff member was trained on use of the SEA Ring, including loading of organisms and measurement of water quality parameters. The Battelle staff member found the SEA Ring easy to operate, but noted that care must be taken when loading some species due to their small size. It should be noted that this is also the case with standard laboratory test methods. The SEA Ring was found to be easy to transport by one person. The waste obtained when operating the SEA Ring was minimal. No maintenance was required when the Battelle staff was onsite.

Section 8: References

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Appendix A:
Daily Work Sheets

Monday, November 05, 2012

Filter seawater 0.45µm into large carboy on incoming tide; put on air	

Tuesday, November 06, 2012

Clean all SEA Rings	JG
Filter seawater 0.45µm into large carboy on incoming tide; put on air	MC/RD
Check cold room temp - 18±1°C	RD
cut new tubing	RD

Wednesday, November 07, 2012

dishware	RD/MC
Clean all SEA Rings	JG
Check cold room temp - 18±1°C	RD 18°C
dispose of old samples	RD/MC

Thursday, November 08, 2012

Calibrate meters	MC/RD
Check in organisms - ~~Eoh,~~ macoma, ~~neanthes~~	MC/RD
Check cold room temp - 18±1°C	MC 18.2°C
Filter seawater 0.45µm into large carboy on incoming tide; put on air	
wipe down shelves in cold room	MC/RD

Friday, November 09, 2012

check in organisms - Eoh, neanthes	RD/MC
Calibrate meters	RD
Check on organisms in holding	RD
Check cold room temp - 18±1°C	18.2°C RD

Saturday, November 10, 2012

Calibrate meters	MC
Check on organisms in holding	MC
Check cold room temp - 18±1°C	MC 18.2°C

Sunday, November 11, 2012

Calibrate meters	MC
Check on organisms in holding	MC
Check cold room temp - 18±1°C	MC 18.1

Monday, November 12, 2012

Calibrate meters	MC
Check on organisms in holding, record in log book	MC
Check cold room temp - 18±1°C	MC 18.2

Tuesday, November 13, 2012

Calibrate meters	MC
Check on organisms in holding, record in log book	MC
Check cold room temp - 18±1°C	MC 18.1
Charge all SEA Rings	Jmg
Receive Trolls	MC
Filter seawater 0.45μm into large carboy on incoming tide; put on air	
Bioassay signs	

Wednesday, November 14, 2012

Perform SEA Ring Pump test	Jmg
Calibrate meters	RD
Check on organisms in holding	RD
Check cold room temp - 18±1°C	RD 18.2
Program SEA Rings - record programming data (~~WED~~ MC) THUR	
Program Trolls - record programming data / calibrate	GR/MC
~~Beakers into cold room~~ MC	
Prep airlines in cold room	MC
Finish SEA Ring assembly/Re-FULL charge	Jmg

Thursday, November 15, 2012

Calibrate meters	MC
Check on organisms in holding	RD
Check cold room temp - 18±1°C	MC 18.2
Distribute sediment to test chambers - beakers and SEA Ring chambers	GR/RD
Add 0.45μm FSW as overlying water to test chambers	MC/RD
Set up aeration - pipettes in beakers and airstones in chemtainers	RD/MC
Set up trolls	MC/GR
Filter seawater 0.45μm into large carboy on incoming tide; put on air	RD/MC
Program SEA Rings	GR/JG

Friday, November 16, 2012

① Calibrate meters		MC
② Check on organisms in holding		MC
③ Check cold room temp - 18±1°C		MC 18.2
⑥ Take water quality measurements on all test chambers		MC /RD
⑤ Set up Reference toxicant tests	Eoh	RD / GR
	Neanthes	RD / GR
⑦ Add organisms to SEA Rings and beakers	Eoh	RD/ GR/ MC
	Neanthes	RD /GR/ MC
	Macoma	RD/ GR/ MC
④ Collect Time 0 analytical samples as needed	Tissue	GR
	MC ~~Sediment~~	GR/RD 11/15/12
	Ammonia	MC
⑧ END OF DAY DATA QC		MC

Saturday, November 17, 2012

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 18.2
Take water quality measurements on all test chambers	MC
Check pumping on all SEA Rings / # lights / battery light	MC
Check aeration on all tests	MC
END OF DAY DATA QC	MC
Troll check	MC

Sunday, November 18, 2012

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 18.3
Take water quality measurements on all test chambers	MC
Check pumping on all SEA Rings	MC
Check aeration on all tests	MC
END OF DAY DATA QC	MC

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped Ⓐ with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
11/9/2012	1030	M. nasuta	110812Mn	–	good	7.64	7.3	18.3	34.2	N	34FSW	N	MC
11/10/2012	1145	M. nasuta	110812Mn	–	good	7.64	7.1	18.2	34.3	N	34FSW	N	MC
11/10/2012	1145	E. estuarius	110912Ee	–	good	7.79	7.4	18.2	34.1	N	34FSW	N	MC
11/10/2012	1145	N. arenaceodentata	110912Na	2w5d	good	7.63	7.3	18.3	32.2	N	–	N	MC
11/11/12	1445	Macoma	110812Mn	–	good	7.81	7.8	18.1	34.1	N	–	N	MC
11/11/12	1445	Ech	110912Ee	–	good	7.78	7.7	18.2	34.2	N	–	N	MC
11/11/12	1445	Neanthes	110912Na	2w6d	good	7.71	7.8	18.3	32.3	N	–	N	MC
11/12/12	1335	Macoma	110812Mn	–	good	7.82	7.4	18.4	34.2	N	–	N	MC
11/12/12	1335	Ech	110912Ee	–	good	7.71	7.6	18.3	34.4	N	–	N	MC
11/12/12	1335	Neanthes	110912Na	3wks	good	7.62	7.5	18.1	32.5	N	–	N	MC
11/13/12	0900	Macoma	110812Mn	–	good	7.63	7.0	18.6	34.5	Y	34FSW	N	MC
11/13/12	0900	Ech	110912Ee	-	good	7.90	7.7	18.4	34.2	Y	34FSW	N	MC
11/13/12	0900	Neanthes	110912Na	3w1d	good	7.76	7.5	18.1	32.7	Y	34FSW	N	MC
11/14/12	1500	Neanthes	110912Na	3w2d	good	7.79	7.6	18.1	32.5	N	~~34~~RD	N	RD
11/14/12	1500	Eoh	110912Ee	—	good	7.87	7.6	17.9	34.7	N	—	N	RD
11/14/12	1500	Macoma	110812Mn	—	good	7.52	6.7	18.2	35.0	N	—	N	RD
11/15/12	1451	Macoma	110812Mn	—	good (H)	7.45	6.5	17.8	34.9	N	–	N	RD
11/15/12	1451	Eoh	110912Ee	—	good	7.76	7.6	17.9	33.3	N	–	N	RD
11/15/12	1451	Neanthes	110912Na	3w3d	good	7.74	7.5	18.1	33.0	N	–	N	RD
11/16/12	0837	Macoma	110812Mn	–	good	7.38	6.2	17.6	35.2	N	–	N	MC
11/16/12	0837	Eoh	110912Ee	–	good	7.70	7.5	17.7	34.9	N	-	N	MC
11/16/12	0837	Neanthes	110912Na	3w4d	good	7.57	7.1	17.7	33.3	N	-	N	MC

Notes: Ⓐ FSW = 0.45 µm Filtered Seawater from Cold room

Cadmium Reference Toxicant Test for *Eohaustorius estuarius*

Stock solution: 1070 mg/L

Stock solution source: Nautilus Environmental

Verified?: Yes

Stock solution ID: ____________

Test Concentrations: 0, 1.25, 2.5, 5, 10, 20 mg/L

Test volume per replicate: 500 mL

No. replicates per concentration: 3

Diluent: filtered seawater (FSW) from SSC Cold Room (~33 psu)

Test Conc. (mg/L)	Stock (mL)	FSW (mL)	Total Vol (mL)	C1	V1	C2	V2
0	0.000	1500.0	1500	1070	**0.000**	0	1500
✓ 1.25	1.752	1498.2	1500	1070	**1.752**	1.25	1500
✓ 2.5	3.505	1496.5	1500	1070	**3.505**	2.5	1500
✓ 5	7.009	1493.0	1500	1070	**7.009**	5	1500
✓ 10	14.019	1486.0	1500	1070	**14.019**	10	1500
✓ 20	28.037	1472.0	1500	1070	**28.037**	20	1500
Total	54	8946	9000				

Copper Reference Toxicant Test for *Neanthes arenaceodentata*

Stock solution: 995.336 mg/L

Stock solution source: SSC Pacific

Verified?: Yes, by Brandon Swope (SSC Pacifici) by ICP-MS on 9/1/11

Test Concentrations: 0, 25, 50, 100, 200, 400 µg/L

Test volume per replicate: 500 mL

No. replicates per concentration: 3

Diluent: filtered seawater (FSW) from SSC Cold Room (~33 psu)

1) Create 250 mL of a 5 mg/L substock in filtered seawater (FSW)

✓	Cu Stock	1.256 mL	C1V1=C2V2
	FSW:	248.744 mL	995.336 (V1)= (5)(250 mL)
	Total Vol:	250 mL	V1=01.256 mL stock in 248.75 mL FSW

2) Create test solutions using 5 mg/L sub-stock as follows:

Test Conc. (µg/L)	Stock (mL)	FSW (mL)	Total Vol (mL)	C1	V1	C2	V2
0	0.0	1500.0	1500	5000	**0**	0	1500
✓ 25	7.5	1492.5	1500	5000	**7.5**	25	1500
✓ 50	15	1485	1500	5000	**15**	50	1500
✓ 100	30	1470	1500	5000	**30**	100	1500
✓ 200	60	1440	1500	5000	**60**	200	1500
✓ 400	120	1380	1500	5000	**120**	400	1500
Total	233	8768	9000				

QA Check: GR 11/16/12

QA Review: lll 11/16/2012

Total Ammonia Analysis
Marine Samples

Project ID: **NESDI SEAP - ETV**
Test Type: **Neanthes 28-day Marine Sediment Bioassay**

N x 1.22

Sample ID	Sample Date	Test Day	Nitrogen (mg/L)	Ammonia (mg/L)	Technician Initials
Blank Spike (10 mg/L NH_3)	NA	NA	9.5	MC 11.6	MC/RD
BlANK (0mg/L)	11/16/2012	MC ~~11/16~~ 0	0.0	0 ND	
SR1 - YB - Ech			0.8	0 98	
SR2 - YB - Poly			ND	ND	
SR2 - DB - Macoma			2.7	3.3	
SR3 - MS Poly			ND	ND	
SR3 - MS Ech			0.3	0.37	
SR4 - PSNS - Ech			ND	ND	
8R5 - PSNS - Poly			ND	ND	
SR5 - PSNS - Macoma			0.0	ND	
Beakers:					
Yaquina Bay			0.0	ND	
Discovery Bay			1.2	1.5	
MS			2.5	3.1	
PSNS			3.0	3.7	

QC Check: ______________________ **Final Review:** ____________

ETV Pump Rate Worksheet – 15 Nov 12

Amphipods: 11 day pump run time, go with 20 turnovers/day conservative, unless we think mini-charges in process will allow us to increase

Amphipod Tests: 11 days including this Thursday (Day -1) before org addition on Friday (Day 0)
1100 minutes (conservative) battery life
Equates to 100 minutes/day average flow rate
4.167 minutes/hr
10,000.8 ml/day
10 L/day
Amounts to **20 turnovers/day (500 ml overlying water per chamber)** under **1100 minute** battery life

Amphipod Tests: 11 days including this Thursday (Day -1) before org addition on Friday (Day 0)
1400 minutes (max) battery life
Equates to 127 minutes/day average flow rate
5.29 minutes/hr
12,676 mL/day
12.7 L day
Amounts to **25.4 turnovers/day (500 ml overlying water per chamber)** under **1400 minute** battery life

Clams/Polychaetes: 29 day pump run time, go with

Clam/Polychaete tests: 29 days including this Thursday (Day -1) before org addition on Friday (Day 0)
2750 minutes (2.5X normal battery life)
Equates to 95 min/day average flow rate
3.96 min/hr
396 mL/hr
9504 ml/day
9.5 L/day
Amounts to 19.0 turnovers/day

Clam/Polychaete tests: 29 days including this Thursday (Day -1) before org addition on Friday (Day 0)
4200 minutes (3X normal battery life)
Equates to 144.8 min/day average flow rate
6.03 min/hr
603 mL/hr
14,472 ml/day
14.47 L day
Amounts to 28.9 turnovers/day

1 minute on 13 min off = 4 min on/52 off = 103 min/day = 20.6 turnovers/day.

6 12

TEST ID	PROJECT	SAMPLE DATE	TEST INITIATION DATE	SAMPLE ID	TEST TYPE	SPECIES	MATRIX
NESDI SEAP - ETV Testing							
SSC-2012-0111	NESDI SEAP - ETV Testing (Sediment)	11/5/2012	16-Nov-12	Yaquina Bay - SEA Ring	10-d surv.	Ee	Sed
SSC-2012-0112	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	Yaquina Bay - SEA Ring	28-d surv. & grwth	Na	Sed
SSC-2012-0113	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	Discovery Bay - SEA Ring	28-d surv.	Mn	Sed
SSC-2012-0114	NESDI SEAP - ETV Testing (Sediment)	7/19/11	16-Nov-12	MS Sediment - SEA Ring	10-d surv.	Ee	Sed
SSC-2012-0115	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	MS Sediment - SEA Ring	28-d surv. & grwth	Na	Sed
SSC-2012-0116	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	PSNS Sediment - SEA Ring	10-d surv.	Ee	Sed
SSC-2012-0117	NESDI SEAP - ETV Testing (Sediment)	11/1/2012	16-Nov-12	PSNS Sediment - SEA Ring	28-d surv. & grwth	Na	Sed
SSC-2012-0118	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	PSNS Sediment - SEA Ring	28-d surv.	Mn	Sed
SSC-2012-0119	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	Yaquina Bay - Beaker	10-d surv.	Ee	Sed
SSC-2012-0120	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	Yaquina Bay - Beaker	28-d surv. & grwth	Na	Sed
SSC-2012-0121	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	Discovery Bay - Beaker	28-d surv.	Mn	Sed
SSC-2012-0122	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	MS Sediment - Beaker	10-d surv.	Ee	Sed
SSC-2012-0123	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	MS Sediment - Beaker	28-d surv. & grwth	Na	Sed
SSC-2012-0124	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	PSNS Sediment - Beaker	10-d surv.	Ee	Sed
SSC-2012-0125	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	PSNS Sediment - Beaker	28-d surv. & grwth	Na	Sed
SSC-2012-0126	NESDI SEAP - ETV Testing (Sediment)		16-Nov-12	PSNS Sediment - Beaker	28-d surv.	Mn	Sed
SSC-2012-0127	NESDI SEAP - ETV Testing (Sediment)	na	16-Nov-12	CuSo$_4$ Reference Toxicant	96-h surv.	Na	Cu
SSC-2012-0128	NESDI SEAP - ETV Testing (Sediment)	na	16-Nov-12	CdCl$_2$ Reference Toxicant	96-h surv.	Ee	Cd
SSC-2012-0129	NESDI SEAP - ETV Testing (Water)	na	3-Dec-12	CuSo$_4$ Reference Toxicant - SEA RING	96-h surv.	Ab	Cu
SSC-2012-0130	NESDI SEAP - ETV Testing (Water)	na	3-Dec-12	CuSo$_4$ Reference Toxicant	96-h surv.	Ab	Cu
SSC-2012-0131	NESDI SEAP - ETV Testing (Water)	na	3-Dec-12	CuSo$_4$ Reference Toxicant - SEA RING	96-h surv.	Aa	Cu
SSC-2012-0132	NESDI SEAP - ETV Testing (Water)	na	3-Dec-12	CuSo$_4$ Reference Toxicant	96-h surv.	Aa	Cu

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: CuSO₄ Reference Toxicant
Test No.: SSC-2012-0127

Test Species: *N. arenaceodentata*
Start Date/Time: 11/16/12 1335
End Date/Time: 11/20/12 1135

	Tech Initials				
	0	24	48	72	96
Counts:	GR	MC	MC	MC	MC
Readings:	RD	MC	MC	MC	MC
Dilutions made by:	GR	-	-	-	-

Concentration CuSO₄ (μg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control	A	10	10	10	10	10	33.9	34.1	34.5	34.6	34.6	18.0	25.0	18.3	18.1	179	7.7	7.5	7.3	7.5	7.4	792	7.83	7.91	7.87	7.84
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
25	A	10	10	10	10	10	34.2	34.2	34.5	34.6	34.6	18.2	17.9	18.1	17.9	17.8	7.7	7.5	7.4	7.5	7.3	795	792	7.94	7.94	791
	B	10	10	10	10	10																				
	C	10	10	10	10	9																				
50	A	10	10	10	10	10	34.2	34.2	34.5	34.6	34.5	15.3	179	18.0	17.9	178	7.7	7.5	7.4	7.5	74	7.94	7.92	7.94	794	791
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
100	A	10	10	10	10	10	34.3	34.2	34.5	34.6	34.7	15.3	17.9	179	17.8	17.7	7.7	7.5	7.4	7.5	7.5	7.94	792	7.94	794	7.91
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
200	A	10	10	10	5	2	34.3	34.3	34.6	34.6	34.6	15.3	179	17.8	17.8	17.7	7.8	7.5	7.5	7.4	7.5	7.94	790	7.94	792	7.91
	B	10	10	10	7	5																				
	C	10	10	10	5	1																				
400	A	10	1	0	-	-	343	34.3	34.5	-	-	18.2	17.8	17.8	-	-	7.8	7.5	7.5	-	-	7.92	7.90	7.94	-	-
	B	10	1	0	-	-																				
	C	10	1	0	-	-																				

Initial Counts QC'd by: MC

Animal Source/Date Received: Aquatic Toxicology Support

Age at Initiation: 3 wks 4 days

	Feeding Times				
	0	24	48	72	96
AM:					
PM:					

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one ([✓ y] / n)

Tests aerated? Circle one (y / n) if yes, sample ID(s): Duration:

Aeration source:

QC Check: MC 11/22/2012

Final Review:

NESDI SEAP - ETV

Configuration #5 - 28d Na & 28d Mn

Test # 5

SEA RING (SR) Info

Sea Ring ID	004 BatPak		
Battery Pack Present? Y/N	Y		
Troll Present? Y/N	Y	Reading frequency?	5 mins
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 10	Na -1	20	PSNS Sediment
~~2~~ 1	Na 2	20	PSNS Sediment
~~3~~ 2	Na 3	20	PSNS Sediment
~~4~~ 3	Na 4	20	PSNS Sediment
~~5~~ 4	Na 5	20	PSNS Sediment
~~6~~ 5	Mn -1	3	PSNS Sediment
~~7~~ 6	Mn - 2	3	PSNS Sediment
~~8~~ 7	Mn -3	3	PSNS Sediment
~~9~~ 8	Mn - 4	3	PSNS Sediment
~~10~~ 9	Mn -5	3	PSNS Sediment

JG

NESDI SEAP - ETV

Configuration #2 - 28d Na & 28d Mn

SEA RING (SR) Info

Sea Ring ID	002 BatPak	
Battery Pack Present? Y/N	Y	
Troll Present? Y/N	Y | Reading frequency?	5 min
Chamber Pumping Flush Duration (min)	1	
Chamber Pump Static Interval (min)	13	
	Start	End
Pump Voltage (V)	8.7	
Memory Usage (%)	0	
Survey Date (mm/dd/yy)	11-15-12	12-15-12
Survey Time (local)	1500	1000

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 10	Na - 1	20	Yaquina Bay
~~2~~ 1	Na - 2	20	Yaquina Bay
~~3~~ 2	Na - 3	20	Yaquina Bay
~~4~~ 3	Na - 4	20	Yaquina Bay
~~5~~ 4	Na - 5	20	Yaquina Bay
~~6~~ 5	Mn - 1	3	Discovery Bay
~~7~~ 6	Mn - 2	3	Discovery Bay
~~8~~ 7	Mn - 3	3	Discovery Bay
~~9~~ 8	Mn - 4	3	Discovery Bay
~~10~~ 9	Mn - 5	3	Discovery Bay

JG

NESDI SEAP - ETV

Configuration #1 - 10d Eoh

SEA RING (SR) Info

Sea Ring ID	008		
Battery Pack Present? Y/N	N		
Troll Present? Y/N	~~Y~~ N	Reading frequency?	—
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 5	Eoh -1	20	Yaquina Bay
~~2~~ 6	Eoh -2	20	Yaquina Bay
~~3~~ 7	Eoh -3	20	Yaquina Bay
~~4~~ 8	Eoh-4	20	Yaquina Bay
~~5~~ 9	Eoh -5	20	Yaquina Bay
~~6~~	-	-	-
~~7~~	-	-	-
~~8~~	-	-	-
~~9~~	-	-	-
~~10~~	-	-	-

JG

NESDI SEAP - ETV

Configuration #4 - 10d Eoh

SEA RING (SR) Info

Sea Ring ID	013		
Battery Pack Present? Y/N	N		
Troll Present? Y/N	N	Reading frequency?	—
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
1	PSNS - Eoh - 1	20	PSNS Sediment
2	PSNS Eoh - 2	20	PSNS Sediment
3	PSNS Eoh - 3	20	PSNS Sediment
4	PSNS Eoh - 4	20	PSNS Sediment
5	PSNS Eoh - 5	20	PSNS Sediment
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-
10	-	-	-

NESDI SEAP - ETV

Configuration #1 - 10d Eoh

SEA RING (SR) Info

Sea Ring ID	008	
Battery Pack Present? Y/N	N	
Troll Present? Y/N	~~Y~~ N	Reading frequency? —
Chamber Pumping Flush Duration (min)	1	
Chamber Pump Static Interval (min)	13	
	Start	End
Pump Voltage (V)	8.7	
Memory Usage (%)	0	
Survey Date (mm/dd/yy)	11-15-12	12-15-12
Survey Time (local)	1500	1000

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 5	Eoh - 1	20	Yaquina Bay
~~2~~ 6	Eoh - 2	20	Yaquina Bay
~~3~~ 7	Eoh - 3	20	Yaquina Bay
~~4~~ 8	Eoh - 4	20	Yaquina Bay
~~5~~ 9	Eoh - 5	20	Yaquina Bay
~~6~~	-	-	-
~~7~~	-	-	-
~~8~~	-	-	-
~~9~~	-	-	-
~~10~~	-	-	-

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NESDI SEAP - ETV

Configuration #2 - 28d Na & 28d Mn

SEA RING (SR) Info

Sea Ring ID	002 BatPak		
Battery Pack Present? Y/N	Y		
Troll Present? Y/N	Y	Reading frequency?	5 min
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 10	Na - 1	20	Yaquina Bay
~~2~~ 1	Na - 2	20	Yaquina Bay
~~3~~ 2	Na - 3	20	Yaquina Bay
~~4~~ 3	Na - 4	20	Yaquina Bay
~~5~~ 4	Na - 5	20	Yaquina Bay
~~6~~ 5	Mn - 1	3	Discovery Bay
~~7~~ 6	Mn - 2	3	Discovery Bay
~~8~~ 7	Mn - 3	3	Discovery Bay
~~9~~ 8	Mn - 4	3	Discovery Bay
~~10~~ 9	Mn - 5	3	Discovery Bay

JG

NESDI SEAP - ETV

Configuration #3 - 10d Eoh & 28d Na

Test # 3

SEA RING (SR) Info

Sea Ring ID	003 BatPak		
Battery Pack Present? Y/N	Y		
Troll Present? Y/N	Y	Reading frequency?	5 mins
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 5	MS-Eoh-1	20	MS Sediment
~~2~~ 6	Eoh -2	20	MS Sediment
~~3~~ 7	Eoh - 3	20	MS Sediment
~~4~~ 8	Eoh - 4	20	MS Sediment
~~5~~ 9	Eoh - 5	20	MS Sediment
~~6~~ 10	Na - 1	20	MS Sediment
~~7~~ 1	Na - 2	20	MS Sediment
~~8~~ 2	Na - 3	20	MS Sediment
~~9~~ 3	Na - 4	20	MS Sediment
~~10~~ 4	Na - 5	20	MS Sediment

JG

NESDI SEAP - ETV

Configuration #4 - 10d Eoh

SEA RING (SR) Info

Sea Ring ID	013		
Battery Pack Present? Y/N	N		
Troll Present? Y/N	N	Reading frequency?	—
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	
Data Download - End Program Date/Time			
SEA Ring Data Filename			
Troll Data Filename			

Test Chamber Info

Chamber #	Organism	#	Sediment Type
1	PSNS Eoh-1	20	PSNS Sediment
2	PSNS Eoh-2	20	PSNS Sediment
3	PSNS Eoh-3	20	PSNS Sediment
4	PSNS Eoh-4	20	PSNS Sediment
5	PSNS Eoh-5	20	PSNS Sediment
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-
10	-	-	-

NESDI SEAP - ETV

Configuration #5 - 28d Na & 28d Mn

Test # 5

SEA RING (SR) Info

Sea Ring ID	004 BatPaK		
Battery Pack Present? Y/N	Y		
Troll Present? Y/N	Y	Reading frequency?	5 mins
Chamber Pumping Flush Duration (min)	1		
Chamber Pump Static Interval (min)	13		
	Start	End	
Pump Voltage (V)	8.7		
Memory Usage (%)	0		
Survey Date (mm/dd/yy)	11-15-12	12-15-12	
Survey Time (local)	1500	1000	

Data Download - End Program Date/Time		
SEA Ring Data Filename		
Troll Data Filename		

Test Chamber Info

Chamber #	Organism	#	Sediment Type
~~1~~ 10	Na -1	20	PSNS Sediment
~~2~~ 1	Na 2	20	PSNS Sediment
~~3~~ 2	Na 3	20	PSNS Sediment
~~4~~ 3	Na 4	20	PSNS Sediment
~~5~~ 4	Na 5	20	PSNS Sediment
~~6~~ 5	Mn-1	3	PSNS Sediment
~~7~~ 6	Mn-2	3	PSNS Sediment
~~8~~ 7	Mn-3	3	PSNS Sediment
~~9~~ 8	Mn-4	3	PSNS Sediment
~~10~~ 9	Mn-5	3	PSNS Sediment

JG

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SR1 - YB Eoh

Test No.: SSC - 2012 - 0111

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments	
						Pumplight	Batterylight
0	34.6	17.7	7.7	7.67	MC	2x	Green
1	34.5	18.0	7.4	7.88	Mc	2x	Green
2	34.7	18.0	7 6	7.83	MC	2x	Green
3	34.7	17.7	7.6	7.81	MC	2x	Green
4	34.6	17.8	7.6	7.84	mc	2x	Green
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SI2 2 - 4B - Poly

Test No.: SSC - 2012 - 0112

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments	
								Pump light	Batt light
0	34.5	17.6	7.5	7.67	y		MC	2x	Green
1	34.5	17.9	7.2	7.86			MC	2x	Green
2	34.6	17.9	7.3	7.61			MC	2x	Green
3	34.6	17.7	7.3	7.77	y	y	MC	2x	Green
4	34.4	17.9	7.4	7.81			MC	2x	Green
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: S22 - DB - Macoma

Test No.: SSC - 2012 - 0113

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments	
							Pumplight	Bottlelight Lt
0	34.5	17.6	7.5	7.60		MC	2x	Green
1	34.5	17.8	6.4	7.81		MC	2x	Green
2	34.5	17.9	6.9	7.67		MC	2x	Green
3	34.6	17.7	6.5	7.72	X	MC	2x	Green
4	34.4	17.9	6.7	7.81		MC	2x	Green
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: 3R 3 MS- Poly

Test No.: SSC-2012-0115

Test Species: *N. arenaceodentata*

Start Date/Time: 4/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments Pumplight Batterylight
0	34.5	17.6	7.5	7.54	y		MC	2x Green
1	34 5	17.7	7.2	7.86			MC	2x Green
2	34.5	17.8	7.3	7.79			MC	2x Green
3	34.7	17.7	7.2	7.78	y	y	MC	2x Green
4	34.6	17 9	7.3	7.82			MC	2x Green
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QC Check:

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SR ~~5~~ 3 MC · MS · ~~Rely~~ MC Ech

Test No.: SSC - 2012 - 0114

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments	
						Pump light	Battery light
0	34 5	17.6	7.5	7 73	MC	2x	Green
1	34.6	17.7	7.0	7.80	MC	·2x	Green
2	34.7	17.8	7.1	7.70	MC	2x	Green
3	34.7	17.7	7.3	7.82	MC	2x	Green
4	34.5	17.9	7.5	7.81	MC	2x	Green
5							
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QC Check:

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: S2 ~~5~~ 4 mc - PSNS - ~~Pety~~ mc Ech

Test No.: SSC-2012-0116

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments	
						Pumplight	Battery Light
0	34.5	17.7	7.2	7.60	MC	2x	Green
1	34.6	17.7	7.3	7.50	MC	2x	Green
2	34.8	17.9	7.5	7.71	MC	2x	Green
3	34.7	17.7	7.4	7.85	MC	2x	Green
4	34.6	17.9	7.6	7.80	MC	2x	Green
5							
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP ETV

Sample ID: S25 - PSNS - Poly

Test No.: SSC-2012-0117

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments	
								Pumplight	Bottlelight
0	34.5	17.7	7.3	7.59	y		MC	2x	Green
1	34.5	17.7	7.3	7.84			MC	2x	Green
2	34.7	17.9	7.4	7.77			MC	2x	Green
3	34.6	17.7	7.4	7.85	y	y	MC	2x	Green
4	34.4	17.8	7.6	7.84			MC	2x	Green
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6									
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SRS - PSNS - Marina

Test No.: SSC-2012-0118

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments	
								Pump Light	B.tt Light
0	34.5	17.7	7.2	7.61	Y		MC	2x	Green
1	34.5	17.7	6.8	7.82			mc	2x	Green
2	34.7	17.7	7.1	7.77			MC	2x	Green
3	34.6	17.7	6.8	7.85	y	y	MC	2x	Green
4	34.5	17.8	6.9	7.80			MC	2x	Green
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QC Check:

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: Lab Control - Yaquina Bay

Test No.: SSC-2012-0119

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments
0	34.3	18.1	7.8	7.76	MC	
1	34.2	18.3	7.7	7.93	MC	
2	34.3	18.3	7.7	7.70	MC	
3	34.2	18.2	7.8	7.73	MC	
4	34.2	18.4	7.7	7.96	MC	
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: Lab Control - Yaquina Bay

Test No.: SSC-2012-0120

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	34.3	18.1	7.7	7.76	Y		MC	
1	34.2	18.1	7.7	7.98			MC	
2	34.4	18.1	7.7	7.80			MC	
3	34.4	18.0	7.8	7.82	Y	Y	MC	
4	34.6	18.1	7.7	7.96			MC	
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: Lab Control - Discovery Bay

Test No.: SSC-20120121

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	34.0	17.9	7.8	7.77		MC	
1	33.9	18.0	7.5	7.84		MC	
2	34.1	18.1	7.6	7.72		KIC	
3	34.1	18.0	7.6	7.68	Y	KIC	
4	34.4	18.0	7.5	7.86		MC	
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QC Check:

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: MS Sediment

Test No.: SSC-2012-0122

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments
0	34.3	18.0	6.5	7.51	MC	
1	34.2	18.2	6.9	7.70	MC	Eoh swimming @ surface, pushed down
2	34.3	18.2	7.0	7.49	MC	" "
3	34.2	18.1	7.6	7.74	MC	" "
4	34.2	18.1	7.6	7.99	MC	
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: MS Sediment

Test No.: SSC-2012-0123

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1520

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	34.3	18.0	7.6	751	y		MC	
1	34.2	18.0	75	7.71			MC	
2	34.2	18.1	7.4	7.73			MC	
3	34.2	17.9	7.5	7.71	y	y	MC	
4	34.4	18.0	7.5	7.89			MC	
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QC Check:

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: PSNS Sediment

Test No.: SSC-2012-0124

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments
0	34.4	17.9	7.7	7.80	MC	
1	34.2	18.1	7.6	7.99	MC	Ech swimming @ surface, pushed down
2	34.3	18.1	7.5	7.87	MC	" "
3	34.2	18.0	7.6	7.89	MC	" "
4	34.3	18.1	7.6	8.09	MC	
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: PSNS Sediment

Test No.: SSC-2012-0125

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	34.4	17.9	7.7	7.80	Y		MC	
1	34.3	18.0	7.6	7.99			MC	
2	34.3	18.0	7.6	7.90			MC	
3	34.1	17.9	7.7	7.93	y	y	MC	
4	34.5	18.0	7.6	8.01			MC	
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QC Check:

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV
Sample ID: PSNS Sediment
Test No.: SSC - 2012 - 0126

Test Species: *M. nasuta*
Start Date/Time: 6/10/2012 1520
End Date/Time:

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	34.4	17.9	7.7	7.80		MC	
1	34.2	18.0	7.1	7.80		MC	
2	34.3	18.0	68	7.64		MC	
3	34.2	17.9	7.2	7.70	y	MC	1 dead pulled from Drop
4	34.4	17.9	7.4	7.82		MC	
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QC Check:

Final Review:

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV **Test Species:** *E. estuarius*

Sample ID: lab Beakers → Yaquina Bay, MS & PSNS **Start Date/Time:** 11/16/2012 1500

Test No.: SSC-2012- 0119, 0122, 0124 **End Date/Time:** 11/26/2012 0930

Sample ID	Initial No.	No. Recovered	Technician Initials	
Yaquina Bay - A	20	19	MC / RD	
" B	20	20	MC / AC	
" C	20	19	MC/RD	
" D	20	17	MC/RD	
" E	20	19	MC/RD	
MS Sediment A	20	17	MC / RD	
" B	20	18	MC/RD	
" C	20	19	MC/RD	1 dead body
" D	20	19	MC/AC	
" E	20	17	MC/AC	1 dead body
PSNS Sediment A	20	16	MC/AC	
" B	20	14	MC/AC	3 dead bodies
" C	20	16	MC/AC	2 dead bodies
" D	20	13	MC/AC	
" E	20	17	MC/AC	1 dead body

QC Check: Mc 11/26/2012 **Final Review:** ____________

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV

Test Species: *E. estuarius*

Sample ID: SEA Rings → SR1, 3 & 4 (Yaquina, MS & PSNS)

Start Date/Time: 11/16/2012 1500

Test No.: SSC-2012 - 0111, 0114, 0116

End Date/Time: 11/26/2012 0930

Sample ID	Initial No.	No. Recovered	Technician Initials	
SR4-PSNS-Ecn MC ~~SR1-4B-Ecn~~ A(1)	20	16	MC/AC	1 dead body
B(2)	20	15	MC/AC	1 dead body
C(3)	20	15	MC/AC/RD	2 dead bodies
D(4)	20	16	MC/AC/RD	
E(5)	20	17	MC/AC/RD	
SR3-MS Ecn A(1)	20	17	MC/RD	
B(2)	20	19	MC/RD	
C(3)	20	16	MC/RD	2 dead bodies
D(4)	20	17	MC/RD	1 dead body
E(5)	20	17	MC/RD	2 dead bodies
SR1-4B Ecn ~~SR4-PSNS-Ecn~~ A(1)	20	20	MC/RD	
B(2)	20	17	MC/AC	2 dead bodies
C(3)	20	20	MC/RD	
D(4)	20	19	MC/RD	1 dead body
E(5)	20	20	MC/RD	

QC Check: MC 11/26/2012 **Final Review:** ____________

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: Lab Control - Yaquina Bay

Test No.: SSC-2012-0119

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time: 11/26/2012 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments
0	34.3	18.1	7.8	7.76	MC	
1	34.2	18.3	7.7	7.93	MC	
2	34.3	18.3	7.7	7.70	MC	
3	34.2	18.2	7.8	7.73	MC	
4	34.2	18.4	7.7	7.96	MC	
5	33.8	18.1	7.7	7.84	RD	
6	33.8	18.6	7.7	7.91	RD	
7	32.4	18.0	7.7	7.97	RD/GR	Rep A,B,&E water renewal
8	33.8	18.1	7.7	7.96	RD	
9	33.9	18.2	7.6	7.96	RD	
10	34.1	18.4	7.7	7.99	MC	

QC Check: MC 11/27/2012

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: MS Sediment

Test No.: SSC-2012-0122

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time: 11/26/2012 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments
0	34.3	18.0	6.5	7.51	MC	
1	34.2	18.2	6.9	7.70	MC	Eoh swimming @ surface, pushed down
2	34.3	18.2	7.0	7.49	MC	" "
3	34.2	18.1	7.6	7.74	MC	" "
4	34.2	18.1	7.6	7.99	MC	" "
5	33.8	18.0	7.5	7.89	RD	" "
6	33.7	18.0	7.5	7.94	RD	" "
7	33.7	18.0	7.4	7.75	RD	
8	33.6	18.0	7.4	7.89	RD	
9	33.6	18.1	7.5	7.95	RD	
10	33.8	18.0	7.5	7.87	MC	

QC Check: MC 11/27/2012

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Test Species: *E. estuarius*

Sample ID: PSNS Sediment

Start Date/Time: 11/16/2012 1500

Test No.: SSC-2012-0124

End Date/Time: 11/26/2012 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments
0	34.4	17.9	7.7	7.80	MC	
1	34.2	18.1	7.6	7.99	MC	Ech swimming @ surface, pushed down
2	34.3	18.1	7.5	7.87	MC	" "
3	34.2	18.0	7.6	7.89	MC	" "
4	34.3	18.1	7.6	8.09	MC	
5	33.9	18.0	7.6	7.98	RD	Eoh swimming @ surface pushed down
6	33.9	17.9	7.6	8.03	RD	" "
7	33.7	18.0	7.6	7.89	RD	" "
8	33.7	17.9	7.5	8.06	RD	
9	33.8	17.9	7.6	8.10	RD	
10	33.8	18.0	7.6	8.07	MC	

QC Check: DJe 11/27/2012

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Test Species: *E. estuarius*

Sample ID: 5121 - YB Ech

Start Date/Time: 11/16/2012 1500

Test No.: SSC-2012-0111

End Date/Time: 11/26/2012 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments	
						Pump light	Battery light
0	34.6	17.7	7.7	7.67	MC	2x	Green
1	34.5	18.0	7.4	7.88	MC	2x	Green
2	34.7	18.0	7.6	7.83	MC	2x	Green
3	34.7	17.7	7.6	7.81	MC	2x	Green
4	34.6	17.8	7.6	7.84	MC	2x	Green
5	34.5	17.6	7.5	7.87	RO	2x	No light*
6	34.4	17.7	7.5	7.74	RD	2x	Red
7	34.4	17.7	7.5	7.80	Rb	2x	green
8	34.3	17.6	7.5	7.93	RP	2x	green
9	34.3	17.7	7.4	7.81	RP	2x	no light*
10	34.5	17.8	7.4	7.87	MC	2x	Red

QC Check: MC 11/27/2012

Final Review:

* SR programming checked - bath OK

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SR~~5~~3 MC - MS - ~~Rety~~ MC Ech

Test No.: SSC - 2012 - 0114

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time: 11/26/2012 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments	
						Pumplight	Battery light
0	34.5	17.6	7.5	7.73	MC	2x	Green
1	34.6	17.7	7.0	7.80	MC	2x	Green
2	34.7	17.8	7.1	7.70	MC	2x	Green
3	34.7	17.7	7.3	7.82	MC	2x	Green
4	34.5	17.9	7.5	7.81	MC	2x	Green
5	34.2	17.5	7.4	7.92	RD	2x	Green
6	34.3	17.5	7.4	7.87	RD	2x	green
7	34.2	17.5	7.3	7.79	RD	2x	green
8	34.2	17.6	7.4	7.95	RD	2x	green
9	34.3	17.6	6.5	7.68	RD	2x	green
10	34.4	17.6	7.4	7.94	MC	2x	green

QC Check: MC 11/27/2012

Final Review:

10-Day Marine Sediment Bioassay
Static Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SR ~~5~~ 4 MC - PSNS - ~~Pcty~~ MC Ech

Test No.: SSC-2012-0116

Test Species: *E. estuarius*

Start Date/Time: 11/16/2012 1500

End Date/Time: 11/26/2012 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Technician Initials	Comments	
						Pumplight	Battery Light
0	34.5	17.7	7.2	7.66	MC	2x	Green
1	34.6	17.7	7.3	7.80	MC	2x	Green
2	34.8	17.9	7.5	7.71	MC	2x	Green
3	34.7	17.7	7.4	7.85	MC	2x	Green
4	34.6	17.9	7.6	7.80	MC	2x	Green
5	34.3	17.6	7.3	7.89	RD	2x	Green
6	34.3	17.6	7.4	7.86	RD	2x	green
7 *	34.5	17.6	7.4	7.76	RD	2x	no light Ⓐ
8	34.2	17.6	7.6	7.97	RD	2x	green
9	34.2	17.5	7.5	7.85	RD	2x	green
10	34.4	17.6	7.4	7.94	MC	2x	green

QC Check: MC 11/27/2012

Final Review:

* water renewal + batt charge

Ⓐ SR programming checked - batt OK, but changed just in case

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: $CdCl_2$ Reference Toxicant
Test No.: SSC-2012-0128

Test Species: *E. estuarius*
Start Date/Time: 11/16/2012 1300
End Date/Time: 11/20/2012 1100

Tech Initials	0	24	48	72	96
Counts:	MC	MC	MC	MC	MC
Readings:	RD	MC	MC	MC	MC
Dilutions made by:	GR	-	-	-	-

Concentration $CdCl_2$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control	A	10	10	10	10	10	34.6	34.4	34.5	34.5	34.5	18.1	17.9	17.9	17.8	18.3	7.8	7.1	7.3	7.4	7.2	7.92	7.83	7.63	7.64	7.8
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
1.25	A	10	10	10	10	10	34.5	34.4	34.6	34.6	34.4	18.3	17.8	17.8	17.8	18.0	7.7	7.2	7.3	7.4	7.2	7.95	7.88	7.72	7.71	7.92
	B	10	10	10	10	9																				
	C	10	10	10	10	10																				
2.5	A	10	10	10	10	10	34.4	34.4	34.6	34.5	34.5	18.4	17.8	17.7	17.8	18.0	7.7	7.3	7.4	7.3	7.4	7.95	7.88	7.74	7.71	7.92
	B	10	10	10	10	10																				
	C	10	10	10	10	9																				
5	A	10	10	10	9	5	34.3	34.3	34.5	34.5	34.4	18.3	17.8	17.7	17.8	17.9	7.7	7.3	7.5	7.4	7.4	7.95	7.88	7.76	7.73	7.92
	B	10	10	10	9	8																				
	C	10	10	10	9	7																				
10	A	10	10	10	9	9	34.2	34.1	34.3	34.3	34.2	18.2	17.8	17.7	17.7	17.8	7.7	7.2	7.4	7.4	7.4	7.94	7.86	7.76	7.73	7.91
	B	10	10	10	8	4																				
	C	10	10	10	8	4																				
20	A	10	7	5	2	0	33.8	33.8	34.0	33.9	33.9	18.1	17.8	17.7	17.7	17.8	7.7	7.2	7.3	7.2	7.4	7.94	7.86	7.76	7.71	7.91
	B	10	9	7	6	1																				
	C	10	9	9	8	1																				

Initial Counts QC'd by: RD

Animal Source/Date Received: NWA 11/9/2012

Size at Initiation: 3-5 mm

Feeding Times	0	24	48	72	96
AM:					
PM:					

Comments:
i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one (y / [✓ n])
Tests aerated? Circle one (y / [✓ n]) if yes, sample ID(s): Duration:
Aeration source:

QC Check: MC 11/26/2012

Final Review:

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: CuSO4 Ref Tox.
Test No.: SSC - 2012 - 0132

Test Species: *A. affinis* - FISH
Start Date/Time: 12/3/2012 1140
End Date/Time: 12/7/2012 0945

	Tech Initials				
	0	24	48	72	96
Counts:	RD/AC	–	MC	–	GR
Readings:	MC	MC	RD	JNG	RD
Dilutions made by:	GR/AC/MC		GR		

Concentration CuSO4 (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control - 0	A	5		5		5	34.0	33.7	i 33.9	33.5	33.9	18.0	17.8	i 17.9	17.6	17.7	7.8	7.8	i 7.7	7.4	7.2	7.87	7.73	i 7.53	7.82	7.83
	B	5		5		5			f 33.7					f 17.7					f 7.2					f 7.66		
	C	5		5		5																				
	D	5		5		5																				
	E	5		5		5																				
50	A	5		5		5	34.0	34.0	i 33.9	33.8	340	18.0	17.7	i 17.9	17.5	17.5	7.7	7.5	i 7.5	7.5	7.2	7.84	7.75	i 7.71	7.84	7.85
	B	5		5		5			f 33.8					f 17.6					f 7.4					f 7.68		
	C	5		5		5																				
	D	5		5		5																				
	E	5		5		5																				
100	A	5		5		5	33.9	33.9	i 33.9	33.8	340	18.0	17.6	i 17.7	17.6	17.5	7.7	7.5	i 7.8	7.5	7.2	7.89	7.75	i 7.75	7.86	7.85
	B	5		5		5			f 33.9					f 17.7					f 7.3					f 7.67		
	C	5		5		5																				
	D	5		5		4																				
	E	5		5		5																				
200	A	5		5		5	34.0	33.8	i 33.9	33.8	340	18.0	17.6	i 17.7	17.5	17.5	7.7	7.5	i 7.8	7.5	7.3	7.85	7.75	i 7.72	7.86	7.85
	B	5		5		5			f 33.7					f 17.7					f 7.4					f 7.62		
	C	5		5		4																				
	D	5		5		4																				
	E	5		5		4																				
400	A	5		0		0	34.0	33.9	i 33.9	33.8	340	18.0	17.6	i 18.0	17.6	17.5	7.8	7.6	i 7.8	7.5	7.3	7.85	7.75	i 7.68	7.84	7.85
	B	5		0		0			f 33.7					f 17.7					f 7.4					f 7.63		
	C	5		2		1																				
	D	5		1		1																				
	E	5		1		1																				
800	A	5		0		0	34.0	33.9	i 33.9			18.0	17.6	i 17.9	·		7.8	7.6	i 7.8			7.83	7.75	i 7.71		
	B	5		0		0			f 33.6					f 17.7					f 7.4					f 7.69		
	C	5		0		0																				
	D	5		0		0																				
	E	5		0		0																				

Initial Counts
QC'd by: MC

Animal Source/Date Received: Aquatic Biosystems 11/30/2012

Age at Initiation: 12 days

	Feeding Times				
	0	24	48	72	96
AM:		1030	0815	0945	0900
PM:	1245	1530	1400	1340	/

Comments:
i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one [✓ y] / n)
Tests aerated? Circle one (y / n) if yes, sample ID(s): Duration:

QC Check: MC 12/10/2012

Final Review:

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: CuSO4 Ref Tox
Test No.: SSC-2012-0130

Test Species: *A. bahia* - MYSID
Start Date/Time: 12/3/2012 1140
End Date/Time: 12/7/2012 0945

	Tech Initials				
	0	24	48	72	96
Counts:	MC	–	MC	–	MC
Readings:	MC	MC	ED	JMG	RD
Dilutions made by:	GR/AC MC		GR		

Concentration CuSO$_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control - 0	A	10		10		10	34.0	33.9	i 33.9	33.4	34.1	18.0	18.0	i 17.9	17.8	17.6	7.8	7.5	i 7.7	7.4	7.1	7.87	7.78	i 7.83	7.83	7.77
	B	10		10		10			f 33.9					f 17.7					f 6.8					f 7.62		
	C	10		9		9																				
	D	10		10		9																				
	E	10		10		10																				
50	A	10		10		9	34.0	34.0	i 33.9	33.7	34.1	18.0	17.8	i 17.9	17.6	17.5	7.7	7.6	i 7.5	7.5	7.1	7.86	7.81	i 7.71	7.8	7.79
	B	10		10		9			f 33.8					f 17.6					f 7.3					f 7.55		
	C	10		10		10																				
	D	10		8		3																				
	E	10		10		9																				
100	A	10		10		9	33.9	34.0	i 33.9	33.8	34.1	18.0	17.7	i 17.7	17.5	17.5	7.7	7.6	i 7.8	7.6	7.2	7.85	7.81	i 7.75	7.87	7.81
	B	10		10		8			f 33.8					f 17.6					f 7.3					f 7.63		
	C	10		10		8																				
	D	10		10		9																				
	E	10		10		8																				
200	A	10		9		2	34.0	34.0	i 33.9	33.8	34.1	18.0	17.7	i 17.7	17.5	17.6	7.7	7.9	i 7.8	7.5	7.3	7.85	7.81	i 7.72	7.81	7.83
	B	10		7		3			f 33.8					f 17.6					f 7.5					f 7.65		
	C	10		10		0																				
	D	10		7		0																				
	E	10		6		2																				
400	A	10		8		0	34.0	34.0	i 33.9	33.8	34.1	18.0	17.7	i 18.0	17.5	17.6	7.8	7.6	i 7.8	7.6	7.5	7.85	7.81	i 7.68	7.85	7.83
	B	10		7		0			f 33.8					f 17.6					f 7.4					f 7.64		
	C	10		8		0																				
	D	10		8		0																				
	E	10		7		1																				
800	A	10		7		1	34.0	34.1	i 33.9	33.8	34.1	18.0	17.7	i 17.9	17.6	17.6	7.8	7.6	i 7.8	7.6	7.5	7.83	7.81	i 7.71	7.85	7.83
	B	10		~~9~~ 7		1			f 33.9					f 17.7					f 7.6					f 7.62		
	C	10		6		0																				
	D	10		6		0																				
	E	10		7		0																				

Initial Counts QC'd by: AC

Animal Source/Date Received: Aquatic Biosystems 11/30/2012
Age at Initiation: 5 days

	Feeding Times				
	0	24	48	72	96
AM:		1030	0830	0945	0900
PM:	1245	1530	1400	1340	-

Comments:
i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one ([✓ y] / n)
Tests aerated? Circle one (y / n) if yes, sample ID(s): Duration:

QC Check: MC 12/10/2012

Final Review:

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: SEA Ring Exposures
Test No.: SSC-2012-0129

Test Species: *A. bahia*
Start Date/Time: 12/3/2012 1235
End Date/Time: 12/7/2012 1035

	Tech Initials				
	0	24	48	72	96
Counts:	MC	--	~~MC~~	--	mc [illegible]
Readings:	MC	MC	RD	[illegible]	RD
Dilutions made by:	ER/AC		GR		

Concentration CuSO$_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
SEA Ring A 0µg/L	A	10				9	34.0	337	i 339	34.1	345	18.0	17.5	i 17.9	17.6	17.3	7.8	7.8	i 7.7	7.6	7.6	7.87	7.64	i 7.83	7.16	7.88
	B	10			6	5 AC			f 337					f 17.5					f 7.6					f 7.75		
	C	10				10																				
	D	10				10																				
	E	10				6																				
SEA Ring B 0µg/L	A	10				7	34.0	338	i 339	34.2	34.1	18.0	17.6	i 17.9	17.5	17.3	7.5	7.8	i 7.7	7.4	7.7	7.87	7.69	i 7.83	7.75	7.84
	B	10				9			f 339					f 17.5					f 7.5					f 7.75		
	C	10				10																				
	D	10				8																				
	E	10				6																				
SEA Ring — 100µg/L	A	10				8	339	34.0	i 33.9	34.1	34.5	18.0	17.9	i 17.7	17.5	17.5	7.7	7.7	i 7.8	7.6	7.6	7.81	7.71	i 7.75	7.92	7.83
	B	10				8			f 338					f 17.6					f 7.5					f 7.77		
	C	10				7																				
	D	10				9																				
	E	10				8																				
SEA Ring A 200µg/L	A	10				3	34.0	339	i 339	33.9	34.4	18.0	17.5	i 17.7	17.6	17.2	7.7	7.8	i 7.8	7.6	7.3	7.85	7.74	i 7.72	7.78	7.88
	B	10				2			f 34.0					f 17.4					f 7.8					f 7.80		
	C	10				3																				
	D	10				2																				
	E	10				4																				
SEA Ring B 200µg/L	A	10				3	34.0	34.0	i 339	34.1	34.4	18.0	17.6	i 17.7	17.4	17.4	7.7	7.8	i 7.8	7.6	7.8	7.85	7.71	i 7.72	7.82	7.82
	B	10				Ⓐ			f 339					f 17.5					f 7.6					f 7.77		
	C	10				2																				
	D	10				2																				
	E	10				5																				
SEA Ring — 400µg/L	A	10				0	34.0	34.2	i 34.1	34.0	34.7	18.0	17.8	i 18.0	17.6	17.6	7.8	7.8	i 7.8	7.6	7.6	7.83	7.75	i 7.63	7.46	7.85
	B	10				0			f 339					f 17.6					f 7.7					f 7.78		
	C	10				0																				
	D	10				0																				
	E	10				2																				

Initial Counts QC'd by: AC

Animal Source/Date Received: Aquatic Biosystems 11/30/2012 **Age at Initiation:** 5 days

	Feeding Times				
	0	24	48	72	96
AM:		1030	0815	0945	0900
PM:	1245	1530	1400	1440	—

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one ([✓ y] / n)

Tests aerated? Circle one (y / [✓ n]) if yes, sample ID(s): Duration:

QC Check: MC 12/10/2012

Ⓐ replicate lost, tech error

Final Review:

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: SEA Ring Exposures
Test No.: SSC-2012-0131

Test Species: *A. affinis*
Start Date/Time: 12/3/2012 1235
End Date/Time: 12/7/2012 1035

	Tech Initials				
	0	24	48	72	96
Counts:	RD/ AC	—	~~RD~~	—	MC/ AC/GR
Readings:	MC	MC	RD	JG	RD
Dilutions made by:	GR/ AC		GR		

Concentration CuSO₄ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
SEA Ring A 0µg/L	A	5				5	34.0	33.7	i33.9	34.1	34.5	15.6	17.5	i17.7	17.4	17.3	7.8	7.8	i7.7	7.6	7.6	7.37	7.64	i[illegible]	7.76	7.88
	B	5				4			f33.7					f17.5					f7.6					f7.75		
	C	5				4																				
	D	5				4																				
	E	5				5																				
SEA Ring B 0µg/L	A	5				4	34.0	33.8	i33.9	34.0	34.1	15.6	17.6	i17.9	17.5	17.3	7.8	7.8	i7.7	7.4	7.7	7.37	7.69	i[illegible]	7.75	7.84
	B	5				5			f33.9					f17.5					f7.5					f7.75		
	C	5				3																				
	D	5				4																				
	E	5				4																				
SEA Ring — 100µg/L	A	5				4	33.9	34.0	33.9	34.1	34.5	15.6	17.9	17.7	17.5	17.5	7.7	7.7	7.8	7.6	7.6	7.39	7.71	7.75	7.90	7.83
	B	5				3			33.8					17.6					7.5					7.77		
	C	5				1Ⓐ																				
	D	5				3																				
	E	5				5																				
SEA Ring A 200µg/L	A	5				0	34.0	33.9	i33.9	33.9	34.4	15.0	17.5	i17.7	17.6	17.2	7.7	7.8	i7.8	7.6	7.3	7.55	7.70	i7.72	7.78	7.88
	B	5				3			f34.0					f17.4					f7.8					f7.80		
	C	5				3																				
	D	5				2																				
	E	5				1																				
SEA Ring B 200µg/L	A	5				2	34.0	34.0	i33.9	34.1	34.4	15.0	17.6	i17.7	17.4	17.4	7.7	7.8	i7.5	7.6	7.8	7.35	7.71	i[illegible]	7.82	7.82
	B	5				4			f33.9					f17.5					f7.6					f7.77		
	C	5				2																				
	D	5				4																				
	E	5				1																				
SEA Ring — 400µg/L	A	5				0	34.0	34.2	i33.9	34.0	34.3	15.0	17.8	i18.0	17.6	17.6	7.8	7.8	i7.8	7.6	7.6	7.53	7.75	i7.68	7.46	7.85
	B	5				0			f33.9					f17.6					f7.7					f7.78		
	C	5				0																				
	D	5				0																				
	E	5				0																				

Initial Counts QC'd by: MC

Animal Source/Date Received: Aquatic Biosystems 11/30/2012 **Age at Initiation:** 12 days

	Feeding Times				
	0	24	48	72	96
AM:		1030	1315	0745	0700
PM:	1245	1530	1400	1340	—

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one ([✓ y] / n)

Tests aerated? Circle one (y / [✓ n]) if yes, sample ID(s): Duration:

QC Check: LLe 12/10/2012

Final Review:

Ⓐ 3 dead Aa found

ORGANISM ARRIVAL LOG

Date Received	Received From	Species	Batch ID	Project	Age when shipped	Number Ordered	Organism Condition (e.g. number dead)	Initial Water Quality				Dripped with	Analyst Initials
								pH	D.O.	Temp.	Salinity		
07/18/12	Brezina	Nephrys MB ~~Nephtys~~ ~~Neanthes~~	071812Ne	NAVFAC Fish Co	1 day	~~60~~ MB 125	good	7.52	30	17.4	33.5	33 psu	BN
07/18/12	Va Institute	C. virginica	071812Cv	NAVFAC Fish Co	1 day	60	good	—	—	—	—	33 psu	MB
07/18/12	Carlsbad	M. gallo	071812Mg	NAVFAC Fish Co	1 day	Bioassay batch	good	—	—	—	—	33 psu	MB
9/25/12	ABS	A. bahia	092512Ab	PSNS/PVA	3 days	960	GOOD	7.23	12.4	24.0	27.9	30 ART	MC
9/11/12	AMEC	S. purpuratus	091112Sp	PSNS	-	1 batch	good	-	-	-	-	[illegible]	MC
10/4/12	AMEC	S. purpuratus	100412Sp	[illegible]	-	1 batch	good	-	-	-	-	-	MC
11/8/12	Reed Gunstone	M. nasuta	110812Mn	NESDI SEAP ETV	-	~110 clams	Good - 1 dead	-	-	-	-	34 FSW	MC/RD
11/9/12	Yves Nakashima Ⓐ	E. esturaius	110912Ee	NESDISEAPETV	3.5mm	1012+1090	Good-8 dead	—	—	13.1	—	34 FSW	MC/RD
11/9/12	ATS	Neanthes	110912Na	NESDISEAPETV	emerge 10/22/12	900	good	7.15	6.78	20.0	25.8	34 FSW	MC/RD
11/30/12	ABS	A affinis	113012Aa#1	NESDISEAP ETV	8 days	575	good - 19 dead	7.37	10.6	19.3	28.4	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab#1	NESDISEAPETV	1 day	575	good	7.49	12.5	19.3	27.8	34 FSW	MC
11/30/12	ABS	A affinis	113012Aa#2	PVA	10 days	800	good - 38 dead	7.29	10.1	19.3	28.0	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab#2	PVA	1 day	1100	good	7.49	12.5	19.3	27.2	34 FSW	MC

Ⓐ Northwest Aquatic

Species

A.a. - Atherinops affinis	**R.a.**- Rhepoxinius abronius
A.b.- Americamysis bahia	**S.p.** - Strongylocentrotus purpuratus
C.g. - Crassostrea gigas	**E.e.** - Eohaustorius esturaius
C.h. - Ceratocorys horrida	**M.b.** - Menidia beryllina
M.g. - Mytilus galloprovincialis	**Other**: Mn - Macoma nasuta

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped Ⓐ with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
11/9/2012	1030	M. nasuta	110312Mn	–	good	7.64	7.3	15.3	34.2	N	34FSW	N	MC
11/10/2012	1145	M. nasuta	110812Mn	–	good	7.64	7.1	15.2	34.3	N	34FSW	N	MC
11/10/2012	1145	E estuarius	110912Ee	–	good	7.79	7.4	18.2	34.1	N	34FSW	N	MC
11/10/2012	1145	N arenaceodentata	110912Na	2w5d	good	7.63	7.3	18.3	32.2	N	-	N	MC
11/11/12	1445	Macoma	110812Mn	–	good	7.81	7.8	18.1	34.1	N	-	N	MC
11/11/12	1445	Eeh	110912Ee	-	good	7.78	7.7	18.2	34.2	N	-	N	MC
11/11/12	1445	Neanthes	110912Na	2w6d	good	7.71	7.8	18.3	32.3	N	-	N	MC
11/12/12	1335	Macoma	110812Mn	-	good	7.82	7.4	18.4	34.2	N	-	N	MC
11/12/12	1335	Eeh	110912Ee	-	good	7.71	7.6	18.3	34.4	N	-	N	MC
11/12/12	1335	Neanthes	110912Na	3wks	good	7.62	7.5	18.1	32.5	N	-	N	MC
11/13/12	0900	Macoma	110812Mn	-	good	7.63	7.0	18.6	34.5	Y	34FSW	N	MC
11/13/12	0900	Eeh	110912Ee	-	good	7.90	7.7	18.4	34.2	Y	34FSW	N	MC
11/13/12	0900	Neanthes	110912Na	3w1d	good	7.76	7.5	18.1	32.7	Y	34FSW	N	MC
11/14/12	1500	Neanthes	110912Na	3w2d	good	7.79	7.6	18.1	32.5	N	RD	N	RD
11/14/12	1500	Eoh	110912Ee	—	good	7.87	7.6	17.9	34.7	N	—	N	RD
11/14/12	1500	Macoma	110812Mn	—	good	7.52	6.7	18.2	35.0	N	—	N	RD
11/15/12	1451	Macoma	110812Mn	—	good (1)	7.45	6.5	17.8	34.9	N	-	N	RD
11/15/12	1451	Eoh	110912Ee	—	good	7.76	7.6	17.9	33.3	N	-	N	RD
11/15/12	1451	Neanthes	110912Na	3w3d	good	7.74	7.5	18.1	33.0	N	-	N	RD
11/16/12	0837	Macoma	110812Mn	-	good	7.38	6.2	17.6	35.2	N	-	N	MC
11/16/12	0837	Eoh	110912Ee	-	good	7.70	7.5	17.7	34.9	N	-	N	MC
11/16/12	0837	Neanthes	110912Na	3w4d	good	7.57	7.1	17.7	33.3	N	-	N	MC

Notes: Ⓐ FSW = 0.45 µm Filtered Seawater from Cold room

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
12/1/12	1000	A. affinis	113012Aa #1	10	good 15d	7.73	7.1	18.5	30.0	y	34FSW	y	MC
12/1/12	1000	↓	113012Aa #2(1)	12	good 10d	7.71	6.8	18.6	30.8	y	↓	y	↓
12/1/12	1000	↓	113012Aa #2(2)	12	good 11d	7.71	6.9	18.7	30.5	y		y	
12/1/12	1000	A. bahia	113012Ab #1	~~2~~ 3	good	7.93	7.4	19.0	30.1	y		y	
12/1/12	1000	↓	113012Ab #2(1)	MC ~~2~~ 3	good	8.08	7.5	18.9	30.2	y		y	
12/1/12	1000	↓	113012Ab #2(2)	~~2~~ 3	good	8.01	7.3	18.7	30.1	y		y	
12/2/12	1015	A. affinis	113012Aa #1	11	good	7.81	7.0	18.6	32.1	y	34FSW	y	MC
↓	↓	↓	113012Aa #2(1)	13	good -15d	7.82	7.1	18.6	32.3	↓	↓	↓	↓
		↓	113012Aa #2(2)	13	good -20d	7.91	6.8	18.7	32.3				
		A. bahia	113012Ab #1	~~3~~ 4	good -12d	7.94	7.4	18.6	32.4				
		↓	113012Ab #2(1)	MC ~~3~~ 4	good	7.97	7.5	18.8	32.4				
		↓	113012Ab #2(2)	~~3~~ 4	good	7.96	7.5	18.8	32.1				
12/3/12	1030	A. affinis	113012Aa #1	12	good -5d	7.59	6.8	17.8	33.3	y	34FSW	y	MC
↓	↓	↓	113012Aa #2(1)	14	good -6d	7.61	6.7	17.9	33.0	↓	↓	↓	↓
		↓	113012Aa #2(2)	14	good -6d	7.61	6.8	18.0	32.3				
		A. bahia	113012Ab #1	~~4~~ 5	good	7.86	7.4	17.9	33.1				
		↓	113012Ab #2(1)	MC ~~4~~ 5	good	7.89	7.4	17.8	33.2				
		↓	113012Ab #2(2)	~~4~~ 5	good	7.85	7.6	17.9	32.3				

Notes:

C n 830A Dissolved Oxygen Meter and Probe – Ma…enance and Calibration Log Sheet

Action Performed	Description	Slope (60%-120%)	Time	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated at 30 ppt	117	0939	11/8/2012	MC | RD
☒ Calibration ☐ Maintenance	Calibrated at 30 ppt	114	1006	11/9/2012	RD
☒ Calibration ☐ Maintenance	" "	117	1130	11/10/12	MC
☒ Calibration ☐ Maintenance	" "	110	1430	11/11/12	MC
☒ Calibration ☐ Maintenance	" "	112	1330	11/12/12	MC
☒ Calibration ☐ Maintenance	" "	116	0850	11/13/12	MC
☒ Calibration ☐ Maintenance	" "	113	1421	11/14/12	RD
☒ Calibration ☐ Maintenance	" "	113	0845	11/15/12	MC
☒ Calibration ☐ Maintenance	" "	112	0750	11/16/12	MC
☒ Calibration ☐ Maintenance	" "	110	0950	11/17/12	MC
☒ Calibration ☐ Maintenance	" "	111	1130	11/18/12	MC
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					

E h Rugged Dissolved Oxygen Meter – Maintenanc ıd Calibration Log Sheet

Action Performed	Description	Time	Date	Analyst Initials
☐E Calibrated ☐M	Calibrated @ 33 ppt	0930	11/19/12	mc
☐E ☐M Cal	" "	0900	11/20/12	mc
☐E ☐M Cal	" "	0945	11/21/12	mc
☐E ☐M Cal	" "	0847	11/22/12	RD
☐E ☐M Cal	" "	0919	11/23/12	RD
☐E ☐M Cal	" "	0930	11/24/12	RD
☐E ☐M Cal	" "	~~0425~~ RD 1629	11/25/12	RD
☐E ☐M Cal	" "	0825	11/26/12	mc
☐E ☐M Cal	" "	1005	11/27/12	mc
☐E ☐M Cal	" "	0815	11/28/12	mc
☐E ☐M Cal	" "	1000	11/29/12	mc
☐E ☐M Cal	" "	1145	11/30/12	mc
☐E ☐M Cal	" "	0945	12/1/12	mc
☐E ☐M Cal	" "	1200	12/2/12	mc
☐E ☐M Cal	" "	0750	12/3/12	mc
☐E ☐M Cal	" "	1000	12/4/12	mc
☐E ☐M Cal	" "	0800	12/5/12	mc
☐E ☐M Cal	" "	0925	12/6/12	GR

E. h Rugged Dissolved Oxygen Meter – Maintenanc id Calibration Log Sheet

Action Performed	Description	Time	Date	Analyst Initials
☑ C ☐ M Calibration	Calibrated @ 33ppt	0830	12/7/12	mi
☐ C ☐ M Cal	" "	1200	12/8/12	mi
☐ C ☐ M Cal	" "	1239	12/9/12	RD
☐ C ☐ M Cal	" "	1355	12/10/12	RD
☐ C ☐ M Cal	" "	1030	12/11/12	JB
☐ C ☐ M Cal	" "	1430	12/12/12	mc
☐ C ☐ M Cal	" "	0915	12/13/12	mi
☐ C ☐ M Cal	" "	0800	12/14/12	RD
☐ C ☐ M Cal	" "	0947	12/15/12	RD
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				
☐ C ☐ M				

Oakton Hand-held pH Meter Model pH 11 – Maintenance and Calibration Log Sheet

Action Performed	Description	pH 7.0 Check (6.95 – 7.05)	Time	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated @ 4, 7, & 10	7.04	0940	11/8/2012	MC/RD
☒ Calibration ☐ Maintenance	Calibrated @ 4, 7 + 10	7.00	0957	11/9/2012	RD
☑ Calibration ☐ Maintenance	" "	7.01	1130	11/10/12	MC
☑ Calibration ☐ Maintenance	" "	7.02	1430	11/11/12	MC
☑ Calibration ☐ Maintenance	" "	7.01	1330	11/12/12	MC
☒ Calibration ☐ Maintenance	" "	7.01	0850	11/13/12	MC
☒ Calibration ☐ Maintenance	" "	~~6.94~~ RD 6.96	1446	11/14/12	RD
☒ Calibration ☐ Maintenance	" "	7.01	0845	11/15/12	MC
☒ Calibration ☐ Maintenance	" "	7.05	0752	11/16/12	MC
☒ Calibration ☐ Maintenance	" "	7.01	0950	11/17/12	MC
☑ Calibration ☐ Maintenance	" "	7.02	1130	11/18/12	MC
☒ Calibration ☐ Maintenance	" "	7.04	0930	11/19/12	MC
☑ Calibration ☐ Maintenance	" "	7.03	0900	11/20/12	MC
☑ Calibration ☐ Maintenance	" "	7.03	0945	11/21/12	MC
☒ Calibration ☐ Maintenance	" "	7.02	0850	11/22/12	RD
☒ Calibration ☐ Maintenance	" "	7.02	0920	11/23/12	RD
☒ Calibration ☐ Maintenance	" "	7.03	0930	11/24/12	RD

Oakton Hand-held pH Meter Model pH 11 – Maintenance and Calibration Log Sheet

Action Performed	Description	pH 7.0 Check (6.95 – 7.05)	Time 1629	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated @ 4, 7, + 10	7.03	~~0429~~ RD	11/25/12	RD
☒ Calibration ☐ Maintenance	" "	7.03	0825	11/26/12	MC
☒ Calibration ☐ Maintenance	" "	7.03	1005	11/27/12	MC
☒ Calibration ☐ Maintenance	" "	7.03	0815	11/28/12	MC
☒ Calibration ☐ Maintenance	" "	7.02	1000	11/29/12	MC
☒ Calibration ☐ Maintenance	" "	7.01	1130	11/30/12	MC
☒ Calibration ☐ Maintenance	" "	7.02	0945	12/1/12	MC
☒ Calibration ☐ Maintenance	" "	7.01	1000	12/2/12	MC
☒ Calibration ☐ Maintenance	" "	7.00	0750	12/3/12	MC
☒ Calibration ☐ Maintenance	" "	7.02	1000	12/4/12	MC
☒ Calibration ☐ Maintenance	" "	7.01	0800	12/5/12	MC
☒ Calibration ☐ Maintenance	" "	7.00	0925	12/6/12	GR
☒ Calibration ☐ Maintenance	" "	7.02	0530	12/7/12	MC
☒ Calibration ☐ Maintenance	" "	7.01	1200	12/8/12	MC
☒ Calibration ☐ Maintenance	" "	7.00	~~13~~ RD 1235	12/9/12	RD
☒ Calibration ☐ Maintenance	" "	6.99	1359	12/10/12	RD
☒ Calibration ☐ Maintenance	" "	7.00	1030	12/11/12	JG
Cal	" "	7.04	1430	12/12/12	MC
Cal	" "	7.02	0915	12/13/12	MC
cal	" "	6.98	0800	12/14/12	RD
cal	" "	7.00	0958	12/15/12	RD

Orion Conductivity Meter Model 105A+ – Maintenance and Calibration Log Sheet

Action Performed	Description	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated to 35 ppt Salinity Standard; Correction Factor = 0	11/26/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/27/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/28/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/29/12	MC
☒ Calibration ☐ Maintenance	" " = 0	11/30/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/1/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/2/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/3/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/4/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/5/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/6/12	GR
☒ Calibration ☐ Maintenance	" " = 0	12/7/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/8/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/9/12	RD
☒ Calibration ☐ Maintenance	" " = 0	12/10/12	RD
☒ Calibration ☐ Maintenance	" " = 0	12/11/12	JG
☒ Calibration ☐ Maintenance	" " = 0	12/12/12	MC
☒ Calibration ☐ Maintenance	" " = 0	12/13/12	MC
Cal	" " = 0	12/14/12	RD
Cal	" " = 0	12/15/12	RD

Orion Conductivity Meter Model 105A+ – Maintenance and Calibration Log Sheet

Action Performed	Description	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated to 35 ppt Salinity Standard. Corr. factor = 0	11/8/2012	MC/RD
☒ Calibration ☐ Maintenance	Calibrated to 35 ppt Salinity Standard Corr. factor = 0	11/9/2012	RD
☒ Calibration ☐ Maintenance	" " = 0	11/10/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/11/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/12/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/13/2012	MC
☒ Calibration ☐ Maintenance	" " corr factor = 0	11/14/2012	RD
☒ Calibration ☐ Maintenance	" " = 0	11/15/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/16/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/17/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/18/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/19/2012	MC
☒ Calibration ☐ Maintenance	" " = 0	11/20/12	MC
☒ Calibration ☐ Maintenance	" " = ~~-0.0~~ -0.2 mc	11/21/12	MC/RD
☒ Calibration ☐ Maintenance	" " = 0	11/22/12	RD
☒ Calibration ☐ Maintenance	" " = 0	11/23/12	RD
☐ Calibration ☐ Maintenance	" " = 0	11/24/12	RD
☐ Calibration ☐ Maintenance	" " = 0	11/25/12	RD

Marine Sediment Bioassay

Organism Survival

Project ID: NESDI SEAP - ETV

Sample ID: SEARing

Test No.: SSC-2012-0113, 0118

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Sample ID	Initial No.	No. Recovered ALIVE	Technician Initials
PSNS-Mn-1	4	2	GR/MC
PSNS-Mn-2	4	0	GR/MC
PSNS-Mn-3	4	1	GR/MC
PSNS-Mn-4	~~2~~ RD 4	2	GR/MC
PSNS-Mn-5	4	1	GR/MC
DB-Mn-1	4	0	GR/MC
DB-Mn-2	4	0	GR/MC
DB-Mn-3	4	0	GR/MC
DB-Mn-4	4	0	GR/MC
DB-Mn-5	4	0	GR/MC

QC Check: lle 12/17/2012 **Final Review:** ____________

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV

Sample ID: Beakers

Test No.: SSC-2012-0121, 0126

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1140

Sample ID	Initial No.	No. Recovered	Technician Initials
PSNS-mn-A	4	4	RD/mc
PSNS-mn-B	4	3	RD/mc
PSNS-mn-C	4	4	RD/mc
PSNS-mn-D	4	3	RD/mc
PSNS-mn-E	4	4	RD/mc
DB-Mn-A	4	3	RD/mc
DB-mn-B	4	1	RD/mc
DB-mn-C	4	2	RD/mc
DB-mn-D	4	3	RD/mc
DB-mn-E	4	4	RD/mc

QC Check: 12/17/2012 **Final Review:** ________

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: Lab Control - Discovery Bay

Test No.: SSC-20120121

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	34.0	17.9	7.8	7.77		MC	
1	33.9	18.0	7.5	7.84		MC	
2	34.1	18.1	7.6	7.72		MC	
3	34.1	18.0	7.6	7.68	Y	MC	
4	34.4	18.0	7.5	7.86		MC	
5	34.1	17.9	7.5	7.78	Y	RD	
6	34.1	17.8	7.3	7.77		RD	
7	34.0	17.9	7.0	7.57	Y	RD/GR	
8	34.0	17.8	7.7	7.96		RD	
9	34.1	17.9	7.6	7.99		RD	
10	34.2	17.9	7.7	7.96	y	MC	
11	33.8	18.1	7.7	7.99		MC	
12	34.1	18.2	7.7	7.99	Y	MC	
13	34.0	18.1	7.6	7.94		MC	
14	34.1	18.0	7.5	7.91	y	MC	
15	34.1	18.0	7.4	7.96		MC	
16	34.1	17.9	7.2	7.90		MC	
17	34.4	17.8	7.7	7.79	Y	RD/MC	1 dead removed Rep B
18	34.1	18.0	7.7	7.67		MC	
19	34.0	17.8	7.62	7.76	y	RD	1 dead removed from rep B + C
20	33.9	17.8	7.51	7.83		Jkg	
21	34.3	17.7	7.6	7.73	y	RD	
22	34.2	18.1	7.3	7.60		MC	
23	34.4	17.7	6.9	7.85		TCR	1 dead removed from rep A
24	34.2	18.0	7.5	7.99	y	MC	1 dead removed Rep C
25	34.3	17.7	7.6	7.88		JH	~~1de~~ MC
26	33.3	18.2	7.9	8.03	y	MC	1 dead removed from Rep B
27	33.3	18.1	7.5	8.11		MC	1 dead removed Rep D
28	33.4	17.7	7.4	7.75	Y	RD	
29	33.8	19.0	7.2	7.91		RD	

QC Check: MC 12/17/2012

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: PSNS Sediment

Test No.: SSC-2012-0126

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1520

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	34.4	17.9	7.7	7.80		MC	
1	34.2	18.0	7.1	7.80		MC	
2	34.3	18.0	6.8	7.64		MC	
3	34.2	17.9	7.2	7.70	y	MC	1 dead, pulled from Drep
4	34.4	17.9	7.4	7.82		MC	
5	34.1	17.8	7.1	7.71	Y	RD	1 dead pulled from Brep
6	34.1	17.8	7.2	7.73		RD	
7	34.0	17.9	7.3	7.62	Y	RD/GP	
8	34.1	17.7	7.3	7.77		RD	
9	34.1	17.8	7.1	7.76		RD	
10	34.2	17.9	7.3	7.74	y	MC	
11	34.0	18.0	7.5	7.87		MC	
12	34.1	18.0	7.1	7.80	y	MC	
13	34.1	18.1	7.0	7.78		MC	
14	34.2	18.2	7.1	7.82	y	MC	
15	34.1	18.0	7.0	7.80		MC	
16	34.2	18.1	7.0	7.91		MC	
17	34.3	17.7	7.3	7.67	Y	RD/MC	
18	34.1	17.9	7.4	7.65		MC	
19	34.0	17.7	7.4	7.62	y	RD	
20	33.9	17.8	7.3	7.70		JMG	
21	34.4	17.7	7.3	7.60	y	RD	
22	34.2	18.1	7.4	7.80		MC	
23	34.5	17.5	7.5	7.81		RD	
24	34.2	17.9	7.4	7.98	y	MC	
25	34.7	17.6	7.5X MC	7.58		JG	
26	33.4	18.0	7.4	8.00	y	MC	
27	33.3	17.9	7.5	8.10		MC	
28	33.7	17.7	7.5	7.79	Y	RD	
29	34.1	18.5	7.6	7.99		RD	

QC Check: MC 12/17/12

Final Review: ______

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: S22 - DB - Macoma

Test No.: SSC - 2012 - 0113

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments	
							Pumplight	Batterylight
0	34.5	17.6	7.5	7.60		MC	2x	Green
1	34.5	17.8	6.4	7.81		MC	2x	Green
2	34.5	17.9	6.9	7.67		MC	2x	Green
3	34.6	17.7	6.5	7.72	Y	MC	2x	Green
4	34.4	17.9	6.7	7.81		MC	2x	Green
5	34.3	17.6	6.7	7.85	Y	RD	2x	Green
6	34.1	17.6	7.3	7.73		RD	2x	green
7	34.0	17.6	7.3	7.73	Y	RD	2x	green
8	34.2	17.6	7.4	7.96		RD	2x	green
9	~~34.3~~ RD 34.4	~~17.5~~ RD 17.6	~~7.4~~ RD 7.4	~~7.95~~ RD 7.79		RD ~~RD~~ RD	2x	green
10	33.9	17.7	7.4	7.90	Y	MC	2x	green
11	33.9	17.7	7.1	7.80		MC	2x	green
12	34.4	17.9	7.2	7.94	Y	MC	2x	green
13	34.3	17.9	7.2	7.95		MC	2x	green
14	34.4	17.9	7.1	7.89	Y	MC	2x	green
15	34.2	17.7	7.0	7.90		MC	2x	green
16	34.2	17.9	7.1	7.92		MC	2x	green
17	34.5	17.6	3.7*	7.32	Y	RD / MC	2x	green
18	34.5	18.2	7.4	7.77		MC	2x	green
19	34.3	17.5	7.4	7.81	Y	RD	2x	green
20	34.1	17.6	7.5	7.95		Jhj	2x	green
21 Ⓐ	34.6	17.5	7.0	7.81	Y	RD	2x	green 90 ml
22	34.7	17.9	7.2	7.84		MC	2x	green
23	34.3	17.6	7.7	7.51		RD	2x	green
24	34.4	17.7	7.2	7.64	Y	MC	2x	green
25	34.8	17.2	7.4	7.88		JG	2x	green
26	33.6	17.5	7.0	7.95	Y	MC	2x	green
27	33.5	17.7	7.1	8.01		MC	2x	green
28	33.4	17.5	7.1	7.75	Y	RD	2x	green
29	33.9	17.9	7.4	7.96		RD	—	

QC Check: ______________________

Final Review: ______________________

*outside DO = 6.5, airstones replaced into chemtainer (tech error)

Ⓐ: Replicates removed, dead clams removed, only rep 3 had 2 surviving clams

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: SRS - PSNS - Macoma

Test No.: SSC - 2012 - 0118

Test Species: *M. nasuta*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments	
							Pump light	Bott Light
0	34.5	17.7	7.2	7.61		MC	2x	green
1	34.5	17.7	6.8	7.82		MC	2x	green
2	34.7	17.9	7.1	7.79		MC	2x	green
3	34.6	17.7	6.8	7.85	Y	MC	2x	green
4	34.5	17.8	6.9	7.80		MC	2x	green
5	34.3	17.6	6.8	7.90	Y	RD	2x	green
6	34.3	17.6	6.8	7.87		RD	2x	green
7	34.2	17.6	6.9	7.78	Y	RD	2x	green
8	34.2	17.6	6.9	7.96		RD	2x	green
9	34.2	17.7	6.3	7.70		RD	2x	green
10	34.4	17.7	7.0	7.94	Y	MC	2x	green
11	34.1	17.7	7.0	7.81		MC	2x	green
12	34.4	17.8	6.9	7.88	Y	MC	2x	green
13	34.4	17.8	7.1	7.89		MC	2x	green
14	34.3	17.9	7.2	7.91	Y	MC	2x	green
15	34.2	17.8	7.1	7.88		MC	2x	green
16	34.1	17.9	7.0	7.87		MC	2x	green
17	34.3	17.6	7.0	7.56	Y	RD/MC	2x	green
18	34.2	17.8	7.0	7.63		MC	2x	green
19	34.1	17.5	6.9	7.73	y	RD	2x	green
20	34.0	17.6	7.2	7.83		Jhg	2x	green
21	34.6	17.5	7.2	7.78	y	RD	2x	green
22	34.4	17.9	7.3	7.81		MC	2x	green
23	34.8	17.3	7.0	7.84		RD	2x	green
24	35.2	17.7	6.9	7.99	y	MC	2x	green
25	35.3	17.3	7.3	8.05		JG	2x	green
26	33.6	17.5	6.8	7.92	Y	MC	2x	No light
27	33.5	17.7	6.9	8.05		MC	2x	Red
28	33.5	17.6	6.8	7.71	Y	RD	2x	Red
29	34.6	17.9	7.8	8.01		RD		

110mL

QC Check: MC 12/17/2012

Final Review:

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV

Sample ID: Beakers

Test No.: SSC-2012-0120, 0123, 0125

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time: 11/14/2012 1148

Sample ID	Initial No.	No. Recovered	Pan Weight (mg)	Pan + Org. Weight (mg) WET	Technician Initials
PSNS-Na-A	20	20	1.2415	1.3843	RD/mc
PSNS-Na-B	20	~~18~~ RD 19	1.2305	1.3406	RD/mc
PSNS-Na-C	20	18	1.1934	1.3058	RD/mc
PSNS-Na-D	20	19	1.1983	1.3103	RD/mc
PSNS-Na-E	20	20	1.2069	1.~~33~~ mc 3449	RD/mc
RD ~~B~~MS-Na-A	20	17	0.5125	0.6038	RD/mc
MS-Na-B	20	~~18~~ RD 18	~~0.5335~~ mc 0.~~5303~~ 0.5335	0.6282	RD/mc
MS-Na-C	20	~~18~~ RD 19	0.5361	0.6303	RD/mc
MS-Na-D	20	18	0.5165	0.6042	RD/mc
MS-Na-E	20	16	0.5105	0.6052	RD/mc
YB-Na-A	20	19	1.1959	1.3223	RD/mc
YB-Na-B	20	20	1.2301	1.3635	RD/mc
YB-Na-~~B~~ rcc C	20	20	1.1804	1.2974	RD/mc
YB-Na-D	20	19	1.1988	1.3440	RD/mc
YB-Na-E	20	20	1.1944	1.3322	RD/mc

QC Check: lle 12/17/2012

Final Review:

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV

Sample ID: SEA Ring

Test No.: SSC-2012-0112, 0115, 0117

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Sample ID	Initial No.	No. Recovered	Pan/vial Weight ~~(mg)~~ g mc	Pan + Org. Weight (mg) WET	Technician Initials	
PSNS-Na-1	20	13	~~1.2109~~ mc 1.1971	1.2865	RD/mc	
TDD ~~$~~PSNS-Na-2	20	10	1.2395	1.2858	RD/mc	1 dead body
PSNS-Na-3	20	9	1.1968	1.2562	RD/mc	9 pulled off sc
PSNS-Na-4	20	8	1.2029	1.2491	RD/mc	5 off sides
PSNS-Na-5	20	5	1.1984	1.2300	RD/mc	
ms-Na-1	20	16	PAN WT. 0.5333	0.6199	RD/mc	@ SWI, NOT burrowed, 2@ sides
ms-Na-2	20	17	0.5174	0.62033 mc	RD/mc	
ms-Na-3	20	19	0.5217	0.6279	RD/mc	
ms-Na-4	20	18	0.5301	0.6359	RD/mc	
ms-Na-5	20	16	0.5367	0.63~~57~~72 mc	RD/mc	
YB-Na-1	20	0	-	—	RD/mc	
YB-Na-2	20	0	-	-	RD/mc	
YB-Na-3	20	1	1.1961	1.~~19~~2003 mc	RD/mc	at top of chamber
YB-Na-4	20	0	—	-	RD/mc	
YB-Na-5	20	0	-	-	RD/mc	

QC Check: lll 12/17/2012

Final Review: ____________________

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: **PSNS Sediment**

Test No.: SSC-2012-0125

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1520

End Date/Time: 12/14/12 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	34.4	17.9	7.7	7.80	Y		MC	
1	34.3	18.0	7.6	7.99			MC	
2	34.3	18.0	7.6	7.90			MC	
3	34.1	17.9	7.7	7.93	y	y	MC	
4	34.5	18.0	7.6	8.01			MC	
5	34.0	17.8	7.6	7.97			RD	
6	33.5	17.8	7.6	8.00			RD	
7	34.1	17.9	7.6	7.92	Y	Y	RD	
8	34.0	17.8	7.6	8.07			RD	
9	34.0	17.8	7.6	8.11			RD	
10	34.2	17.9	7.6	8.09	y	y	MC	
11	34.0	18.0	7.6	8.11			MC	
12	34.1	18.0	7.6	8.15			MC	
13	34.1	18.1	7.5	8.11			MC	
14	34.2	17.9	7.3	8.04	y	y	MC	
15	34.1	17.8	7.2	8.00			MC	
16	34.1	17.9	7.1	7.98			MC	
17	34.2	17.8	7.5	8.03	y	Y	RD/MC	
18	34.0	17.9	7.5	7.80			MC	
19	33.9	17.8	7.5	7.92			RD	
20	33.8	17.8	7.4	7.98			JMG	
21	34.4	17.7	7.6	7.92	y	y	RD	
22	34.2	18.1	7.6	8.02			MC	
23	34.0	17.5 ~~19.6~~ RD	7.6	8.15			RD	
24	34.0	17.9	7.6	8.27	y	y	MC	
25	34.5	17.6	7.6	7.86			JG	
26	33.4	18.0	7.6	8.23			MC	
27	33.3	18.0	7.5	8.25			MC	
28	33.2	17.7	7.6	8.02			RD	

QC Check: MC 12/17/12

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: Lab Control - Yaquina Bay

Test No.: SSC-2012-0120

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	34.3	18.1	7.7	7.76	Y		MC	
1	34.2	18.1	7.7	7.98			MC	
2	34.4	18.1	7.7	7.80			MC	
3	34.4	18.0	7.8	7.82	Y	Y	MC	
4	34.6	18.1	7.7	7.96			MC	
5	34.2	17.9	7.7	7.89			RP	
6	34.1	17.9	7.8	7.96			RD	
7	34.1	17.9	7.8	7.75	Y	Y	RD/GR	
8	34.0	17.9	7.7	7.99			RD/GR	
9	34.0	18.0	7.7	8.04			RD	
10	34.1	18.1	7.7	8.04	y	y	MC	
11	33.8	18.2	7.7	7.99			MC	
12	34.1	18.4	7.7	8.00			MC	
13	34.2	18.1	7.6	8.01			MC	
14	34.2	17.9	7.4	8.00	Y	Y	MC	
15	34.1	17.8	7.3	8.06			MC	
16	34.2	17.9	7.6	7.94			MC	
17	34.3	17.9	7.7	7.98	y	Y	RD/MC	
18	34.0	18.0	7.7	7.67			MC	
19	33.9	17.9	7.7	7.81			RD	
20	33.8	18.0	7.6	7.88			Jmg	
21	34.1	17.8	7.5	7.77	y	y	RD	
22	34.4	17.9	7.5	7.39			MC	
23	34.1	18.1	7.6	7.92			RD	
24	34.0	18.2	7.7	7.66	Y	y	MC	
25	33.9	17.9	7.7	7.97			JG	
26	33.4	18.5	7.6	8.00			MC	
27	33.2	18.3	7.5	8.11			MC	
28	33.7	17.8	7.7	7.94			RD	

QC Check: MC 12/17/2012

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: **MS Sediment**

Test No.: SSC-2012-0123

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1520

End Date/Time: 12/14/12 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	34.3	18.0	7.6	7.51	y		MC	
1	34.2	18.0	7.5	7.71			MC	
2	34.2	18.1	7.4	7.73			MC	
3	34.2	17.9	7.5	7.71	y	y	MC	
4	34.4	18.0	7.5	7.89			MC	
5	34.1	17.8	7.5	7.85			RD	
6	34.1	17.5	7.5	7.86			RD	
7	34.0	17.9	7.5	7.75	Y	X	RD/GR	
8	34.0	17.8	7.5	7.89			RD	
9	34.0	17.9	7.4	7.90			RD	
10	34.1	17.9	7.5	7.89	y	y	MC	
11	33.9	18.0	7.6	7.86			MC	
12	34.1	18.1	7.6	7.88			MC	
13	34.1	18.2	7.4	7.81			MC	
14	34.2	18.1	7.3	7.52	y	y	MC	
15	34.0	18.0	7.0	7.79			MC	
16	34.1	17.8	7.2	7.83			MC	
17	34.2	17.8	7.5	7.78	y	Y	RD/MC	
18	34.1	17.9	7.6	7.61			MC	
19	340	17.8	7.6	7.75			RD	
20	33.9	17.8	7.5	7.85			Jng	
21	34.3	17.7	7.7	7.82	y	y	TJD	
22	34.2	18.3	7.4	7.66			MC	
23	34.1	17.5	7.6	7.92			RD	
24	34.1	18.0	7.6	7.98	y	y	MC	
25	34.5	17.6	7.6	7.77			JG	
26	33.4	18.1	7.6	8.01			MC	
27	334	18.0	7.6	8.11			MC	
28	333	17.7	7.7	7.87			RD	

QC Check: MC 12/17/12

Final Review:

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV
Sample ID: SI2 2 - 4B - Poly
Test No.: SSC - 2012 - 0112

Test Species: *N. arenaceodentata*
Start Date/Time: 11/16/2012 1500
End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments	
								Pump Light	Bath Light
0	34.5	17.6	7.5	7.67	y		MC	2x	Green
1	34.5	17.9	7.2	7.86			MC	2x	Green
2	34.6	17.9	7.3	7.61			MC	2x	Green
3	34.6	17.7	7.3	7.77	y	y	MC	2x	Green
4	34.4	17.9	7.4	7.81			MC	2x	Green
5	34.3	17.7	7.4	7.88			RD	2x	Green
6	34.4	17.6	7.5	7.82			RD	2x	Green
7	34.2	17.6	7.4	7.74	Y	Y	RD	2x	green
8	34.2	17.6	7.5	7.96			RD	2x	green
9	34.2	17.6	7.3	7.68			RD	2x	green
10	34.3	17.7	7.3	7.86	Y	Y	MC	2x	green
11	34.3	17.7	7.4	7.80			MC	2x	green
12	34.4	17.9	7.3	7.94			MC	2x	green
13	34.3	17.9	7.2	7.91			MC	2x	green
14	344	17.9	7.1	7.86	y	y	MC	2x	green
15	34.2	17.8	7.2	7.91			MC	2x	green
16	34.3	17.9	7.0	7.87			MC	2x	green
17	34.4	17.6	4.3*	7.40	y	Y	RD/MC	2x	green
18	34.0	18.2	7.5	7.75			MC	2x	green
19	34.1	17.5	7.5	7.80			RD	2x	green
20	33.9	17.7	7.5	7.96			JG	2x	green
21	34.5	17.5	7.4	7.81	y	y	RD	2x	green
22	34.8	17.9	7.3	7.57			MC	2x	green
23	34.8	17.7	7.4	6.96			RD	2x	green
24	35.0	17.7	7.2	7.57	Y	Y	MC	2x	green
25	35.0	17.2	7.5	7.89			JG	2x	green
26	33.4	17.6	7.2	7.92			MC	2x	green
27	33.4	17.7	7.4	8.08			MC	2x	green
28	33.5	17.6	7.2	7.88			RD	2x	green

75mL

QC Check: MC 12/17/2012

Final Review:

* outside DO = 6.5, airstones replaced into chambers (tech error)

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: *323 MS- Poly

Test No.: SSC-2012-0115

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments	
								Pump light	Battery light
0	34.5	17.6	7.5	7.54	y		MC	2x	Green
1	34.5	17.7	7.2	7.80			MC	2x	Green
2	34.5	17.8	7.3	7.79			MC	2x	Green
3	34.7	17.7	7.2	7.78	y	y	MC	2x	Green
4	34.6	17.9	7.3	7.82			MC	2x	Green
5	34.6	17.5	7.2	7.91			RD	2x	Green
6	34.4	17.5	7.3	7.87			RD	2x	green
7	34.2	17.6	7.14 RD	7.81	Y	Y	RD	2x	green
8	34.3	17.5	7.4	7.95			RD	2x	green
9	34.3	17.6	7.4	7.74			RD	2x	green
10	34.1	17.6	7.3	7.88	y	y	MC	2x	green
11	34.1	17.6	7.4	7.87			MC	2x	green
12	34.4	17.8	7.4	8.01			MC	2x	green
13	34.3	17.9	7.3	7.98			MC	2x	green
14	34.2	17.9	7.2	7.89	y	y	MC	2x	green
15	34.2	17.7	7.0	7.87			MC	2x	green
16	34.3	17.8	7.1	7.89			MC	2x	green
17	33.8	17.5	7.4	7.68	y	Y	RD / MC	2x	no light
Ⓐ 18	34.3	17.9	7.4	7.70			MC	2x	Red
19	339	17.5	7.9	7.83			RD	2x	green Ⓑ
20	33.9	17.5	7.3	7.96			Jmg	2x	green
21	34.4	17.6	7.4	7.86	y	y	RD	2x	red 75mL
22	34.8	17.7	7.3	7.75			MC	2x	green
23	34.4	17.7	7.4	6.63			RD	2x	green
24	34.4	17.8	7.5	8.14	y	y	MC	2x	green
25	35.4	17.2	7.4	7.95			JG	2X	green
26	335	17.5	7.1	7.97			MC	2x	Red
27	337	17.6	7.3	8.07			MC	2x	Red
28	33.6	17.3	7.3	7.86			RD	2x	red

QC Check: ML 12/17/12

Final Review:

* squaking when pump on

Ⓐ tubing fell out of chemtainer allowing air into test chambers; tubing placed back into chemtainer & lines purged of air w/ filtered seawater.

Ⓑ charged for 45min

28-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP ETV

Sample ID: S25 - PSNS - Poly

Test No.: SUC-2012-0117

Test Species: *N. arenaceodentata*

Start Date/Time: 11/16/2012 1500

End Date/Time: 12/14/2012 1148

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments	
								Pumplight	Bottlelight
0	34.5	17.7	7.3	7.59	y		MC	2x	Green
1	34.5	17.7	7.3	7.34			MC	2x	Green
2	34.7	17.9	7.4	7.77			MC	2x	Green
3	34.6	17.7	7.4	7.85	Y	Y	MC	2x	Green
4	34.4	17.8	7.6	7.84			MC	2x	Green
5	34.3	17.6	7.3	7.93			RD	2x	Green
6	34.3	17.6	7.4	7.89			RD	2x	green
7	34.3	17.6	7.5	7.77	Y	Y	RD	2x	green
8	34.2	17.6	7.5~~6~~.9RD	7.93			RD	2x	green
* 9	34.1	17.8	7.5	7.79			RD	2x	green
10	34.2	17.7	7.4	7.84	y	y	MC	2x	green
11	34.1	17.7	7.3	7.85			MC	2x	green
12	34.4	17.8	6.9	7.89			MC	2x	green
13	34.3	17.7	7.0	7.92			MC	2x	green
14	34.2	17.8	7.1	7.88	Y	Y	MC	2x	green
15	34.1	17.9	7.0	7.86			MC	2x	green
16	34.2	17.9	7.0	7.90			MC	2x	green
17	34.3	17.6	6.5	7.61	y	Y	RD/MC	2x	green
18	34.3	17.9	7.3	7.64			MC	2x	green
19	34.0	17.5	7.3	7.73			RD	2x	green
20	34.~~8~~	17.6	7.2	7.78			JHG	2x	gr
21	3~~48~~.5 RD	17.5	7.4	7.79	y	y	RD	2x	green 100mL
22	34.3	17.7	7.1	7.69			MC	2x	green
23	34.8	17.7	7.2	7.66			RD	2x	green
24	35.2	17.7	7.2	8.07	y	y	MC	2x	green
25	35.5	17.3	7.4	8.00			JG	2x	green
26	33.5	17.5	7.2	7.97			MC	2x	No light
27	33.5	17.7	7.1	8.05			MC	2x	Red
28	33.5	17.6	7.3	7.76			RD	2x	red

QC Check: MC 12/17/2012

Final Review:

* troll hose fell off - air in compartment - fixed, pumping fine

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: $CuSO_4$ Reference Toxicant
Test No.: SSC-2012-0127

Test Species: *N. arenaceodentata*
Start Date/Time: 11/16/12 1335
End Date/Time: 11/20/12 1135

	Tech Initials				
	0	24	48	72	96
Counts:	RD GR	MC	MC	MC	MC
Readings:	RD	MC	MC	MC	MC
Dilutions made by:	GR	-	-	-	-

Concentration $CuSO_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control	A	10	10	10	10	10	33.9	34.1	34.5	34.6	34.6	18.6	15.6	18.3	18.1	17.9	7.7	7.5	7.3	7.5	7.4	7.92	7.88	7.91	7.87	7.89
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
25	A	10	10	10	10	10	34.2	34.2	34.5	34.6	34.6	18.2	17.9	18.1	17.9	17.8	7.7	7.5	7.4	7.5	7.3	7.95	7.92	7.94	7.94	7.91
	B	10	10	10	10	10																				
	C	10	10	10	10	9																				
50	A	10	10	10	10	10	34.2	34.2	34.5	34.6	34.5	15.3	17.9	18.6	17.9	17.8	7.7	7.5	7.4	7.5	7.4	7.94	7.92	7.94	7.94	7.91
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
100	A	10	10	10	10	10	34.3	34.2	34.5	34.6	34.7	15.3	17.9	17.9	17.8	17.7	7.7	7.5	7.4	7.5	7.5	7.94	7.92	7.94	7.94	7.91
	B	10	10	10	10	10																				
	C	10	10	10	10	10																				
200	A	10	10	10	5	2	34.3	34.3	34.6	34.6	34.6	18.3	17.9	17.8	17.8	17.7	7.8	7.5	7.5	7.4	7.5	7.94	7.90	7.94	7.92	7.91
	B	10	10	10	7	5																				
	C	10	10	10	5	1																				
400	A	10	1	0	-	-	34.3	34.3	34.5	-	-	18.2	17.8	17.8	-	-	7.8	7.5	7.5	-	-	7.92	7.90	7.94	-	-
	B	10	1	0	-	-																				
	C	10	1	0	-	-																				

Initial Counts QC'd by: MC

Animal Source/Date Received: Aquatic Toxicology Support

Age at Initiation: 3 wks 4 days

	Feeding Times				
	0	24	48	72	96
AM:					
PM:					

Comments:
i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one ([✓ y] / n)
Tests aerated? Circle one (y / n) if yes, sample ID(s): Duration:
Aeration source:

QC Check: MC 11/20/2012

Final Review:

ORGANISM ARRIVAL LOG

Date Received	Received From	Species	Batch ID	Project	Age when shipped	Number Ordered	Organism Condition (e.g. number dead)	Initial Water Quality				Dripped with	Analyst Initials
								pH	D.O.	Temp.	Salinity		
07/18/12	Brezina	Nephrys NB ~~Nephrys~~ ~~Neanthes~~	071812Ne	NAVFAC Fish Co	1 day	~~60~~ MB 125	good	7.52	30	17.4	33.5	33 psu	BN
07/18/12	Va Institute	C. virginica	071812Cv	NAVFAC Fish Co	1 day	60	good	—	—	—	—	33 psu	MB
07/18/12	Carlsbad	M. gallo	071812Mg	NAVFAC Fish Co	1 day	Bioassay batch	good	—	—	—	—	33 psu	MB
9/26/12	ABS	A. bahia	092612Ab	PSNS/PVA	3 day	960	GOOD	7.23	12.4	24.0	27.9	30ART	MC
9/11/12	AMEC	S. purpuratus	091112Sp	PSNS	-	1 batch	good	-	-	-	-	Flo-thru	MC
10/4/12	AMEC	S. purpuratus	100412Sp	Literand	-	1 batch	good	-	-	-	-	-	MC
11/8/12	Reed Gunstone	M. nasuta	110812Mn	NESDI SEAFETY	-	~110 clams	Good - 1 dead	-	-	-	-	34 FSW	MC/RD
11/9/12	Yves Ⓐ Nakashima	E. esturaius	110912Ee	NESDISEAFETY	3.5mm	1012+1090	Good - 8 dead	—	—	13.1	—	34 FSW	MC/RD
11/9/12	ATS	Neanthes	110912Na	NESDISEAFETY	emerge 10/22/12	900	good	7.15	6.78	20.0	25.8	34 FSW	MC/RD
11/30/12	ABS	A affinis	113012Aa#1	NESDISEAFETY	8 days	575	good - 19 dead	7.37	10.6	19.3	28.4	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab#1	NESDISEAFETY	1 day	575	good	7.49	12.5	19.3	27.8	34 FSW	MC
11/30/12	ABS	A affinis	113012Aa#2	PVA	10 days	800	good - 38 dead	7.29	10.1	19.3	28.0	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab#2	PVA	1 day	1100	good	7.49	12.5	19.3	27.8	34 FSW	MC

Ⓐ Northwest Aquatic

Species

A.a. - Atherinops affinis
A.b.- Americamysis bahia
C.g. - Crassostrea gigas
C.h. - Ceratocorys horrida
M.g. - Mytilus galloprovincialis

R.a.- Rhepoxinius abronius
S.p. - Strongylocentrotus purpuratus
E.e. - Eohaustorius esturaius
M.b. - Menidia beryllina
Other: Mn - Macoma nasuta

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped ^{A} with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
11/9/2012	1030	M. nasuta	110312Mn	–	good	7.64	7.3	15.3	34.2	N	34FSW	N	MC
11/10/2012	1145	M. nasuta	110812Mn	–	good	7.64	7.1	15.2	34.3	N	34FSW	N	MC
11/10/2012	1145	E. estuarius	110912 Ee	–	good	7.79	7.4	18.2	34.1	N	34FSW	N	MC
11/10/2012	1145	N. arenaceodentata	110912 Na	2w5d	good	7.63	7.3	18.3	32.2	N	-	N	MC
11/11/12	1445	Macoma	110812 Mn	–	good	7.81	7.8	18.1	34.1	N	-	N	MC
11/11/12	1445	Eoh	110912Ee	-	good	7.78	7.7	18.2	34.2	N	-	N	MC
11/11/12	1445	Neanthes	110912 Na	2w6d	good	7.71	7.8	18.3	32.3	N	-	N	MC
11/12/12	1335	Macoma	110812 Mn	-	good	7.82	7.4	18.4	34.2	N	-	N	MC
11/12/12	1335	Eoh	110912Ee	-	good	7.71	7.6	18.3	34.4	N	-	N	MC
11/12/12	1335	Neanthes	110912 Na	3wks	good	7.62	7.5	18.1	32.5	N	-	N	MC
11/13/12	0900	Macoma	110812 Mn	-	good	7.63	7.0	18.6	34.5	Y	34FSW	N	MC
11/13/12	0900	Eoh	110912Ee	-	good	7.90	7.7	18.4	34.2	Y	34FSW	N	MC
11/13/12	0900	Neanthes	110912 Na	3w1d	good	7.76	7.5	18.1	32.7	Y	34FSW	N	MC
11/14/12	1500	Neanthes	110912 Na	3w2d	good	7.79	7.6	18.1	32.5	N	~~34F~~RD	N	RD
11/14/12	1500	Eoh	110912Ee	—	good	7.87	7.6	17.9	34.7	N	—	N	RD
11/14/12	1500	Macoma	110812 Mn	—	good	7.52	6.7	18.2	35.0	N	—	N	RD
11/15/12	1451	Macoma	110812 Mn	—	good (1d)	7.45	6.5	17.8	34.9	N	-	N	RD
11/15/12	1451	Eoh	110912Ee	—	good	7.76	7.6	17.9	33.3	N	-	N	RD
11/15/12	1451	Neanthes	110912 Na	3w3d	good	7.74	7.5	18.1	33.0	N	—	N	RD
11/16/12	0837	Macoma	110812 Mn	-	good	7.38	6.2	17.6	35.2	N	-	N	MC
11/16/12	0837	Eoh	110912 Ee	-	good	7.70	7.5	17.7	34.9	N	-	N	MC
11/16/12	0837	Neanthes	110912 Na	3w4d	good	7.57	7.1	17.7	33.3	N	-	N	MC

Notes: A FSW = 0.45 μm Filtered Seawater from Cold room

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
12/1/12	1000	A. affinis	113012Aa #1	10	good 15d	7.73	7.1	18.5	30.0	Y	34FSW	Y	MC
12/1/12	1000		113012 Aa #2(1)	12	Good 10d	7.71	6.8	18.6	30.8	Y		Y	
12/1/12	1000		113012 Aa #2 (2)	12	Good 11d	7.71	6.9	18.7	30.5	y		Y	
12/1/12	1000	A. bahia	113012 Ab #1	~~2~~ 3	good	7.93	7.4	19.0	30.1	y		Y	
12/1/12	1000		113012Ab #2(1)	MC ~~2~~ 3	good	8.08	7.5	18.9	30.2	y		y	
12/1/12	1000		113012Ab #2(2)	~~2~~ 3	good	8.01	7.3	18.7	30.1	y		y	
12/2/12	1015	A. affinis	113012Aa #1	11	good.	7.81	7.0	18.6	32.1	Y	34FSW	y	MC
			113012Aa #2(1)	13	good -15d	7.82	7.1	18.6	32.3				
			113012Aa #2(2)	13	good - 20d	7.91	6.8	18.7	32.3				
		A. bahia	113012Ab #1	~~3~~ 4	good - 12d	7.94	7.4	18.6	32.4				
			113012Ab #2(1)	MC ~~3~~ 4	good	7.97	7.5	18.8	32.4				
			113012Ab #2(2)	~~3~~ 4	good	7.96	7.5	18.8	32.1				
12/3/12	1030	A. affinis	113012Aa #1	12	good -5d	7.59	6.8	17.8	33.3	y	34FSW	y	MC
			113012Aa #2 (1)	14	good -6d	7.61	6.7	17.9	33.0				
			113012Aa #2 (2)	14	good -6d	7.61	6.8	18.0	32.3				
		A. bahia	113012Ab #1	~~4~~ 5	good	7.86	7.4	17.9	33.1				
			113012Ab #2 (1)	MC ~~4~~ 5	good	7.89	7.4	17.8	33.2				
			113012Ab #2 (2)	~~4~~ 5	good	7.85	7.6	17.9	32.3				

Notes: ______________________________

ORGANISM ARRIVAL LOG

Date Received	Received From	Species	Batch ID	Project	Age when shipped	Number Ordered	Organism Condition (e.g. number dead)	Initial Water Quality				Dripped with	Analyst Initials
								pH	D.O.	Temp.	Salinity		
3/22/13	ABS	A. affinis	032213Aa	ETV-NESDI	11 d	350	Good - 3dead	7.08	11.9	21.9	29.2	33FSW	MC
3/22/13	ABS	A. bahia	032213Ab	ETV-NESDI	1 d	650	Good	7.38	11.3	21.1	26.3	33FSW	MC

Species

A.a. - Atherinops affinis

A.b.- Americamysis bahia

C.g. - Crassostrea gigas

C.h. - Ceratocorys horrida

M.g. - Mytilus galloprovincialis

R.a.- Rhepoxinius abronius

S.p. - Strongylocentrotus purpuratus

E.e. - Eohaustorius esturaius

M.b. - Menidia beryllina

Other: ______________________

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
3/23/13	1515	A. affinis	032213Aa	~~12d~~ 13d	9	7.84	7.8	19.4	31.2	y	33FSW	y	mc
"	1515	A. bahia	032213Ab	3d mc	0	7.96	7.9	19.4	30.1	y	33FSW	y	mc
3/24/13	1130	A. affinis	032213Aa	~~13d~~ 14d	0	7.86	7.1	18.3	31.4	Y	—	Y	Rb
"	1130	A bahia	032213Ab	4d	0	8.03	7.6	18.5	30.4	Y	—	Y	Rb
3/25/13	0830	A. affinis	032213Aa	15d	3	7.89	7.2	18.6	31.9	y	—	y	MC
"	0830	A. bahia	032213Ab	5d	0	8.04	7.5	18.9	30.7	y	—	y	MC

Notes: ______________________________

ORGANISM ARRIVAL LOG

Date Received	Received From	Species	Batch ID	Project	Age when shipped	Number Ordered	Organism Condition (e.g. number dead)	Initial Water Quality				Dripped with	Analyst Initials
								pH	D.O.	Temp.	Salinity		
07/18/12	Brezina	Nephtys MB ~~Nephtys~~ ~~Neanthes~~	071812Ne	NAVFAC Fish Cu	1 day	~~60~~ MB 125	good	7.52	30	17.4	33.5	33 psu	BN
07/18/12	Va Institute	C. virginica	071812Cv	NAVFAC Fish Cu	1 day	60	good	—	—	—	—	33 psu	MB
07/18/12	Carlsbad	M. gallo	071812My	NAVFAC Fish Co	1 day	Bioassay batch	good	—	—	—	—	33 psu	MB
8/28/12	ABS	A. bahia	082812Ab	PSNS/PVA	3 day	960	GOOD	7.23	12.4	24.0	27.9	30 ART	MC
9/11/12	AMEC	S. purpuratus	091112Sp	PSNS	-	1 batch	good	-	-	-	-	Flo-thru	MC
10/4/12	AMEC	S. purpuratus	100412Sp	Literand	-	1 batch	good	-	-	-	-	-	MC
11/8/12	Reed Gunstone	M. nasuta	110812Mn	NESDISEAP-ETV	-	~110 clams	Good - 1 dead	-	-	-	-	34 FSW	MC/RD
11/9/12	Yves Ⓐ Nakahama	E. esturaius	110912Ee	NESDISEAPETV	3-5mm	1012+10%	Good - 8 dead	—	—	13.1	—	34 FSW	MC/RD
11/9/12	ATS	Neanthes	110912Na	NESDISEAPETV	emerge 10/22/12	900	good	7.15	6.78	20.0	25.8	34 FSW	MC/RD
11/30/12	ABS	A. affinis	113012Aa #1	NESDISEAP ETV	8 days	575	good - 19 dead	7.37	10.66	19.3	28.4	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab #1	NESDISEAP ETV	1 day	575	good	7.49	12.5	19.3	27.8	34 FSW	MC
11/30/12	ABS	A. affinis	113012Aa #2	PVA	10 days	800	good - 38 dead	7.29	10.1	19.3	28.0	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab #2	PVA	1 day	1100	good	7.49	12.5	19.3	27.8	34 FSW	MC
1/31/13	Reed Gunstone	M. nasuta	013113Mn	NESDISEAPETV	—	~100	good - 2 dead	—	—	—	—	34 FSW	RD
2/1/13	ATS	Neanthes	020113Na	NESDISEAPETV	emerge 1/14/13	800	good	7.40	6.9	18.5	29.3	34 FSW	RD
2/12/13	ABS	A. bahia	021213Ab	PSNS/Biofuel	3 days	1000 + 100	good	7.68	11.8	16.9	24.8	34 FSW	MC
2/13/13	Nautilus	S. purpuratus	021313Sp	PSNS/Biofuel	—	1 batch	good	—	—	—	—	—	RD
2/13/13	Carlsbad	M. gallo	021313My	PSNS/Biofuel	—	1 batch	good	—	—	—	—	—	RD
2/28/13	NWA	E. estuarius	022813EE	BIGHT 13	3-5mm	1260+10%	good	-	-	14.2	-	34 FSW	MC

Ⓐ Northwest Aquatic

Species

A.a. - Atherinops affinis	**R.a.** - Rhepoxinius abronius
A.b. - Americamysis bahia	**S.p.** - Strongylocentrotus purpuratus
C.g. - Crassostrea gigas	**E.e.** - Eohaustorius esturaius
C.h. - Ceratocorys horrida	**M.b.** - Menidia beryllina
M.g. - Mytilus galloprovincialis	**Other**: Mn - Macoma nasuta

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
2/1/13	1145	macoma	013113 Mn	–	good	7.88	7.3	17.4	33.9	N	—	N	RD
2/2/13	1715	Macoma	013113 Mn	–	good	7.91	7.3	17.8	33.8	Y	34FSW	N	MC
2/2/13	1715	Neanthes	020113 Na	19d	ø good	7.81	7.4	17.8	30.9	Y	34FSW	Y	MC
2/3/13	1015	macoma	013113 Mn	–	good	7.82	7.0	17.6	33.9	Y	34FSW	N	MC
2/3/13	1015	Neanthes	020113 Na	20d	ø good	7.81	7.3	17.5	32.0	Y	34FSW	Y	MC
2/4/13	1515	macoma	013113 Mn	–	good	7.76	7.2	17.8	33.9	N	–	N	MC
2/4/13	1515	neanthes	020113 Na	21d	good	7.82	7.4	17.7	33.2	N	–	Y	MC
2/5/13	0851	macoma	013113 Mn	–	good	7.96	7.3	17.5	34.3	N	–	N	RD
2/5/13	0851	Neanthus	020113 Na	22d	good	8.01	7.4	17.5	31.6	N	–	Y	RD
2/6/13	0924	Neanthus	020113 Na	23d	good	7.90	7.1	17.5	32.5	N	–	N	RD
2/6/13	0933	macoma	013113 Mn	–	good	7.89	7.4	17.6	34.6	N	–	N	RD
3/1/13	0800	Eoh	022813 Ee	-	good (7d)	7.84	7.7	15.1	35.0	Y	34FSW	N	MC
3/4/13	0900	Eoh	022813 Ee	-	good (2d)	7.81	7.6	15.2	35.0	Y	34FSW	N	MC

Notes:

NESDI SEAP - ETV

Configuration #3 - 20d Na & 14d Mn

SEA RING (SR) Info

Sea Ring ID	SR0002	
Battery Pack Present? Y/N	Y	
Chamber Pumping Flush Duration (min)	1	
Chamber Pump Static Interval (min)	3	
	Start	**End**
Pump Voltage (V)	8.8	8.1
Memory Usage (%)	0 %	1%
Survey Date (mm/dd/yy)	2/5/13	2/26/13
PUMP START ~~Survey~~ Time (local)	1400	0911
Data Download - End Program Date/Time	2/27/13	1413
SEA Ring Data Filename	SEA0002_NaMn-PSNS	

Test Chamber Info

Chamber #	Organism	#	Sediment Type
1	Na	20	PSNS Sediment
2	Na	20	PSNS Sediment
3	Na	20	PSNS Sediment
4	Na	20	PSNS Sediment
5	Na	20	PSNS Sediment
6	Mn	4	PSNS Sediment
7	Mn	4	PSNS Sediment
8	Mn	4	PSNS Sediment
9	Mn	4	PSNS Sediment
10	Mn	4	PSNS Sediment

NESDI SEAP - ETV

Configuration #2 - 20d Na

SEA RING (SR) Info

Sea Ring ID	SR0003	
Battery Pack Present? Y/N	Y	
Chamber Pumping Flush Duration (min)	1	
Chamber Pump Static Interval (min)	3	
	Start	End
Pump Voltage (V)	8.8	8.0
Memory Usage (%)	0 %	1%
Survey Date (mm/dd/yy)	2/5/13	2/26/13
PUMP START ~~Survey~~ Time (local)	1400	0911

Data Download - End Program Date/Time	2/27/13	1417
SEA Ring Data Filename	SEA0003_Na_MS	

Test Chamber Info

Chamber #	Organism	#	Sediment Type
1	Na	20	MS Sediment
2	Na	20	MS Sediment
3	Na	20	MS Sediment
4	Na	20	MS Sediment
5	Na	20	MS Sediment
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-
10	-	-	-

NESDI SEAP - ETV

Configuration #1 - 20d Na & 14d Mn

SEA RING (SR) Info

Sea Ring ID	SR0004	
Battery Pack Present? Y/N	Y	
Chamber Pumping Flush Duration (min)	1	
Chamber Pump Static Interval (min)	3	
	Start	**End**
Pump Voltage (V)	8.8	8.1
Memory Usage (%)	0%	1%
Survey Date (mm/dd/yy)	2/5/13	2/26/13
PUMP START ~~Survey~~ Time (local)	1400 HR	0914
Data Download - End Program Date/Time	2/27/13	1421
SEA Ring Data Filename	SEA0004_NaMn_LabControl	

Test Chamber Info

Chamber #	Organism	#	Sediment Type
1	Na	20	Yaquina Bay
2	Na	20	Yaquina Bay
3	Na	20	Yaquina Bay
4	Na	20	Yaquina Bay
5	Na	20	Yaquina Bay
6	Mn	4	Discovery Bay
7	Mn	4	Discovery Bay
8	Mn	4	Discovery Bay
9	Mn	4	Discovery Bay
10	Mn	4	Discovery Bay

5 Feb 2013 - SEA Ring Sediment Testing Round 2
Pump Rate Programming

Results from Battery Longevity Trial - January 2013

	Time until 6.5V	14 day Flow Rate	Total Turnovers on charge
SR4	5684	81	1137
SR3	5481	78	1096
SR2	5800	83	1160
Mean	5655	80.8	1131
SD	161.4651665	2.306645236	32.2930333
CV	2.855263776	2.855263776	2.855263776

For ETV, assume conservative 5000 minute battery life over 14 days (will recharge on or prior to Day 14 to ensure batteries last for 20 days).

57.6 Turnovers/Day: Flush Rate of 1 minute on followed by 4 minutes off = 12 min/hr = 288 min/day = 4032 total minutes

This turnover rate based on 500 mL overlying water. In Chemtainer, 700 mL is more accurate for overlying water, which equates to 41.4 turnovers/day

72 Turnovers/Day: Flush Rate of 1 minute on followed by 3 minutes off = 15 min/hr = 360 min/day = 5040 total minutes

This turnover rate based on 500 mL overlying water. In Chemtainer, 700 mL is more accurate for overlying water, which equates to 51.4 turnovers/day

Decision: All 3 SEA Rings to be programmed 1 min on, 3 min off, based on above.

Monday, February 04, 2013

Calibrate meters	MC
Check on organisms in holding, record in log book	MC
Check cold room temp - 18±1°C	MC
Charge SEA Rings	MC
Prep airlines in cold room	MC

Tuesday, February 05, 2013

Calibrate meters	RD
Check on organisms in holding, record in log book	RD
Check cold room temp - 18±1°C	RD 18.1
Program SEA Rings - record programming data	GR
Distribute sediment to test chambers - beakers and SEA Ring chambers	MC/GR
Add 0.45µm FSW as overlying water to test chambers	RD/MC/GR
Set up aeration - pipettes in beakers and airstones in chemtainers	RD

Wednesday, February 06, 2013

Calibrate meters		RD
Check on organisms in holding		RD
Check cold room temp - 18±1°C		RD 18.1
Take water quality measurements on all test chambers		RD
Set up Reference toxicant test for Neanthes		RD/MC
Add organisms to SEA Rings and beakers	Neanthes	RD/GR
	Macoma	RD/GR
Collect Time 0 analytical samples as needed	Tissue	RD/GR/MC
	Sediment	MC
	Ammonia	RD
END OF DAY DATA QC		MC
END OF DAY AIR CHECK		MC

Thursday, February 07, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 17.9
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	MC/RD
Check aeration on all tests	MC/RD
END OF DAY DATA QC	RD
Collect T0 neanthes	RD 0.223g

Friday, February 08, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.1
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
Feed neanthes tests	RD
Water change on neanthes tests	RD
Water change on macoma tests	RD
END OF DAY DATA QC	RD

Saturday, February 09, 2013

Calibrate meters	GR
Check cold room temp - 18±1°C	GR 18
Take water quality measurements on all test chambers	GR
Check pumping on all SEA Rings	GR
Check aeration on all tests	GR
END OF DAY DATA QC	GR

Sunday, February 10, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.1
Take water quality measurements on all test chambers	RD
Terminate reference toxicant test for neanthes	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
END OF DAY DATA QC	RD

Monday, February 11, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	RD 18.0
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
Feed neanthes tests	RD
Water change on neanthes tests	RD
Water change on macoma tests	RD
END OF DAY DATA QC	RD

Tuesday, February 12, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	MS 18.2
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	MC
Check aeration on all tests	MC
Filter seawater 0.45µm into large carboy on incoming tide; put on air	RD
END OF DAY DATA QC	MC

Wednesday, February 13, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 18.2
Take water quality measurements on all test chambers	MC
Check pumping on all SEA Rings	MC
Check aeration on all tests	MC
Water change on macoma tests	MC
END OF DAY DATA QC	

Thursday, February 14, 2013

Happy Valentine's Day!!

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 18.2
Take water quality measurements on all test chambers	MC
Check pumping on all SEA Rings	MC
Check aeration on all tests	MC
END OF DAY DATA QC	MC

Friday, February 15, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.2
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD SRC02 red-charged
Check aeration on all tests	RD
Feed neanthes tests	RD
Water change on neanthes tests	RD
Water change on macoma tests	RD
END OF DAY DATA QC	RD

Saturday, February 16, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.5
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
END OF DAY DATA QC	RD

Sunday, February 17, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 18.6
Take water quality measurements on all test chambers	MC
Check pumping on all SEA Rings	MC/GR
Check aeration on all tests	MC
END OF DAY DATA QC	MC

Monday, February 18, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	MC 18.4
Take water quality measurements on all test chambers	MC
Feed neanthes tests	MC
Water change on neanthes tests	MC
Water change on macoma tests	MC
Check pumping on all SEA Rings	MC
Check aeration on all tests	MC
END OF DAY DATA QC	MC

Tuesday, February 19, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.6
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
Filter seawater 0.45µm into large carboy on incoming tide; put on air	RD
Prep for termination of 14-d macoma tests	[illegible] RD
END OF DAY DATA QC	RD

Wednesday, February 20, 2013

Calibrate meters	MC
Check cold room temp - 18±1°C	RD 18.6
Take water quality measurements on all test chambers	MC
Check pumping on all SEA Rings	MC - all charged 1hr.
Check aeration on all tests	MC
terminate macoma tests - SEA Ring and lab beakers, depurate 24hrs	MC/RD
END OF DAY DATA QC	RD

Thursday, February 21, 2013

Calibrate meters RD
Check cold room temp - 18±1°C MC 18.2
Take water quality measurements on all test chambers MC
Check pumping on all SEA Rings RD
Check aeration on all tests MC
Collect depurated macoma samples RD/GR
END OF DAY DATA QC RD

Friday, February 22, 2013

Calibrate meters RD
Check cold room temp - 18±1°C RD 18.3
Take water quality measurements on all test chambers RD
Check pumping on all SEA Rings RD
Check aeration on all tests RD
Feed neanthes tests RD
Water change on neanthes tests RD
END OF DAY DATA QC RD

Saturday, February 23, 2013

Calibrate meters GR
Check cold room temp - 18±1°C GR 18.3
Take water quality measurements on all test chambers GR
Check pumping on all SEA Rings GR — 30 min charge on all
Check aeration on all tests GR
END OF DAY DATA QC GR

Sunday, February 24, 2013

Calibrate meters RD
Check cold room temp - 18±1°C RD 18.3
Take water quality measurements on all test chambers RD
Check pumping on all SEA Rings RD
Check aeration on all tests RD
END OF DAY DATA QC RD

Monday, February 25, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.1
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
Feed neanthes tests	RD
Water change on neanthes tests	RD
Prep for termination of Neanthes test	RD
END OF DAY DATA QC	RD

Tuesday, February 26, 2013

Calibrate meters	RD
Check cold room temp - 18±1°C	RD 18.2
Take water quality measurements on all test chambers	RD
Check pumping on all SEA Rings	RD
Check aeration on all tests	RD
terminate neanthes tests - SEA Ring and lab beakers, depurate 24hrs	RD | mc
collect ammonia samples and other analytical samples as needed	RD
END OF DAY DATA QC	RD

Wednesday, February 27, 2013

collect depurated neanthes samples	RD | mc
END OF DAY DATA QC	RD

Oi a Conductivity Meter Model 105A+ – Maintenan and Calibration Log Sheet

Action Performed	Description	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated to 35 ppt Salinity Standard; correction factor = 0	2/1/13	RD
☒ Calibration ☐ Maintenance	" " " = 0	2/2/13	MC
☒ Calibration ☐ Maintenance	" " " = 0	2/3/13	MC
☒ Calibration ☐ Maintenance	" " = 0	2/4/13	MC
☒ Calibration ☐ Maintenance	" " " = 0	2/5/13	RD
☒ Calibration ☐ Maintenance	" " " = 0	2/6/13	RD
☒ Calibration ☐ Maintenance	" " " = 0	2/7/13	MC
☒ Calibration ☐ Maintenance	" " " = 0	2/8/13	RD
☒ Calibration ☐ Maintenance	" " " = 0	2/9/13	GR
☒ Calibration ☐ Maintenance	" " " = 0	2/10/13	RD
☒ Calibration ☐ Maintenance	" " = 0	2/11/13	MC
☒ Calibration ☐ Maintenance	" " = 0	2/12/13	MC
☒ Calibration ☐ Maintenance	" " = 0	2/13/13	MC
☒ Calibration ☐ Maintenance	" " = 0	N/A	
☒ Calibration ☐ Maintenance	" " =		
☐ Calibration ☐ Maintenance			
☐ Calibration ☐ Maintenance			
☐ Calibration ☐ Maintenance			

Hach ged Dissolved Oxygen Meter – Maintenance and libration Log Sheet

Action Performed	Description		Time	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated @ 33ppt		1113	2/1/13	RD
☒ Calibration ☐ Maintenance	"	"	1700	2/2/13	MC
☑ Calibration ☐ Maintenance	"	"	1000	2/3/13	MC
☑ Calibration ☐ Maintenance	"	"	1500	2/4/13	MC
☒ Calibration ☐ Maintenance	"	"	0842	2/5/13	RD
☒ Calibration ☐ Maintenance	"	"	0912	2/6/13	RD
☑ Calibration ☐ Maintenance	"	"	0915	2/7/13	MC
☒ Calibration ☐ Maintenance	"	"	1150	2/8/13	RD
☒ Calibration ☐ Maintenance	"	"	1045	2/9/13	GR
☑ Calibration ☐ Maintenance	"	"	RD ~~20~~ 1400	2/10/13	RD
☒ Calibration ☐ Maintenance	"	"	0830	2/11/13	MC
☑ Calibration ☐ Maintenance	"	"	0930	2/12/13	MC
☒ Calibration ☐ Maintenance	"	"	0800	2/13/13	MC
☑ Calibration ☐ Maintenance	"	"	0800	2/14/13	MC
☒ Calibration ☐ Maintenance	"	"	0830	2/15/13	RD
☑ Calibration ☐ Maintenance	"	"	1100	2/16/13	RD
☑ Calibration ☑ Maintenance	"	"	1045	2/17/13	MC

+ calib. " " 0830 2/18/13 MC

Hach Rugged Dissolved Oxygen Meter – Maintenance and Calibration Log Sheet

Action Performed	Description		Time	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated to 33ppt		0948	2/19/13	Rb
☒ Calibration ☐ Maintenance	Calibrated to 33ppt		0900	2/20/13	MC
☒ Calibration ☐ Maintenance	"	"	0900	2/21/13	Rb
☒ Calibration ☐ Maintenance	"	"	1300	2/22/13	Rb
☒ Calibration ☐ Maintenance	"	"	1105	2/23/13	LR
☒ Calibration ☐ Maintenance	"	"	1330	2/24/13	Rb
☒ Calibration ☐ Maintenance	"	"	1000	2/25/13	Rb
☐ Calibration ☐ Maintenance	"	"	0900	2/26/13	Rb
☒ Calibration ☐ Maintenance	"	"	1000	3/5/13	MC
☒ Calibration ☐ Maintenance	"	"	1300	3/6/13	MC
☒ Calibration ☐ Maintenance	"	"	1000	3/7/13	MC
☒ Calibration ☐ Maintenance	"	"	0930	3/8/13	MC
☒ Calibration ☐ Maintenance	"	"	0900	3/9/13	MC
☒ Calibration ☐ Maintenance	"	"	MC 1400	3/10/13	MC
☒ Calibration ☐ Maintenance	"	"	0830	3/11/13	MC
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					

Oa on Hand-held pH Meter Model pH 11 – Mainten ce and Calibration Log Sheet

Action Performed	Description	pH 7.0 Check (6.95 – 7.05)	Time	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated @ 4, 7, + 10	7.01	1113	2/1/13	RD
☒ Calibration ☐ Maintenance	" "	7.00	1700	2/2/13	MC
☒ Calibration ☐ Maintenance	" "	7.01	1000	2/3/13	MC
☒ Calibration ☐ Maintenance	" "	7.01	1500	2/4/13	MC
☒ Calibration ☐ Maintenance	" "	7.00	0849	2/5/13	RD
☒ Calibration ☐ Maintenance	" "	6.99	0916	2/6/13	RD
☒ Calibration ☐ Maintenance	" "	7.00	0915	2/7/13	MC
☒ Calibration ☐ Maintenance	" "	~~1150~~ RD 7.01	1150	2/8/13	RD
☒ Calibration ☐ Maintenance	" "	7.60	1050	2/9/13	GR
☒ Calibration ☐ Maintenance	" "	7.00	1400	2/10/13	RD
☒ Calibration ☐ Maintenance	" "	7.00	0830	2/11/13	MC
☒ Calibration ☐ Maintenance	" "	7.00	0930	2/12/13	MC
☒ Calibration ☐ Maintenance	" "	6.99	0800	2/13/13	MC
☒ Calibration ☐ Maintenance	" "	7.00	0800	2/14/13	MC
☒ Calibration ☐ Maintenance	" "	7.00	0830	2/15/13	RD
☒ Calibration ☐ Maintenance	" "	7.01	1100	2/16/13	RD
☒ Calibration ☐ Maintenance	" "	7.00	1045	2/17/13	MC
✓ Cal.	" "	7.00	0830	2/18/13	MC

Oakton Hand-held pH Meter Model pH 11 – Maintenance and Calibration Log Sheet

Action Performed	Description	pH 7.0 Check (6.95 – 7.05)	Time	Date	Analyst Initials
☒ Calibration ☐ Maintenance	Calibrated @ 4, 7, + 10	6.96	0952	2/19/13	RD
☒ Calibration ☐ Maintenance	" "	7.01	0900	2/20/13	mc
☒ Calibration ☐ Maintenance	" "	7.03	0900	2/21/13	RD
☒ Calibration ☐ Maintenance	" "	7.03	1300	2/22/13	RD
☒ Calibration ☐ Maintenance	" "	7.06	1110	2/23/13	GR.
☒ Calibration ☐ Maintenance	" "	7.05	1330	2/24/13	RD
☒ Calibration ☐ Maintenance	" "	~~1000~~ RD 7.05	1000	2/25/13	RD
☒ Calibration ☐ Maintenance	" "	~~0900~~ RD 7.05	0900		
☒ Calibration ☐ Maintenance	" "	7.04	1000	3/5/13	me
☒ Calibration ☐ Maintenance	" "	7.03	1300	3/6/13	mc
☒ Calibration ☐ Maintenance	" "	7.03	1000	3/7/13	mc
☒ Calibration ☐ Maintenance	" "	7.04	0930	3/8/13	me
☒ Calibration ☐ Maintenance	" "	7.04	0900	3/9/13	me
☒ Calibration ☐ Maintenance	" "	7.03	1400	3/10/13	me
☒ Calibration ☐ Maintenance	" "	7.01	0830	3/11/13	me
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					
☐ Calibration ☐ Maintenance					

ORGANISM ARRIVAL LOG

Date Received	Received From	Species Nephtys^{MB}	Batch ID	Project	Age when shipped	Number Ordered	Organism Condition (e.g. number dead)	Initial Water Quality				Dripped with	Analyst Initials
								pH	D.O.	Temp.	Salinity		
07/18/12	Brezina	~~Nephtys~~ ~~Neanthes~~	071812Ne	NAVFAC Fish Co	1 day	~~60~~ ^{MB} 125	good	7.52	30	17.4	33.5	33 psu	BN
07/18/12	Va Institute	C. virginica	071812Cv	NAVFAC Fish Co	1 day	60	good	—	—	—	—	33 psu	MB
07/18/12	Carlsbad	M. gallo	071812My	NAVFAC Fish Co	1 day	Bioassay batch	good	—	—	—	—	33 psu	MB
8/28/12	ABS	A. bahia	082812Ab	PSNS/PVA	3 day	960	GOOD	7.23	12.4	24.0	27.9	30ART	MC
9/11/12	AMEC	S. purpuratus	091112Sp	PSNS	-	1 batch	good	-	-	-	-	Flowthru	MC
10/4/12	AMEC	S. purpuratus	100412Sp	Literature	-	1 batch	good	-	-	-	-	-	MC
11/8/12	Reed Gunstone	M. nasuta	110812Mn	NESDISEAP-ETV	-	~110 clams	Good - 1 dead	-	-	-	-	34 FSW	MC/RD
11/9/12	Yves Ⓐ Nakahama	E. esturaius	110912Ee	NESDISEAPETV	3-5mm	1012+10%	Good-8 dead	-	-	13.1	—	34 FSW	MC/RD
11/9/12	ATS	Neanthes	110912Na	NESDISEAPETV	emerge 10/22/12	900	good	7.15	6.78	20.0	25.8	34 FSW	MC/RD
11/30/12	ABS	A affinis	113012Aa#1	NESDISEAP-ETV	8 days	575	good - 19 dead	7.37	10.6	19.3	28.4	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab#1	NESDISEAP-ETV	1 day	575	good	7.49	12.5	19.3	27.8	34 FSW	MC
11/30/12	ABS	A. affinis	113012Aa#2	PVA	10 days	800	good - 38 dead	7.29	10.1	19.3	28.0	34 FSW	MC
11/30/12	ABS	A. bahia	113012Ab#2	PVA	1 day	1100	good	7.49	12.5	19.3	27.8	34 FSW	MC
1/31/13	Reed Gunstone	M. nasuta	013113Mn	NESDISEAPETV	—	~100	good - 2 dead	—	—	—	—	34 FSW	RD
2/1/13	ATS	Neanthes	020113Na	NESDISEAPETV	emerge 1/14/13	500	good	7.40	6.9	18.5	29.3	34 FSW	RD
2/12/13	ABS	A. bahia	021213Ab	PSNS/Biofuel	3 days	1000+100	good	7.68	11.8	16.9	24.8	34 FSW	MC
2/13/13	Nautilus	S. purpuratus	021313Sp	PSNS/Biofuel	—	1 batch	good	—	—	—	—	—	RD
2/13/13	Carlsbad	M. gallo	021313My	PSNS/Biofuel	—	1 batch	good	—	—	—	—	—	RD
2/28/13	NWA	E. estuarius	022813Ee	BIGHT 13	3-5mm	1260+10%	good	-	-	14.2	-	34 FSW	MC

Ⓐ Northwest Aquatic

Species

A.a. - Atherinops affinis
A.b.- Americamysis bahia
C.g. - Crassostrea gigas
C.h. - Ceratocorys horrida
M.g. - Mytilus galloprovincialis

R.a.- Rhepoxinius abronius
S.p. - Strongylocentrotus purpuratus
E.e. - Eohaustorius esturaius
M.b. - Menidia beryllina
Other: Mn - Macoma nasuta

TEST ORGANISM ACCLIMATION LOG

Date	Time	Species	Batch ID	Age (d)	Condition (e.g. # dead)	Water Quality				Tank Cleaned	Dripped with	Fed (Y/N)	Analyst Initials
						pH	D.O.	Temp.	Salinity				
2/1/13	1145	macoma	013113Mn	—	good	7.88	7.3	17.4	33.9	N	—	N	RD
2/2/13	1715	Macoma	013113Mn	-	good	7.91	7.3	17.8	33.8	Y	34FSW	N	MC
2/2/13	1715	Neanthes	020113 Na	19d	ø good	7.81	7.4	17.8	30.9	Y	34FSW	Y	MC
2/3/13	1015	Macoma	013113Mn	-	good	7.82	7.0	17.6	33.9	Y	34FSW	N	MC
2/3/13	1015	Neanthes	020113 Na	20d	ø good	7.81	7.3	17.5	32.0	Y	34FSW	Y	MC
2/4/13	1515	macoma	013113Mn	-	good	7.76	7.2	17.8	33.9	N	--	N	MC
2/4/13	1515	neanthes	020113 Na	21d	good	7.82	7.4	17.7	33.2	N	—	Y	MC
2/5/13	0851	macoma	013113 Mn	—	good	7.96	7.3	17.5	34.3	N	-	N	RD
2/5/13	0851	Neanthus	020113 Na	22d	good	8.01	7.4	17.5	31.6	N	-	Y	RD
2/6/13	0924	Neanthus	020113 Na	23d	good	7.90	7.1	17.5	32.5	N	-	N	RD
2/6/13	0933	Maccoma	013113Mn	-	good	7.89	7.4	17.6	34.6	N	-	N	RD
3/1/13	0800	Ech	022813Ee	-	good(7d)	7.84	7.7	15.1	35.0	Y	34FSW	N	MC
3/4/13	0900	Ech	022813Ee	-	good(2d)	7.81	7.6	15.2	35.0	Y	34FSW	N	MC

Notes: ____

Aquatic Toxicology Support
1849 Charleston Beach Road West
Bremerton, Washington 98312
(360) 813-1202

Order Summary

Species: *Neanthes arenaceodentata**	Emerge Date: Jan 14-16 '13
Number Ordered: 800	Number Shipped: 800 + 10%
Date Shipped: Jan 31'13	Salinity (ppt): 30

*Smith 1964. CSU Long Beach strain. Feed upon arrival.

Copper Reference Toxicant Test for *Neanthes arenaceodentata*

Stock solution: 1000 mg/L = 9924 mg/L
Stock solution source: SSC Pacific
Verified?: Yes, by Brandon Swope (SSC Pacifici) by ICP-MS on 09/2011
Test Concentrations: 0, 25, 50, 100, 200, 400 µg/L
Test volume per replicate: 500 mL
No. replicates per concentration: 3
Diluent: filtered seawater (FSW) from SSC Cold Room (~33 psu)

1) Create 250 mL of a 5 mg/L substock in filtered seawater (FSW)

Cu Stock	1.25 mL	C1V1=C2V2
FSW:	248.75 mL	1000 (V1)= (5)(250 mL)
Total Vol:	250 mL	V1=01.25 mL stock in 248.75 mL FSW

2) Create test solutions using 5 mg/L sub-stock as follows:

Test Conc. (µg/L)	**Stock (mL)**	**FSW (mL)**	**Total Vol (mL)**	C1	**V1**	C2	V2
0	0.0	1500.0	1500	5000	**0**	0	1500
25	7.5	1492.5	1500	5000	**7.5**	25	1500
50	15	1485	1500	5000	**15**	50	1500
100	30	1470	1500	5000	**30**	100	1500
200	60	1440	1500	5000	**60**	200	1500
400	120	1380	1500	5000	**120**	400	1500
Total	233	8768	9000				

SPAWAR
Systems Center PACIFIC

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ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY
BRANCH, CODE 7176
53475 STROTHE ROAD
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 2/21/2013
Page: 1 of 3

Project Title/Project Number: USEPA Environ. Tech. Verification (ETV) Testing: SEA Ring

Project Leader: Gunther Rosen

Remarks/Air Bill Tracking №: Samples shipped via FEDEX priority overnight -

Contact: Gunther Rosen

Sampler(s): (Signature) G.Rosen (Code 7176) /

Contact Tel: (619) 890-9692 & (619) 553-0886

Tel: 619-890-9692

Fax: 619-553-6305

Email: *gunther.rosen@navy.mil*

Special Instructions:
Kept dark & cold (4 °C)

						Requested Analyses						
Field Sample Identification	**Date**	**Local Time**	**№ containers**	**Matrix**	**Pres.**	PCB congeners	grainsize	TOC				
PSNS	2/4/2013		1-8oz.	Sediment	none	X		X				
PSNS			1-ziploc	Sediment	none		X					
				Sediment	none							
				Sediment	none							
				Sediment	none							
				Sediment	none							
				Sediment	none							

Relinquished by: (Signature)

Received by: (Signature)

Date: 2/21/2013

Time: 1300

Relinquished by: (Signature)

Received by: (Signature)

Date:

Time:

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Systems Center
San Diego

ENVIRONMENTAL SCIENCES AND
APPLIED SYSTEMS BRANCH, CODE 71750
53605 HULL STREET
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 2/21/2013
Page: 2 of 3

Project Title/Project Number: USEPA ETV Testing : SEA Ring
Project Leader: Gunther Rosen
Remarks/Air Bill: Samples shipped via FedEx priority overnight
Contact: Gunther Rosen
Sampler(s): (Signature) G. Rosen, M. Colvin, R. Dolecal
Contact Tel: (619)553-0886
Tel: (619)553-0886
Fax: (619)553-6305
Email: gunther.rosen@navy.mil
Special Instructions:

Requested Analyses

	Field Sample Identification	Date	Time	Matrix	~~Type~~ wet weight(g)	Temp (°C)	PCB Congeners	Lipids								
1	BK-MN-DB-A	2/21/2013	0930	TISSUE	1.2		X									
2	BK-MN-DB-B	"		"	1.2620		X	X								
3	BK-MN-DB-C	"		"	1.1465		X									
4	BK-MN-PSNS-A	"		"	1.0406		X									
5	BK-MN-PSNS-B	"		"	1.1429		X									
6	BK-MN-PSNS-C	"		"	1.1652		X	X								
7	SR-MN-DB-A	"		"	1.1827		X									
8	SR-MN-DB-B	"		"	1.3730		X	X								
9	SR-MN-DB-C	"		"	1.3722		X									
10	SR-MN-PSNS-A	"		"	1.5300		X	X								
11	SR-MN-PSNS-B	"		"	1.3152		X									
12	SR-MN-PSNS-C	"		"	1.1673		X									
13	T0-MN-A	"		"	1.7608		X	X								
14	T0-MN-B	"		"	1.6710		X									
15	T0-MN-C	"		"	1.7701		X									

Relinquished by: (Signature)	**Received by: (Signature)**	**Date:** 2/21/2013	**Time:** 1300
Relinquished by: (Signature)	**Received by: (Signature)**	**Date:**	**Time:**

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Systems Center
San Diego

ENVIRONMENTAL SCIENCES AND
APPLIED SYSTEMS BRANCH, CODE 71750
53605 HULL STREET
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 2/21/2013
Page: 3 of 3

Project Title/Project Number: USEPA ETV Testing: SEARing
Project Leader: Gunther Rosen
Remarks/Air Bill: Samples shipped via FedEx priority overnight
Contact: Gunther Rosen
Sampler(s): (Signature) G. Rosen, M. Colvin, R. Dolecal
Contact Tel: (619) 553-0886
Tel: (619) 553-0886
Fax (619) 553-6305
Email: gunther.rosen@navy.mil
Special Instructions:

						Requested Analyses									
Field Sample Identification	**Date**	**Time**	**Matrix**	wet wt ~~**Type**~~ (mg)	**Temp (°C)**	PCB Congeners	Lipid								
16 T0-Ee-A	11/16/12		TISSUE	166.2		X									
17 T0-Ee-B	↓		↓	252.0		X	X								
18 T0-Ee-C				148.0	145.0 GR	X									
19 YB1-B	11/26/12			148.6		X	X								
20 YB2-B	↓			134.9		X									
21 YB3-B				138.0		X									
22 YB1-SR				140.5		X									
23 YB2-SR				132.3		X									
24 YB3-SR				143.7		X	X								
25 PSNS1-SR				105.7		X									
26 PSNS2-SR				99.5		X									
27 PSNS3-SR				113.2		X	X								
28 PSNS1-B				112.9		X									
29 PSNS2-B				93.9		X									
30 PSNS3-B				110.0		X	X								

Relinquished by: (Signature)	**Received by: (Signature)**	**Date:** 2/21/2013	**Time:** 1300
Relinquished by: (Signature)	**Received by: (Signature)**	**Date:**	**Time:**

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San Diego

ENVIRONMENTAL SCIENCES AND
APPLIED SYSTEMS BRANCH, CODE 71750
53605 HULL STREET
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 2/27/13
Page: of

Project Title/Project Number: USEPA ETV Testing: SEA Ring
Project Leader: Gunther Rosen
Remarks/Air Bill: Samples shipped via FedEx priority overnight
Contact: Gunther Rosen
Sampler(s): (Signature) G. Rosen, M. Colvin, R. Dolecal
Contact Tel: (619) 553-0886
Tel: (619) 553-0886 **Fax:** (619) 553-6305 **Email:** gunther.rosen@navy.mil
Special Instructions:

Requested Analyses

	Field Sample Identification	Date	Time	Matrix	~~Type~~ wet weight(g)	Temp (°C)	PCB Congeners	Lipids								
1	BK-Na-YB-C	2/27/13	0900	tissue	222.4		X	X								
2	BK-Na-YB-D	"	"	"	166.7		X									
3	BK-Na-YB-E	"	"	"	140.4		X									
4	SR-Na-YB-A	"	"	"	184.9		X	X								
5	SR-Na-YB-B	"	"	"	178.2		X									
6	SR-Na-YB-D	"	"	"	168.1		X									
7	SR-Na-PSNS-A	"	"	"	219.7		X									
8	SR-Na-PSNS-B	"	"	"	216.7		X									
9	SR-Na-PSNS-D	"	"	"	222.7		X	X								
10	BK-Na-PSNS-A	"	"	"	144.3		X	X								
11	BK-Na-PSNS-B	"	"	"	137.6		X									
12	BK-Na-PSNS-C	"	"	"	134.4		X									
13	ETV-Na-Day 0	2/6/13	0900	"	223.0		X	X								

Relinquished by: (Signature) Renee Dolecal	**Received by: (Signature)**	**Date:** 2/27/13	**Time:** 1400
Relinquished by: (Signature)	**Received by: (Signature)**	**Date:**	**Time:**

14-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: lab Control - Discovery Bay - SR004

Test No.: SSC - 2013 - 0041

Test Species: *M. nasuta*

Start Date/Time: 2/6/2013 1100

End Date/Time: 2/20/2013 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	33.9	17.9	7.6	8.12	N	RD/MC	
1	338	17.6	7.4	8.09		RD/MC	
2	33.7	17.7	7.5	7.92	Y	RD	Clams burrowed
3	33.7	17.5	7.5	8.13		GR	" "
4	33.9	18.0	7.5	8.11		RD	" "
5	33.7	17.7	7.6	8.13	Y	RD	" "
6	33.5	17.6	7.6	8.07		RD/MC	" "
7	33.8	17.7	7.4	8.02	Y	MC	" "
8	34	18.5	7.6	7.99		MC	" "
9	34	18.2	7.6	7.96	Y	RD	" "
10	34	18.2	7.5	8.11		RD	" "
11	34	18.3	7.5	8.19		MC	" "
12	34	18.4	7.5	8.11	Y	MC	" "
13	34	18.1	7.5	7.95		RD	Rep 9, one clam on surface
14	34	18.5	7.5	8.19		MC	All burrowed

QC Check: ML 3/12/13

Final Review: GR 3/12/13

14-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: PSNS Sediment - SR 002

Test No.: SSC - 2013- 0044

Test Species: *M. nasuta*

Start Date/Time: 2/6/2013 1100

End Date/Time: 2/20/2013 0930

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	33.8	18.5	7.4	8.04	N	RD/MC	
1	33.2	17.5	7.4	8.03		RD/MC	
2	32.9	17.7	7.2	7.91	y	RD	clams burrowed
3	33.6	17.4	7.3	8.11		GR	" "
4	33.9	17.8	7.5	8.11		RD	" "
5	33.7	17.8	7.5	8.13	y	RD	" "
6	33.5	17.5	7.4	8.07		RD/MC	" "
7	33.7	17.7	7.5	8.01	y	MC	" "
8	34	18.5	7.4	7.97		MC	" "
9	34	18.2	7.3	7.95	y	RD	" "
10	34	18.2	7.5	8.07		RD	" "
11	34	18.5	7.4	8.16		MC	" "
12	34	18.4	7.5	8.10	y	MC	" "
13	34	18.2	7.5	7.99		RD	" "
14	34	18.5	7.4	8.17		MC	" "

QC Check: JLC 3/12/13

Final Review: GR 3/12/13

14-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV
Sample ID: lab control - Discovery Bay - Beakers
Test No.: SSC-2013-0046

Test Species: *M. nasuta*
Start Date/Time: 2/6/2013 1100
End Date/Time: 2/20/2013 1000

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	33.1	17.8	7.5	8.13	N	RD	
1	33.2	17.7	7.5	8.07		RD	
2	33.4	17.6	7.5	7.96	y	RD	clams burrowed
3	33.6	17.7	7.5	8.10		GR	" "
4	33.6	17.8	7.5	8.08		RD	" "
5	33.6	17.8	7.5	8.16	y	RP	" "
6	33.6	17.7	7.5	8.08		RD	" "
7	33.5	17.7	7,5	8.10	y	MC	" "
8	34	18.4	7.5	7.99		MC	" "
9	34	18.4	7.5	7.95	y	RD	" "
10	34	18.4	7.5	8.08		RD	" "
11	34	18.5	7.4	8.16		MC	" "
12	34	18.4	7.5	8.12	y	MC	" "
13	34	18.5	7.4	7.93		RD	" "
14	34	18.3	7.4	8.14		MC	" "

QC Check: MC 3/12/13

Final Review: GR 3/12/13

14-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: PSNS Sediment - Beakers

Test No.: SSC-2013-0049

Test Species: *M. nasuta*

Start Date/Time: 2/6/2013 1100

End Date/Time: 2/20/2013 1000

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Water Change	Technician Initials	Comments
0	33.4	17.8	7.4	8.14	N	RD	
1	33.3	17.7	7.4	8.16		RD	
2	33.1	17.8	7.4	8.03	y	RD	clams burrowed RepA - 1 on surface
3	335	17.8	7.4	8.19		GR	Still one RepA on surface
4	334	17.8	7.4	8.23		RD	" "
5	33.5	17.7	7.4	8.25	y	RD	" " , siphon out
6	336	17.7	7.4	8.14		RD	clams all burrowed
7	33.7	17.8	7.5	8.09	y	MC	" "
8	34	18.4	7.4	8.04		MC	" "
9	34	18.4	7.4	8.07	y	RD	" "
10	34	18.4	7.4	8.10		RD	" "
11	34	18.5	7.4	8.21		MC	" "
12	34	18.4	7.5	8.13	y	MC	" "
13	34	18.5	7.4	8.07		RD	" "
14	34	18.3	7.4	8.19		MC	" "

QC Check: MC 3/12/13

Final Review: GR 3/12/13

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV

Sample ID: SEA Ring - DB/PSNS Sediment

Test No.: SSC-2013-0041, -0044

Test Species: *M. nasuta*

Start Date/Time: 2/6/13, 1100

End Date/Time: 2/20/13 0930

Sample ID	Initial No.	No. Recovered	Technician Initials
SR-MN-PSNS-1	3	3	RD/MC
2	3	3	↓
3	3	3	
4	3	3	
5	3	3	
SR-Mn-DB-1	3	3	
2	3	3	
3	3	3	
4	3	3	
5	3	3	↓

QC Check: GR

Final Review: RD / MC 3/12/13

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV
Sample ID: Beakers- DB / PSNS Sediment
Test No.: SSC-2013 -0046, -0049

Test Species: *M. nasuta*
Start Date/Time: 2/6/13, 1100
End Date/Time: 2/20/13, 1000

Sample ID	Initial No.	No. Recovered	Technician Initials
BK-MN-DB-A	3	3	RD/MC
B	3	3	
C	3	3	
D	3	3	
E	3	3	
BK-Mn-PSNS-A	3	3	
B	3	3	
C	3	3	
D	3	3	
E	3	3	

QC Check: GR

Final Review: RD/MC 3/12/13

20-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: lab Control - Yaquina Bay - 3R004

Test No.: SSC 2013 - 0040

Test Species: *N. arenaceodentata*

Start Date/Time: 2/6/2013 1130

End Date/Time: 2/26/2013 0900

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	SR lights ~~Comments~~	
								battery	pump
0	33.7	17.9	7.6	8.12	N		RD/MC		
1	33.8	17.6	7.6	8.10			RD/MC		
2	33.5	17.7	7.5	7.88	y	y	RD	green	2X
3	33.7	17.5	7.5	8.12			GR	green	2X
4	33.9	17.8	7.5	8.13			RD	green	2X
5	33.1	17.7	7.5	8.11	y	y	RD	"	"
6	33.4	17.6	7.5	8.05			RD/MC	"	"
7	33.4	17.7	7.4	8.02			MC	"	"
8	34	18.4	7.5	7.96			MC	"	"
9	34	18.3	7.4	7.94	y	y	RD	"	"
10	34	18.2	7.5	8.08			RD	"	"
11	34	18.2	7.5	8.14			MC	No light	"
12	34	18.3	7.5	8.15	y	y	MC	No light	"
13	34	18.3	7.5	7.92			RD	Red	"
14	34	18.4	7.4	8.18			MC	Red	"
15	34	18.2	7.5	8.26			MC	Red	"
16	34	18.0	7.6	7.99	y	y	RD	No light	"
17	34	17.7	7.6	8.10			GR	orange	"
18	34	18.1	7.6	8.14			RD	red	"
19	34	18.0	7.7	8.06	y	y	RD	red	"
20	34	18.1	7.6	8.12			MC/RD	"	"

QC Check: MC 3/12/13

Final Review: GR 3/12/13

20-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: MS Sediment · SR003

Test No.: SSC - 2013-0042

Test Species: *N. arenaceodentata*

Start Date/Time: 2/6/2013 1130

End Date/Time: 2/26/2013 0900

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	SR Lights ~~Comments~~	
								BATT	PUMP
0	33.7	18.2	7.5	8.12	N		RD/ME		
1	33.8	17.7	7.5	8.16			RD/ME		
2	33.8	17.7	7.5	7.92	Y	y	RD	green	2x
3	33.6	17.3	7.5	8.14			GR	green	2x tubesprout
4	33.9	17.8	7.3	8.09			RD	green	2X " "
5	33.7	17.7	7.4	8.13	Y	y	RD	"	" " "
6	33.6	17.6	7.4	8.07			RD/ME	"	"
7	33.7	17.7	7.5	8.04			ME	"	"
8	34	18.4	7.5	7.99			ME	"	"
9	34	18.2	7.5	8.10	y	y	RD	"	"
10	34	18.3	7.4	8.10			RD	No lights	"
11	34	18.6	7.5	8.19			MC	Red	"
12	34	18.5	7 4	8.11	y	y	MC	No lights	"
13	34	18.1	7.5	797			RD	Red	"
14	34	18.5	7.4	8.17			MC	"	"
15	34	18.4	7.6	8.15			MC	"	"
16	34	18.0	7.5	8.01	y	y	RD	No light	"
17	34	17.8	7.6	8.16			GR	orange	"
18	34	18.2	7.5	8.13			RD	red	"
19	34	18.1	5.4	7.59	y	y	RD	Red	"
20	34	18.0	7.5	8.12			MC/RD	"	"

QC Check: ME 3/12/13

Final Review: GR 3/12/13

20-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV

Sample ID: PSNS Sediment - SR002

Test No.: SSC-2013-0043

Test Species: *N. arenaceodentata*

Start Date/Time: 2/6/2013 1130

End Date/Time: 2/26/2013 0900

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	SR lights ~~Comments~~ Batt	Pump	
0	339	18.3	7.4	8.03	N		RD/MC			
1	336	17.6	7.5	8.02			RD/MC			
2	33.5	17.7	7.4	791	Y	Y	RD	green	2x	
3	337	17.4	7.4	811			GR	green	2x	new tubes
4	34.0	17.8	7.4	8.09			RD	green	2x	"
5	329	17.8	7.4	8.13	Y	y	RD	"	"	"
6	336	17.5	7.4	8.05			RD MC	"	"	"
7	33.5	17.6	7.5	8.01			MC	"	"	
8	34	18.4	7.4	7.99			MC	"	"	
9	34	18.2	7.4	7.97	y	y	RD	red	2x - charged 1hr	
10	34	18.3	7.4	8.08			RD	green	2x	
11	34	18.5	7.3	8.16			MC	red	2x	
12	34	18.4	7.4	8.10	y	y	MC	no light	2x	
13	34 MC	18.2	7.4	7.98			RD	red	"	
14	3~~4~~4	18.4	7.4	8.17			MC	"	"	
15	34	18.4	7.5	8.21			MC	"	"	
16	34	18.1	7.6	8.03	y	y	RD	no light	"	
17	34	18.1	7.6	8.16			GR	orange	"	
18	34	18.1	7.6	8.15			RD	red	"	
19	34	18.2	7.1	8.05	y	y	RD	red	"	
20	34	18.1	7.6	8.14			MC/RD	"	"	

QC Check: MC 3/12/13

Final Review: GR 3/13/13

20-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV
Sample ID: Lab Control - Yaquina Bay - Beakers
Test No.: SSC 2013-0045

Test Species: *N. arenaceodentata*
Start Date/Time: 2/6/2013 1130
End Date/Time: 2/26/2013 0900

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	33.2	17.9	7.5	8.10	N		RD	
1	33.1	17.9	7.6	8.06			RD	
2	33.1	17.9	7.5	7.93	y	y	RD	
3	33.5	17.7	7.5	8.07			GR	
4	33.5	17.9	7.5	8.07			RD	
5	33.5	17.8	7.5	8.10	y	y	RD	
6	33.3	17.8	7.5	8.08			RD	
7	33.5	17.7	7.5	8.08			MC	
8	34	18.4	7.5	7.99			MC	
9	34	18.4	7.5	7.96	y	y	RD	
10	34	18.4	7.5	8.08			RD	
11	34	18.7	7.4	8.16			MC	
12	34	18.6	7.5	8.10	y	y	MC	
13	34	18.5	7.5	7.97			RD	
14	34	18.4	7.4	7.82			MC	
15	34	18.2	7.6	8.12			MC	
16	34	18.3	7.6	8.05	y	y	RD	
17	34	18.3	7.6	8.12			GR	
18	34	18.3	7.6	8.14			RD	
19	34	18.3	7.6	8.08	y	y	RD	
20	34	18.6	7.5	8.05			MC/RD	

QC Check: MC 3/12/13

Final Review: GR 3/12/13

20-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV
Sample ID: NS Sediment - Beakers
Test No.: SSC-2013-0047

Test Species: *N. arenaceodentata*
Start Date/Time: 2/6/2013 1130
End Date/Time: 2/26/2013 0900

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	33.4	17.8	7.3	8.03	N		RD	
1	33.3	17.8	7.4	8.03			RD	
2	33.1	17.8	7.3	7.87	y	y	RD	
3	33.4	17.7	7.3	8.01			GR	
4	33.3	17.8	7.4	8.07			RD	
5	33.3	17.7	7.4	8.12	y	y	RD	
6	33.5	17.7	7.4	8.06			RD	
7	33.5	17.7	7.4	7.95			MC	
8	34	18.4	7.3	7.89			MC	
9	34	18.4	7.4	7.68	y	y	RD	
10	34	18.3	7.4	8.03			RD	
11	34	18.4	7.4	8.10			MC	
12	34	18.6	7.5	8.14	y	y	MC	
13	34	18.4	7.4	7.93			RD	
14	34	18.3	7.4	8.04			MC	
15	34	18.2	7.6	8.07			MC	
16	34	18.1	7.6	7.97	y	y	RD	
17	34	18.2	7.5	8.09			GR	
18	34	18.3	7.5	8.07			RD	
19	34	18.3	7.5	8.04	y	y	RD	
20	34	18.4	7.4	8.02			MC/RD	

QC Check: MC 3/12/13

Final Review: GR 3/12/13

20-Day Marine Sediment Bioassay
Static-Renewal Conditions

Water Quality Measurements

Project ID: NESDI SEAP - ETV
Sample ID: PSNS Sediment - Beakers
Test No.: SSC - 2013 - 0048

Test Species: *N. arenaceodentata*
Start Date/Time: 2/6/2013 1130
End Date/Time: 2/26/2013 0900

Test Day	Salinity (ppt)	Temperature (°C)	Dissolved Oxygen (mg/L)	pH (units)	Fed	Water Change	Technician Initials	Comments
0	33.4	17.8	7.4	8.11	N		RD	
1	33.2	17.8	7.4	8.12			RD	
2	33.0	17.8	7.4	8.04	y	y	RD	
3	334	17.7	7.4	8.15			GR	
4	334	17.7	7.4	8.24			RD	
5	33.3	17.7	7.4	8.29	y	y	RD	
6	335	17.7	7.4	8.16			RD	
7	335	17.8	7.5	8.11			MC	
8	34	18.4	7.4	8.10			MC	
9	34	18.~~3~~4 MC	7.4	7.94	y	y	RD	
10	34	18.~~5~~3 MC	7.4	8.19			RD	
11	34	18.~~4~~5 MC	7.3	8.27			MC	
12	34	18.~~4~~4 MC	7.4	8.15	y	y	MC	
13	34	18.~~3~~4 MC	7.4	8.16			RD	
14	34	18.~~0~~3 MC	7.4	8.28			MC	
15	34	18.~~1~~0 MC	7.6	8.24			MC	
16	34	18.2	7.5	8.17	y	y	RD	
17	3~~3~~4 MC	18.2	7.4	8.29			GR	
18	34	18.3	7.5	8.24			RD	
19	34	18.3	7.6	8.21	y	y	RD	
20	34	18.4	7.5	8.17			MC/RD	

QC Check: MC 3/12/13

Final Review: GR 3/12/13

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV
Sample ID: YB/MS/PSNS Sediment-SR
Test No.: SSC-2013-0040, -0042, -0043
Test Species: *N. arenaceodentata*
Start Date/Time: 2/6/13, 1130
End Date/Time: 2/26/13, 0900

Sample ID	Initial No.	No. Recovered	Pan Weight ~~(mg)~~ (g)	Pan + Org. Weight ~~(mg)~~ WET (g)	Pan + Org. Weight (mg) DRY	Technician Initials
SR-~~YB~~Na-YBA	20	20	1.1964	1.3811	—	RB/MC
SR-Na-YB-B	20	19	1.2299	1.4081	—	
SR-Na-YB-C	20	14*	1.1934	1.3340	—	
SR-Na-YB-D	20	16 (4 dead body)	1.1961	1.3642	—	
SR-Na-YB-E	20	20	1.2298	1.3660	—	
SR-Na-ms-A	20	16	0.5310	0.6971	0.5637	
SR-Na-ms-B	20	20	0.5373	0.6948	0.5726	
SR-Na-ms-C	20	20	0.5269	0.6909	0.5671	
SR-Na-ms-D	20	20	0.5197	0.6827	0.5533	
SR-Na-ms-E	20	19	0.5265	0.6964	0.5621	
SR-Na-PSNS A	20	20	1.2035	1.4282	—	
SR-Na-PSNS B	20	20	1.1981	1.4148	—	
SR-Na-PSNS-C	20	17	1.2297	1.4309	—	
SR-Na-PSNS-D	20	20	1.1933	1.4160	—	
SR-Na-PSNS-E	20	19	1.2033	1.3854	—	↓

QC Check: JLL 3/12/13 **Final Review:** GR 3/12/13

* chamber spilled, worms ~~potentially~~ lost, Replicate excluded from survival & wet weight summaries/statistics. JLC 3/12/13

Marine Sediment Bioassay **Organism Survival**

Project ID: NESDI SEAP - ETV

Sample ID: YB/ms/PSNS Sediment - Beakers

Test No.: SSC-2013-0045, -0047, -0048

Test Species: *N. arenaceodentata*

Start Date/Time: 2/6/13, 1130

End Date/Time: 2/26/13, 0900

Sample ID	Initial No.	No. Recovered	Pan Weight ~~(mg)~~ RD (g)	Pan + Org. Weight ~~(mg)~~ RD WET (g)	Pan + Org. Weight ~~(mg)~~ DRY (g)	Technician Initials
BK-Na-YB-A	20	16	1.2410	1.3597	—	RD/MC
Bk-Na-YB-B	20	20	1.2087	1.3426	—	
BK-Na-YB C	20	19	1.1962	1.4186	—	
Bk-Na-YB-D	20	20	1.2072	1.3739	—	
Bk-Na-YB-E	20	20	1.2036	1.3440	—	
Bk-Na-ms-A	20	18	0.5257	0.6480	0.5516	
Bk-Na-ms-B	20	19	0.5373	0.6539	0.5611	
Bk-Na-ms-C	20	20	GR 0.5263 ~~0.5470~~	0.6699	0.5578	
Bk-Na-ms-D	20	20	0.5275	0.6652	0.5564	
Bk-Na-ms-E	20	17	0.5275	0.6448	~~0.5655~~ RD	0.5652
Bk-Na-PSNS-A	20	20	1.2297	1.3740	—	
Bk-Na-PSNS-B	20	20	1.1981	1.3357	—	
Bk-Na-PSNS-C	20	20	1.1796	1.3140	—	
Bk-Na-PSNS D	20	18	1.2295 ~~1.3300~~ RD	1.3524	—	
Bk-Na-PSNS-E	20	20	~~1.2295~~ RD 1.2300	1.3538	—	

QC Check: ue 3/12/13

Final Review: GR 3/12/13

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: $CuSO_4$ Reference Toxicant
Test No.: SSC - 2013-0050

Test Species: *N. arenaceodentata*
Start Date/Time: 2/6/2013, 1130
End Date/Time: 2/10/2013, 1100

	Tech Initials				
	0	24	48 RD	72	96
Counts:	MC	RD	~~RD~~	—	RD
Readings:	MC	RD	RD	GR	RD
Dilutions made by:	MC/RD				

Concentration $CuSO_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control	A	10		10		10	33.3	33.6	33.6	33.5	33.5	13.4	17.7	17.8	18.0	17.6	7.1	7.2	7.3	7.1	7.4	8.00	8.02	7.88	8.06	7.98
	B	10		10		10																				
	C	10		10		10																				
25	A	10		10		10	33.4	33.3	33.6	33.4	33.6	18.5	17.7	17.7	17.9	17.7	7.2	7.2	7.2	7.2	7.2	8.08	8.02	7.88	8.08	7.98
	B	10		10		10																				
	C	10		10		10																				
50	A	10		10		10	33.4	33.6	33.6	33.6	33.5	18.6	17.7	17.7	17.7	17.7	7.3	7.2	7.1	7.2	7.2	8.08	8.02	7.90	8.07	7.99
	B	10		10		10																				
	C	10		10		10																				
100	A	10		10		10	33.4	33.6	33.4	33.6	33.5	18.6	17.7	17.8	17.7	17.7	7.3	7.2	7.1	7.2	7.1	8.10	8.04	7.90	8.08	8.00
	B	10		10		10																				
	C	10		10		10																				
200	A	10		10		10	33.5	33.5	33.5	33.6	33.6	18.5	17.7	17.7	17.7	17.7	7.3	7.2	6.8	6.9	6.2	8.09	8.02	7.87	8.06	7.8
	B	10		5*		0																				
	C	10		10		0																				
400	A	10		0		—	33.4	33.5	33.5	—	-	18.4	17.7	17.8	—	—	7.3	7.2	6.2	—	_	8.09	8.02	7.82	—	—
	B	10		0		—																				
	C	10		0		—																				

Initial Counts QC'd by: GR

* no dead bodies - only 5 @ start?

Animal Source/Date Received: Aquatic Toxicology Support 2/1/2013
Age at Initiation: 23 days

	Feeding Times				
	0	24	48	72	96
AM:					
PM:					

Comments:
i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one ([✓ y] / n)
Tests aerated? Circle one (~~y~~ RD / [✓ n]) if yes, sample ID(s): Duration: 96hrs MC
Aeration source: N/A

QC Check: MC 3/12/13

Final Review: CR 3/12/13

Total Ammonia Analysis
Marine Samples

Project ID: **NESDI SEAP - ETV**
Test Type: **Neanthes 20-day Marine Sediment Bioassay**

Sample ID	Sample Date	Test Day	Nitrogen (mg/L)	Ammonia (mg/L) N x 1.22	Technician Initials
Blank Spike (10 mg/L NH_3)	NA	NA	9.6	11.7	RD
Lab Control-YB-SR	2/6/13	0	0	0	↓
MS Sediment-SR	↓	↓	0	0	↓
PSNS Sediment-SR	↓	↓	0	0	↓
Lab Control-YB-Beaker	↓	↓	0	0	↓
MS Sediment-Beaker	↓	↓	3.6	4.4	↓
PSNS Sediment-Beaker	↓	↓	6.2	7.6	↓
Lab Control-YB-SR	2/26/13	20	0	0	RD
MS Sediment - SR	↓	↓	0.4	0.5	↓
PSNS Sediment - SR	↓	↓	0	0	↓
Lab Control-YB-Beaker	↓	↓	0.8	1.0	↓
MS Sediment-Beaker	↓	↓	0	0	↓
PSNS Sediment-Beaker	↓	↓	0	0	↓
Blank Spike	↓	↓	9.8	11.9	↓

QC Check: RD

Final Review: ~~RD~~ MC 3/12/13

Total Ammonia Analysis
Marine Samples

Project ID: **NESDI SEAP - ETV**
Test Type: **Macoma 14-day Marine Sediment Bioassay**

N x 1.22

Sample ID	Sample Date	Test Day	Nitrogen (mg/L)	Ammonia (mg/L)	Technician Initials
Blank Spike (10 mg/L NH_3)	NA	NA	9.6	11.7	RD
Lab Control-DB-SR	2/6/13	0	-0.9	0	|
PSNS Sediment - SR	|	|	0.3	0.4	|
Lab Control-DB-Beaker	|	|	-0.7	0	|
PSNS Sediment-Beaker	↓	↓	5.8	7.1	↓

QC Check: RD

Final Review: ~~RD~~ MC 3/12/13

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: CuSo$_4$ Reference Toxicant
Test No.: SSC-2013-0054

Test Species: *A. bahia*
Start Date/Time: 3/25/2013 1300
End Date/Time: 3/29/2013 1100

	Tech Initials				
	0	24	48	72	96
Counts:	MC	MC	RD	RD mc	MC
Readings:	MC	MC	RD	RD	MC
Dilutions made by:	GR		GR		

Concentration CuSO$_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control - 0	A	10	10	10	10	10	33.9	33.8	i 33.4	33.4	33.7	19.5	20.3	i 19.7	19.6	19.7	7.8	7.0	i 5.8	6.9	6.6	8.08	7.78	i 7.76	7.84	7.84
	B	10	10	10	10	10			f —					f —					f —					f —		
	C	10	10	10	10	10																				
	D	10	10	10	10	10																				
	E	10	10	10	10	10																				
50	A	10	10	10	10	10	33.7	33.7	i 33.5	33.7	33.6	19.3	19.9	i 19.7	19.6	19.6	7.8	7.0	i 6.2	6.7	6.3	8.04	7.81	i 7.83	7.84	7.82
	B	10	10	10	10	10			f —					f —					f —					f —		
	C	10	10	10	10	10																				
	D	10	10	10	10	10																				
	E	10	10	10	10	10																				
100	A	10	10	10	10	10	33.7	33.7	i 33.4	33.7	33.7	19.1	19.8	i 19.7	19.6	19.7	7.8	7.0	i 6.1	6.6	6.3	8.04	7.85	i 7.79	7.82	7.82
	B	10	10	10	10	10			f —					f —					f —					f —		
	C	10	10	10	10	10																				
	D	10	10	10	10	10																				
	E	10	10	9	9	9																				
200	A	10	10	10	10	10	33.8	33.8	i 33.6	33.6	33.8	19.1	19.7	i 19.7	19.6	19.6	7.9	7.1	i 6.8	7.6	6.5	8.02	7.85	i 7.87	7.88	7.88
	B	10	10	9	8	8			f —					f —					f —					f —		
	C	10	10	9	8	8																				
	D	10	10	7 mc	6	6																				
	E	10	10	4 3	4	4																				
400	A	10	9	1	0	–	33.3	33.7	i 33.6	33.9	–	19.2	19.6	i 19.6	19.4	–	7.9	7.3	i 6.6	7.1	–	8.00	7.89	i 7.83	7.78	–
	B	10	9	2	0	–			f —					f —					f —					f —		
	C	10	10	2	0	–																				
	D	10	10	4	0	–																				
	E	10	10	4	0	–																				
800	A	10	10 mc	1	0	–	33.6	33.8	i 33.7	33.8	–	19.1	19.6	i 19.6	19.4	–	7.9	7.4	i 7.0	7.3	–	8.02	7.89	i 7.85	7.82	–
	B	10	~~9~~ 10	3	0	–			f —					f —					f —					f —		
	C	10	10	2	0	–																				
	D	10	10	1	0	–																				
	E	10	10	6	0	–																				

Initial Counts QC'd by: GR | RD

Animal Source/Date Received: Aquatic Biosystems 3/22/2013 **Age at Initiation:** 5 days

	Feeding Times				
	0	24	48	72	96
AM:		0900	0900	1011	0900
PM:	1400	1431	1532	1541	—

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one (y / [✓ n])

Tests aerated? Circle one (y / [✓ n]) if yes, sample ID(s): Duration: 96hrs

QC Check: RD

Final Review: MC 4/2/13

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: CuSo$_4$ Reference Toxicant
Test No.: SSC-2013-0056

Test Species: *A. affinis*
Start Date/Time: 3/25/2013 1300
End Date/Time: 3/29/2013 1100

Tech Initials	0	24	48	72	96
Counts:	MC	MC	MC	MC	MC
Readings:	MC	MC	MC	RD	MC
Dilutions made by:	GR		GR		

Concentration CuSO$_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Lab Control - 0	A	5	5	5	5	5	339	335	i 338	33.7	34.0	19.5	19.6	i 19.6	19.5	19.5	7.8	7.3	i 6.9	7.2	7.2	8.09	7.86	i 7.81	7.80	7.91
	B	5	5	5	5	5			f —					f —					f —					f —		
	C	5	5	5	5	5																				
	D	5	5	5	5	5																				
	E	5	5	5	5	5																				
50	A	5	5	5	5	5	33.7	33.7	i 33.7	33.7	34.0	19.3	19.6	i 19.6	19.5	19.6	7.8	7.3	i 7.0	6.9	6.9	8.41	7.88	i 7.84	7.77	7.57
	B	5	5	5	5	5			f —					f —					f —					f —		
	C	5	5	5	5	5																				
	D	5	5	5	5	4																				
	E	5	5	5	5	5																				
100	A	5	5	1	1	1	33.7	33.8	i 33.4	33.9	33.7	19.1	19.6	i 19.6	19.5	19.6	7.8	7.3	i 7.0	7.3	7.1	8.41	7.70	i 7.84	7.85	7.73
	B	5	4	2	1	1			f —					f —					f —					f —		
	C	5	5	1	1	1																				
	D	5	5	3	2	1																				
	E	5	5	4	1	1																				
200	A	5	2	1	1	0	33.5	33.8	i 33.6	33.9	33.4	19.1	19.7	i 19.7	19.5	19.6	7.9	7.2	i 7.0	7.3	7.3	8.42	7.88	i 7.85	7.86	7.58
	B	5	3	2	0	–			f —					f —					f —					f —		
	C	5	3	1	1	1																				
	D	5	4	3	0	–																				
	E	5	1	1	0	–																				
400	A	5	0	0	0	–	33.5	33.4	i —	—	—	19.2	19.7	i —	—	—	7.9	7.3	i —	—	—	8.40	7.88	i —	—	—
	B	5	0	0	0	–			f —					f —					f —					f —		
	C	5	0	0	0	–																				
	D	5	0	0	0	–																				
	E	5	0	0	0	–																				
800	A	5	0	0	0	–	33.6	33.4	i —	—	—	19.1	19.7	i —	—	—	7.9	7.4	i —	—	—	8.40	7.80	i —	—	—
	B	5	0	0	0	–			f —					f —					f —					f —		
	C	5	0	0	0	–																				
	D	5	0	0	0	–																				
	E	5	0	0	0	–																				

Initial Counts QC'd by: GR/RD

Animal Source/Date Received: Aquatic Biosystems 3/22/2013

Age at Initiation: 15 days

Feeding Times	0	24	48	72	96
AM:		0930	0904	1011	0900
PM:	1400	1434	1504	1541	–

Comments:
i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one (y / [✓ n])
Tests aerated? Circle one (y / [✓ n]) if yes, sample ID(s): Duration: 96 hrs

QC Check: RD

Final Review: MC 4/2/13

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: SEA Ring Exposures
Test No.: SSC-2013-0053

Test Species: *A. bahia*
Start Date/Time: 3/25/2013 1330
End Date/Time: 3/29/2013 1130

	Tech Initials				
	0	24	48	72	96
Counts:	MC	—	—	—	MC
Readings:	MC	MC	RD	RD	MC
Dilutions made by:	GR		GR		

Concentration CuSO₄ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
SEA Ring 004 0µg/L A	A	10				8	33.7	33.8	i 33.3	33.2	34.0	19.2	19.7	i 20.1	20.3	20.4	7.8	7.3	i 7.3	7.3	7.3	7.43	7.95	i 7.77	7.66	7.77
	B	10				*			f —					f —					f —					f —		
	C	10				8																				
	D	10				10																				
	E	10				10																				
SEA Ring 002 0µg/L B	A	10				10	33.7	33.8	i 33.7	33.7	33.6	19.4	19.5	i 19.6	19.6	20.2	7.9	7.4	i 7.2	7.0	7.3	7.95	7.95	i 7.80	7.73	7.94
	B	10				10			f —					f —					f —					f —		
	C	10				10																				
	D	10				9																				
	E	10				10																				
SEA Ring 003 100µg/L	A	10				9	33.7	33.8	i 33.8	33.7	33.7	19.2	19.9	i 19.6	19.5	20.0	7.9	7.5	i 6.0 A	6.8	7.3	7.95	7.95	i 7.76	7.76	7.91
	B	10				10			f —					f —					f —					f —		
	C	10				9																				
	D	10				10																				
	E	10				10																				
SEA Ring 013 200µg/L A	A	10				9	33.7	33.6	i 33.7	33.7	33.7	19.2	19.3	i 19.5	19.5	19.6	7.8	7.7	i 7.3	7.4	7.5	7.95	8.03	i 7.96	7.97	8.02
	B	10				5			f —					f —					f —					f —		
	C	10				6																				
	D	10				5																				
	E	10				3																				
SEA Ring 008 200µg/L B	A	10				8	33.7	33.9	i 33.8	33.8	33.7	19.4	19.1	i 19.4	19.3	19.5	7.8	7.6	i 7.3	7.4	7.5	7.12	8.03	i 8.01	8.01	8.04
	B	10				9			f —					f —					f —					f —		
	C	10				9																				
	D	10				9																				
	E	10				6																				
SEA Ring 011 400µg/L	A	10				0	33.8	33.8	i 33.7	33.8	33.7	19.2	19.1	i 19.3	19.3	19.4	7.9	7.7	i 7.4	7.6	7.5	7.83	8.05	i 8.02	8.03	8.03
	B	10				0			f —					f —					f —					f —		
	C	10				0																				
	D	10				0																				
	E	10				1																				

Initial Counts QC'd by: GR/RD * replicate dropped, no data

A air stone fell out of container

Animal Source/Date Received: Aquatic Biosystems 3/22/2013
Age at Initiation: 5 days

	Feeding Times				
	0	24	48	72	96
AM:		0900	0900	1011	0900
PM:	1400	1434	1320	1511	—

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one (y / [✓ n])

Tests aerated? Circle one (y / [✓ n]) if yes, sample ID(s):
Duration: 96hrs

QC Check: TJD

Final Review: ML 4/2/13

Marine Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Project: NESDI SEAP - ETV
Sample ID: SEA Ring Exposures
Test No.: SSC-2013-0055

Test Species: *A. affinis*
Start Date/Time: 3/25/2013 1330
End Date/Time: 3/29/2013 1136

	Tech Initials				
	0	24	48	72	96
Counts:	MC	MC	MC	-	GR
Readings:	MC	MC	RD	RD	MC
Dilutions made by:	GR		GR	—	—

Concentration CuSO$_4$ (µg/L)	Rep	Number of Live Organisms					Salinity (ppt)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
SEA Ring 004 0µg/L A	A	5				5	33.7	33.8	i 33.3	33.2	34.0	19.2	19.7	i 20.1	20.3	20.4	7.8	7.3	i 7.3	7.3	7.3	793	795	i 777	766	777
	B	5				5			f —					f —					f —					f —		
	C	5				5																				
	D	5				4																				
	E	5				5																				
SEA Ring 002 0µg/L B	A	5				5	33.7	33.8	i 33.7	33.7	33.6	19.4	19.5	i 19.6	19.6	20.2	7.9	7.4	i 7.2	7.0	7.3	795	795	i 780	778	794
	B	5				5			f —					f —					f —					f		
	C	5				5																				
	D	5				5																				
	E	5				5																				
SEA Ring 003 100µg/L	A	5				1	33.7	33.5	i 33.8	33.7	33.7	19.2	19.9	i 19.6	19.5	20.8	7.9	7.5	Ⓐ i 6.6	6.8	7.3	795	775	i 776	776	791
	B	5				1			f —					f —					f —					f —		
	C	5				1																				
	D	5				4																				
	E	5				1																				
SEA Ring 013 200µg/L A	A	5				0	33.7	33.6	i 33.7	33.7	33.7	19.2	19.3	i 19.5	19.5	19.6	7.8	7.7	i 7.3	74	75	795	803	i 796	797	802
	B	5				0			f —					f —					f —					f —		
	C	5				1																				
	D	5				0																				
	E	5				0																				
SEA Ring 008 200µg/L B	A	5				0	33.7	33.9	i 33.8	33.8	33.7	19.4	19.1	i 19.4	19.3	19.5	7.8	7.6	i 73	74	75	792	803	i 804	801	804
	B	5				1			f —					f —					f —					f —		
	C	5				1																				
	D	5				1																				
	E	5				0																				
SEA Ring 011 400µg/L	A	5				0	33.8	33.8	i 33.7	33.8	33.7	19.2	19.1	i 19.3	19.3	19.4	7.9	7.7	i 7.4	7.6	75	783	805	i 802	803	805
	B	5				0			f					f —					f —					f —		
	C	5				0																				
	D	5				0																				
	E	5				0																				

Initial Counts QC'd by: GR/RD

Ⓐ - airstone fell out of container

Animal Source/Date Received: Aquatic Biosystems 3/22/2013 **Age at Initiation:** 15 days

	Feeding Times				
	0	24	48	72	96
AM:		0900	0900	1011	0900
PM:	1400	1431	1520	1541	—

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one (y / [✓ n])

Tests aerated? Circle one (y / [✓ n]) If yes, sample ID(s): Duration: 96hrs

QC Check: RD

Final Review: MC 4/2/13

Appendix B:
Laboratory Reports

INORGANIC ANALYSIS DATA PACKAGE

Corps of Engineers – Vicksburg, MS

Report Date: 03/26/13

Lab Name: ARDL, Inc.
Samples Received at ARDL: 26-Feb-2013
Project Name: 3022201
BPA Call No. 188

ARDL Report No.: 6505

CASE NARRATIVE

Sample ID No.	Date Collected	Lab ID No.	Analysis Requested
PSNS	02/21/13	6505-01	Grain Size/TOC

NOTE: TOC analyses were performed by an outside laboratory due to instrument status.

The quality control data are summarized as follows:

LABORATORY CONTROL SAMPLES

Percent recovery of the LCS analysis was within control limits.

PREPARATION BLANKS

The result of the preparation blank was within acceptable limits.

MATRIX SPIKES

Percent recovery of all matrix spikes and matrix spike duplicates were within control limits.

DUPLICATES

Duplication between replicate analyses was acceptable.

Release of the data contained in this package has been authorized by the Technical Services Manager or his designee as verified by the following signature.

Dean S. Dickerson
Technical Services Manager

This laboratory report consists of 10 pages with the sample receipt information (chain-of-custody, cooler receipt, courier documentation, and additional instruction/email as appropriate) appended to the end of the report.

ARDL, INC.
400 Aviation Drive; P.O. Box 1566
Mt. Vernon, Illinois 62864

Lab Report No: 006505 Report Date: 03/26/2013

Project Name: 3022201
Project No: CALL #188

Analysis: TOTAL ORGANIC CARBON
NELAC Certified - IL100308

Field ID: PSNS
Sampling Loc'n: 3022201
Sampling Date: 02/21/2013
Sampling Time:

ARDL No: 006505-01
Received: 02/26/2013
Matrix: SEDIMENT
Moisture: No Moisture Present

Analyte	Detection Limit	Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run Number
Total Organic Carbon	1000	19000	MG/KG	NONE	9060	03/12/13	03/14/13	16039486

ARDL SAMPLE # 6505-01

GRAIN SIZE ANALYSIS - ASTM METHOD D422

PRELIMINARY SIEVE ANALYSIS

Sample Amount Sieved with # 4 and # 10 sieves (g): 258.02

Amt Retained on # 4 sieve: 0
Percent retained on #4: 0.00%

Amt retained on # 10 (g): 0
Percent retained on #10: 0.00%

Amt passing # 10 sieve (g): 258.02
Percent passing #10: 100.00%

HYGROSCOPIC MOISTURE

Tare Wt. (g): 1.27
Tare + Wet Wt. (g): 6.73
Tare + Dry Wt. (g): 6.6
Hygrosopic Moisture Correction Factor = **0.976**

SPECIFIC GRAVITY

Sample Wt (Mo) (g): 6.6
Vol. Flask Tare (Mf) (g): 75.2704
Flask + H2O (Ma) (g): 175.0871
temp (C): 21

Flask + Sample + H2O (Mb): 178.3672
Temp (Tb) (C): 23

G at Tb: 1.9880

Correction factor for Tb from D854 Table 1: 0.9993

G at 20 C **1.9866**

HYDROMETER ANALYSIS

Hydrometer # 741958 Correction Factors: Slope = -0.288
Intercept = 11.6

Air Dry Sample Wt. Dispersed (g): 50

Oven Dry Sample Wt Dispersed (g): 48.80

Total Sample Represented by Hydrometer Aliquot (g): 48.80

Factor a ASTM D422 Table 1 **= 1.05**

Manual Entry of Factor K ASTM D422 Table 3 = 0.01456

Hydrometer Readings at Temp T

Target Elapsed Time	Actual Elapsed Time	Actual Hydrometer Reading	Corrected Hydrometer Reading	Temp (C)	Percentage of Soil in Suspension	Diameter of Particles in Suspension (mm)
2 min	2	25.0	19.2	20.0	41.2%	0.0360
5 min	5	24.0	18.2	20.0	39.1%	0.0229
15 min	15	21.0	15.2	20.0	32.6%	0.0135
30 min	30	19.0	13.2	20.0	28.3%	0.0097
60 min	60	18.0	12.3	20.5	26.5%	0.0069
250 min	250	14.0	8.2	20.0	17.6%	0.0034
1440 min	1440	11.0	4.9	19.0	10.5%	0.0015
			Ave temp (C) =	19.9		

SIEVE ANALYSIS

Sieve Mesh #	Wt. (g) Retained	Sieve Mesh #	Sieve Diameter (mm)	Percent Passing
# 4	0.00	4	4.750	100.0%
# 10	0.00	10	2.000	100.0%
# 20	3.62	20	0.850	92.6%
# 40	5.66	40	0.425	81.0%
# 60	6.41	60	0.250	67.8%
# 140	7.06	140	0.106	53.4%
# 200	2.17	200	0.075	48.9%

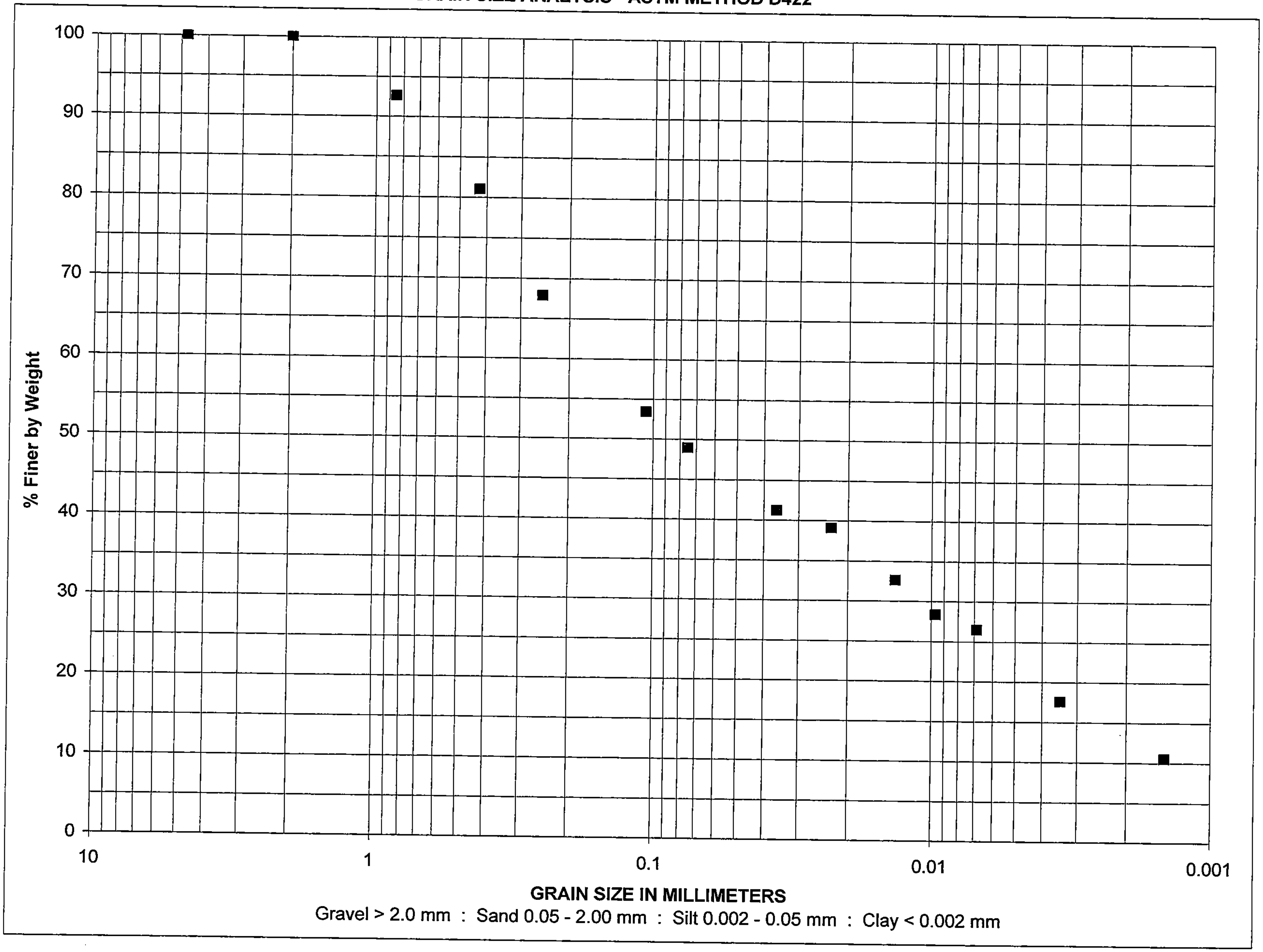
Gravel 0.0%
Sand 51.1%
Silt 38.4%
Clay 10.5%

☐ = Requires manual entry of data.

Revision Date: 18 April, 2012

ARDL SAMPLE # 6505-01

GRAIN SIZE ANALYSIS - ASTM METHOD D422



BLANK SUMMARY REPORT

ARDL, INC. 400 Aviation Drive; P.O. Box 1566 Mt. Vernon, IL 62864

Lab Report No: 006505

Report Date: 03/26/2013

Project Name: 3022201
Project No.: CALL #188

NELAC Certified - IL100308

Analyte	Detect Limit	Blank Result	Units	Prep Method	Analysis Method	Prep Date	Analysis Date	Run	QC Lab Number
Total Organic Carbon	33.0	ND	MG/KG	NONE	LYDKHN	03/12/13	03/14/13	16039486	006505-01B1

Method Blanks for 006505-01, Method TOC

LABORATORY CONTROL SAMPLE REPORT

ARDL, INC. **400 Aviation Drive; P.O. Box 1566 Mt. Vernon, IL 62864**

Lab Report No: 006505

Report Date: 03/26/2013

Project Name: 3022201
Project No.: CALL #188

NELAC Certified - IL100308

Analyte	LCS 1 Result	LCS 1 Level	LCS 1 % Rec	LCS 2 Result	LCS 2 Level	LCS 2 % Rec	% Rec Limits	Mean % Rec	Analytical Run	QC Lab Number
Total Organic Carbon	3080	3320	93	--	--	--	33-140	--	16039486	006505-01C1

NOTE: Any values tabulated above marked with an asterisk are outside of acceptable limits.

LCS Results for 006505-01, Method TOC

MATRIX SPIKE/SPIKE DUPLICATE REPORT

ARDL, INC.   400 Aviation Drive; P.O. Box 1566 Mt. Vernon, IL 62864

Lab Report No: 006505   Report Date: 03/26/2013

Project Name: 3022201
Project No.: CALL #188

NELAC Certified - IL100308

Analyte	Sample Matrix	Sample Result	MS Result	MS Level	MS % Rec	MSD Result	MSD Level	MSD % Rec	% Rec Limits	RPD	RPD Limit	Run	QC Lab Number
Total Organic Carbon	SEDIMENT	19000	30100	10000	111	--	--	--	50-150	--	--	16039486	006505-01MS

NOTE: Any values tabulated above marked with an asterisk are outside of acceptable limits.

Matrix Spikes for 006505-01, Method TOC

SAMPLE DUPLICATE REPORT

ARDL, INC. 400 Aviation Drive; P.O. Box 1566 Mt. Vernon, IL 62864

Lab Report No: 006505

Report Date: 03/26/2013

Project Name: 3022201
Project No.: CALL #188

NELAC Certified - IL100308

Analyte	Sample Conc'n	First Duplicate	Second Duplicate	Units	Percent Diff	Mean (Smp,D1,D2)	Analytical Run	QC Lab Number
Total Organic Carbon	19000	15300	--	MG/KG	22	--	16039486	006505-01D1

ARDL SAMPLE # 6505-01 dup

GRAIN SIZE ANALYSIS - ASTM METHOD D422

PRELIMINARY SIEVE ANALYSIS

Sample Amount Sieved with # 4 and # 10 sieves (g): 258.02

Amt Retained on # 4 sieve: 0
Percent retained on #4: 0.00%

Amt retained on # 10 (g): 0
Percent retained on #10: 0.00%

Amt passing # 10 sieve (g): 258.02
Percent passing #10: 100.00%

HYGROSCOPIC MOISTURE

Tare Wt. (g): 1.28
Tare + Wet Wt. (g): 6.77
Tare + Dry Wt. (g): 6.65
Hygrosopic Moisture Correction Factor = **0.978**

SPECIFIC GRAVITY

Sample Wt (Mo) (g): 6.65
Vol. Flask Tare (Mf) (g): 78.2302
Flask + H2O (Ma) (g): 178.0655
temp (C): 21

Flask + Sample + H2O (Mb): 181.3196
Temp (Tb) (C): 24

G at Tb: 1.9582

Correction factor for Tb from D854 Table 1: 0.9991

G at 20 C **1.9565**

HYDROMETER ANALYSIS

Hydrometer # 741958 Correction Factors: Slope = -0.288 Intercept = 11.6

Factor a ASTM D422 Table 1 **= 1.05**

Manual Entry of Factor K ASTM D422 Table 3 = 0.01456

Air Dry Sample Wt. Dispersed (g): 50

Oven Dry Sample Wt Dispersed (g): 48.90

Total Sample Represented by Hydrometer Aliquot (g): 48.90

Hydrometer Readings at Temp T

Target Elapsed Time	Actual Elapsed Time	Actual Hydrometer Reading	Corrected Hydrometer Reading	Temp (C)	Percentage of Soil in Suspension	Diameter of Particles in Suspension (mm)
2 min	2	25.0	19.2	20.0	41.1%	0.0360
5 min	5	24.0	18.2	20.0	39.0%	0.0229
15 min	15	21.0	15.2	20.0	32.6%	0.0135
30 min	30	19.0	13.2	20.0	28.3%	0.0097
60 min	60	18.0	12.3	20.5	26.4%	0.0069
250 min	250	13.0	7.2	20.0	15.4%	0.0035
1440 min	1440	11.0	4.9	19.0	10.5%	0.0015
			Ave temp (C) =	19.9		

SIEVE ANALYSIS

Sieve Mesh #	Wt. (g) Retained
# 4	0.00
# 10	0.00
# 20	4.14
# 40	5.78
# 60	6.11
# 140	6.72
# 200	1.61

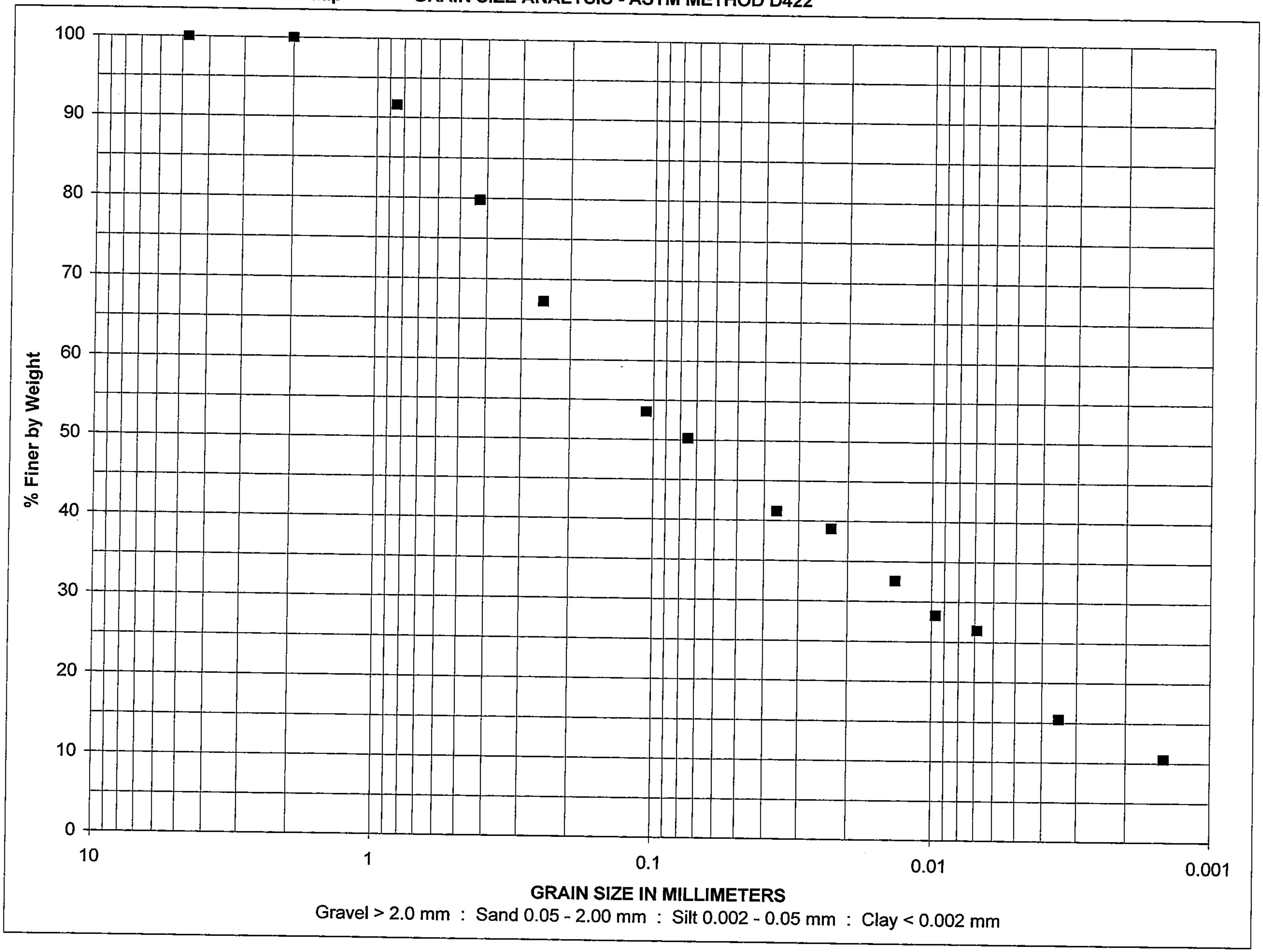
Sieve Mesh #	Sieve Diameter (mm)	Percent Passing
4	4.750	100.0%
10	2.000	100.0%
20	0.850	91.5%
40	0.425	79.7%
60	0.250	67.2%
140	0.106	53.5%
200	0.075	50.2%

Gravel	0.0%
Sand	49.8%
Silt	39.7%
Clay	10.5%

☐ = Requires manual entry of data.

Revision Date: 18 April, 2012

ARDL SAMPLE # 6505-01 dup GRAIN SIZE ANALYSIS - ASTM METHOD D422



Gravel > 2.0 mm : Sand 0.05 - 2.00 mm : Silt 0.002 - 0.05 mm : Clay < 0.002 mm

CHAIN-OF-CUSTODY DOCUMENTATION

SUBCONTRACT ORDER

ERDC- EL-EP-C (Environmental Chemistry Branch)

3022201

SENDING LABORATORY:

ERDC- EL-EP-C (Environmental Chemistry Branch)
3909 Halls Ferry Road , Building 3299
Vicksburg, MS 39180
Phone: 601-634-4826
Fax: 601-634-2742
Project Manager: Patty Tuminello

RECEIVING LABORATORY:

ARDL, INC
400 Aviation Drive
Mount Vernon, IL 62864
Phone :(618) 244-3235
Fax: (618) 244-1149

BPA Call No: 188

BPA Call Date:

Analysis	**Due**	**Expires**	**Laboratory ID**	**Comments**
ID: PSNS	**Soil/Sedi Sampled:21-Feb-2013 00:00**		6505-1	
TOC	25-Mar-2013 00:00	23-Mar-2013 00:00		
Particle Size - Sieve	23-Feb-2013 00:00	23-Mar-2013 00:00		
Particle Size - Hydrometer	23-Feb-2013 00:00	23-Mar-2013 00:00		
Containers Supplied:				

	2/25/13		2/26/13 @ 0930
Released By	Date	Received By	Date
Released By	Date	Received By	Date

COOLER RECEIPT REPORT
ARDL, INC.

ARDL #: 6505

Cooler # NONE
Number of Coolers in Shipment: 1

Project: 3022301

Date Received: 2-26-13

A. **PRELIMINARY EXAMINATION PHASE:** Date cooler was opened: 2-26-13 (Signature) D L Cochrum

1. Did cooler come with a shipping slip (airbill, etc.)?.......... [✓ YES] NO

   If YES, enter carrier name and airbill number here: Fedex 7948 2656 3941

2. Were custody seals on outside of cooler?.......... YES [✓ NO] N/A

   How many and where?________, Seal Date:________, Seal Name:________

3. Were custody seals unbroken and intact at the date and time of arrival?.......... YES NO [✓ NA]

4. Did you screen samples for radioactivity using a Geiger Counter?.......... [✓ YES] NO

5. Were custody papers sealed in a plastic bag and taped inside to the lid?.......... [✓ YES] NO

6. Were custody papers filled out properly (ink, signed, etc.)?.......... [✓ YES] NO N/A

7. Were custody papers signed in appropriate place by ARDL personnel?.......... [✓ YES] NO N/A

8. Was project identifiable from custody papers? If YES, enter project name at the top of this form.......... [✓ YES] NO N/A

9. Was a separate container provided for measuring temperature? YES_____ NO ✓ Cooler Temp. 3.8 C

B. **LOG-IN PHASE:** Date samples were logged-in: 2-26-13 (Signature) D L Cochrum

10. Describe type of packing in cooler: ~~bag~~ ice packs / air pack DLC 2-26-13

11. Were all bottles sealed in separate plastic bags? No Bottle / plastic bag.......... YES [✓ NO] N/A

12. Did ~~all bottles~~ bag arrive unbroken and were labels in good condition?.......... [✓ YES] NO

13. ~~Were bottle~~ Was bag label~~s~~ complete?.......... [✓ YES] NO

14. Did all ~~bottle~~ bag labels agree with custody papers?.......... [✓ YES] NO

15. Were correct containers used for the tests indicated?.......... [✓ YES] NO

16. Was pH correct on preserved water samples?.......... YES NO [✓ N/A]

17. Was a sufficient amount of sample sent for tests indicated?.......... [✓ YES] NO

18. Were bubbles absent in VOA samples? If NO, list by sample #:________ YES NO [✓ N/A]

19. Was the ARDL project coordinator notified of any deficiencies?.......... YES NO [✓ N/A]

Comments and/or Corrective Action:
(By: Signature) Date:

Sample Transfer	
Fraction All	Fraction
Area # Walkin	Area #
By DLC	By
On 2-26-13	On

NOTE: SAMPLE SPLIT SENT TO TEST AMERICA.

From: (601) 634-4060 Origin ID: JANA
Mike Catt
U.S. ARMY ERDC CE-WES-LM-MS
3909 Halls Ferry Road

Vicksburg, MS 39180

FedEx
Express

E

J131012121190326

Ship Date: 25FEB13
ActWgt: 6.0 LB
CAD: 103995832/WSXI2600

Dims: 10 X 7 X 7 IN

Delivery Address Bar Code

Ref # 13019501W81EWFB56
Invoice #
PO #
Dept #

SHIP TO: (618) 244-3235 **BILL SENDER**

Dean Dickerson
ARDL Inc.
400 Aviation Drive

Mount Vernon, IL 62864

TUE - 26 FEB 10:30A
PRIORITY OVERNIGHT

TRK# **7948 2656 3941**
0201

62864

XX MVNA

IL-US
STL

518G2/DCF8/93AB

Units = ug/kg

🟪 Cannot be resolved due to coelutions on both columns

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	1	3	5	6	7	8	9	12	13	14
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67				89.5							
		MS %Rec			79.5	64.5				89.5							
		MSD %Rec			90.5	74				96							

18 NOAA only (minus 209)		8	18	28/31	44	52	66	101/90	105	118	128
	652.808	N.D.		5.94	35.20	72.99			ND	135.60	35.77
		N.D.	5.97				32.73	155.41	ND		

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply for Round 1 and 2, while the PSNS sample data here are relevant only to the PSNS tox for Eohaustorius.

Units = ug/kg

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	15	16	17	18	19	20	22	24	25	26
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.	N.D.	N.D.		N.D.		N.D.	N.D.	2.06	6.48
								N.D.	N.D.	N.D.	5.97	N.D.		N.D.	N.D.		
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67					104.5						
		MS %Rec			79.5	64.5					101.5						
		MSD %Rec			90.5	74					112						

18 NOAA only (minus 209)		138/163	153	170	180	187	195	206	209		
	652.808	133.40	ND	12.79	18.17	7.64		0.65			
			ND				0.58				

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	27	28/31	29	32	33	34	35	37	40	41
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.	5.94	N.D.	1.34		N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.		N.D.			N.D.	N.D.	N.D.	N.D.	N.D.
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67											
		MS %Rec			79.5	64.5											
		MSD %Rec			90.5	74											

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**42**	**44**	**45**	**46**	**47**	**48**	**49**	**51**	**52**	**53**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892		35.20	1.25	2.04			30.48	1.65	72.99	
								4.51				10.63	3.63				
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67			99.5							99.5	
		MS %Rec			79.5	64.5			108.5							101	
		MSD %Rec			90.5	74			119.5							110.5	

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**54**	**56**	**59**	**60**	**63**	**64**	**66**	**67**	**69**	**70**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.		N.D.		N.D.	11.37		N.D.	N.D.	64.39
								N.D.	10.06	N.D.	3.41	N.D.		32.73	N.D.	N.D.	
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67								107			
		MS %Rec			79.5	64.5								118.5			
		MSD %Rec			90.5	74								130			

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	71	73	74	75	77	81/87	82	83	84	85
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	8.03	N.D.	4.96	N.D.	N.D.	92.41	20.65	10.17		29.78
									N.D.		N.D.	N.D.				51.08	
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67							110				
		MS %Rec			79.5	64.5							119				
		MSD %Rec			90.5	74							135				

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**90/101**	**91**	**92**	**93**	**95**	**97**	**99**	**100**	**103**	**104**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892		22.74		N.D.		48.07	68.72	N.D.	N.D.	N.D.
								155.41		31.63	N.D.	115.97			N.D.	N.D.	N.D.
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67		90									
		MS %Rec			79.5	64.5		96									
		MSD %Rec			90.5	74		107									

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	105	107	110	114	115	117	118	119	122	123
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.		166.91		4.49	N.D.	135.60	4.28	N.D.	
								N.D.			5.86		N.D.			N.D.	4.13
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67				98							
		MS %Rec			79.5	64.5				107.5							
		MSD %Rec			90.5	74				122							

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	124	128	129	130	131	132	134	135	136	137
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.	35.77	10.13	11.56		N.D.	9.90		15.09	11.83
								N.D.					N.D.		19.36		
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67											
		MS %Rec			79.5	64.5											
		MSD %Rec			90.5	74											

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**138**	**141**	**144**	**146**	**147/149**	**151**	**153**	**154**	**156**	**157**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	133.40	23.34		16.32		16.25	N.D.	N.D.	22.58	5.39
										8.34		78.47		N.D.	N.D.		
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67		104	94				91.5	102			
		MS %Rec			79.5	64.5		109	101.5				100	99			
		MSD %Rec			90.5	74		123	113.5				111	117			

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**158**	**163/164**	**165**	**167**	**170**	**171**	**172**	**173**	**174**	**175**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892		33.81	N.D.		12.79	4.07	2.08	N.D.	9.28	0.46
								28.06		N.D.	9.52				N.D.		
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67						79					
		MS %Rec			79.5	64.5						83					
		MSD %Rec			90.5	74						93.5					

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**176**	**177**	**178**	**179**	**180/193**	**183**	**185**	**187**	**189**	**190**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.	5.08	N.D.	2.56	18.17	5.59		7.64	0.71	N.D.
								N.D.		N.D.							N.D.
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67						93.5	93.5		91		
		MS %Rec			79.5	64.5						91	98.5		94.5		
		MSD %Rec			90.5	74						103.5	107.5		105.5		

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	**Lab ID**	**Detect Limit**	**Report Limit**	**Surrogate TMX**	**% Rec 209**	**Sum Congeners**	**191**	**194**	**195**	**196**	**197**	**199**	**200**	**201**	**202**	**203**
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	0.56	1.26			N.D.	1.32	N.D.	N.D.	N.D.	
										0.58	0.81	N.D.		N.D.	N.D.	N.D.	0.98
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67											
		MS %Rec			79.5	64.5											
		MSD %Rec			90.5	74											

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units = ug/kg

	Sample ID	Lab ID	Detect Limit	Report Limit	Surrogate TMX	% Rec 209	Sum Congeners	205	206	207	208
All Congeners	YB ETV	2112004-01	0.05	0.15	85.5	66	0	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.
	DB ETV	2112004-03	0.05	0.16	79.5	58	0	N.D.	N.D.	N.D.	N.D.
								N.D.	N.D.	N.D.	N.D.
	PSNS ETV	2112004-07	0.1	0.31	89.5	50	1850.892	N.D.	0.65	N.D.	
								N.D.		N.D.	0.21
		B	0.04	0.13	82	67.5		N.D.	N.D.	N.D.	N.D.
		BS %Rec			79.5	67			86.5		
		MS %Rec			79.5	64.5			90		
		MSD %Rec			90.5	74			87.5		

18 NOAA only (minus 209)

652.808

Note: These data are from Round 1, which were repeated (Round 2) for Macoma and Neanthes. The Control data still apply

Units=ug/kg

🟨 sample concentration is significantly higher than spike concentration

		Detect Limit	Report Limit	TMX	8	18	28/31	44	52	66	101/90	105	118	128	138/163	153	170	180	187	195	206	209
T0 EE A	302201-16	0.29	0.86	67.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 EE B	-17	0.16	0.49	76.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 EE C	-18	0.30	0.9	73.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB1 B	-19	0.26	0.79	59.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB2 B	-20	0.28	0.83	79.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB3 B	-21	0.26	0.78	58.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB1 SR	-22	0.31	0.93	67.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB2 SR	-23	0.28	0.83	67.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB3 SR	-24	0.27	0.8	68.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSNS1 SR	-25	0.37	1.1	62.25	ND	7.07	18.3	39.9	98.4	35.9	126	46.3	116	24.5	102	80.5	7.51	11.4	4.48	ND	ND	ND
PSNS2 SR	-26	0.40	1.2	69.75	ND	10.3	20.6	76	180	218	864	217	1024	195	1138	847	93.5	116	44.3	4.61	2.72	ND
PSNS3 SR	-27	0.37	1.1	75	ND	8.07	14.8	51.5	126	70.1	620	258	747	146	883	592	59.3	75.8	28.7	2.89	1.8	ND
PSNS1 B	-28	0.33	1	73.75	ND	8.73	15.9	59.9	144	72.4	350	176	402	126	425	297	39.2	58.1	13.9	ND	ND	ND
PSNS2 B	-29	0.40	1.2	64.75	ND	8.79	19.5	87.8	208	90.5	656	174	624	81.7	554	342	20.6	28.6	12	0.871	ND	ND
PSNS3 B	-30	0.33	1	76	ND	16.9	35.5	200	821	289	1946	868	2207	639	2515	1831	173	205	75.6	7.85	4.62	ND
	B	0.33	1	59.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec			75		84.25	82.25	82.25	75.5	85.5	79.5				93.25	91.75	88.25	97	78		91.25	
	BSD %Rec			70.5		88.5	83.5	82	77	85	76.5				89	82.75	81.5	86.25	86.75		74.25	
	MS %Rec			62.25		65.25	70	71.75	64	73.5	74				80.5	77.5	81.75	77.5	77		67.25	
BK MN DB A	3022202-1	0.07	0.2	74.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK MN DB B	-2	0.06	0.19	74.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK MN DB C	-3	0.07	0.2	77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK MN PSNS A	-4	0.06	0.19	61	ND	ND	2.48	3.42	19.9	6.6	17.4	4.18	12.8	1.79	7.79	6.75	ND	0.577	0.349	ND	ND	ND
BK MN PSNS B	-5	0.07	0.2	64.25	ND	ND	2.56	0.714	18.9	5.93	18.7	4.49	14.2	2.29	9.6	8.27	ND	0.712	0.389	ND	ND	ND
BK MN PSNS C	-6	0.06	0.19	69.5	ND	ND	2.88	2.61	14.9	5.52	16.5	4.83	13.8	2.42	9.99	8.42	ND	0.782	0.387	ND	ND	ND
SR MN DB A	-7	0.06	0.17	64.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR MN DB B	-8	0.06	0.19	62.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR MN DB C	-9	0.06	0.18	59.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR MN PSNS A	-10	0.07	0.2	70.25	ND	ND	3.28	1.86	14.9	5.89	16.7	3.01	9.53	1.27	5.32	4.38	ND	0.332	0.193	ND	ND	ND
SR MN PSNS B	-11	0.06	0.19	55.25	ND	ND	2.38	1.32	22.4	8.67	25.5	6.21	19	2.72	11.8	12.2	ND	0.765	0.458	ND	ND	ND
SR MN PSNS C	-12	0.06	0.19	64	ND	ND	2.16	2.5	17	6.64	17.3	4.03	13.6	1.84	7.73	6.87	ND	0.525	0.287	ND	ND	ND
T0 MN A	-13	0.06	0.17	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 MN B	-14	0.06	0.18	54.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 MN C	-15	0.06	0.17	75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	B	0.07	0.2	66	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec			67	ND	70.75	76.25	78	74.25	78.25	76				88.5	86.5	86.25	87	83		81	
	BSD %Rec			77.25	ND	75.5	87	84.25	79.75	84.75	80.75				87.5	91.5	88.75	92	80.25		89.75	
	MS %Rec			73.25	ND	72.5	80.5	81.25	76.75	85.75	78.5				95.5	91.5	87.5	92.75	85.5		83.25	
BK NA YB C	3022802-1	0.33	1	60.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK NA YB D	-2	0.33	1	58.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK NA YB E	-3	0.47	1.4	54.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA YB A	-4	0.31	0.93	55.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA YB B	-5	0.33	1	57.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA YB D	-6	0.33	0.99	66.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA PSNS A	-7	0.31	0.92	76.3	ND	ND	10.2	12.5	46.4	41.7	93.6	19.2	65	11	48.1	37.2	ND	2.7	2.9	ND	ND	ND

Units=ug/kg

🟨 sample concentration is significantly higher than spike concentration

		Detect Limit	Report Limit	TMX	8	18	28/31	44	52	66	101/90	105	118	128	138/163	153	170	180	187	195	206	209
SR NA PSNS B	-8	0.33	1	62.3	ND	ND	8.94	14.3	51.1	29.4	91.6	16.5	64.1	10	44.6	37.7	ND	3.62	2.25	ND	ND	ND
SR NA PSNS D	-9	0.33	1	68.8	ND	ND	8.37	15.7	55.5	30.7	88.6	16.8	61	9.65	43.3	37.3	ND	4.39	2.11	ND	ND	ND
BK NA PSNS A	-10	0.37	1.11	64.8	ND	ND	9.14	7.09	31.3	28.3	74	14.7	53.1	7.25	32.8	29.2	ND	2.16	1.5	ND	ND	ND
BK NA PSNS B	-11	0.43	1.3	54.5	ND	ND	7.48	5.54	26.7	29.2	89.2	20.9	70.5	11.3	48.1	41.9	ND	2.97	1.99	ND	ND	ND
BK NA PSNS C	-12	0.43	1.3	67.5	ND	ND	8.28	9.84	36.8	34.8	105	29.6	81.2	15.3	68.5	54.6	ND	5.64	4.52	ND	ND	ND
ETV NA DAY0 A	-13	0.47	1.4	60.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETV NA DAY0 B	-14	0.50	1.5	62.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	B	0.33	1	63.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec			57.8		72.5	81.5	80.8	76.0	86.3	77.3				89	88.5	89.5	89	82		82	
	BSD %Rec			53.0		69.8	81.5	80.3	75.0	84.8	77.8				89.5	89.25	86.75	89	82.75		80.25	
	MS %Rec			63.5		63.9	58.2	65.5	51.4	46.4	32.7				57.3	87.0	77.0	72.3	65.5		66.1	
PSNS	3022201-01	0.09	0.28	11	ND	9.7	10.6	47.3	109.0	50.8	195.0	82	196	44.5	199.0	153.0	17.3	22.2	9.3	0.638	1.1	ND
	B	0.04	0.13	11.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec			10.7		92.5	99.5	96.5	91.5	102	94				105	104.5	92	98.5	96		88	
	BSD %Rec			10.8		94.5	97.5	99	94	87.5	97.5				97.5	104.5	96	103	99.5		91.5	
	MS %Rec			12		70.9	37.5	55.4	🟨	47.8	🟨				🟨	🟨	25.0	75.0	67.1		63.2	
	MSD %Rec			12.7		79.8	53.6	94.6	🟨	55.4	🟨				🟨	🟨	152	198	97.5		71.4	

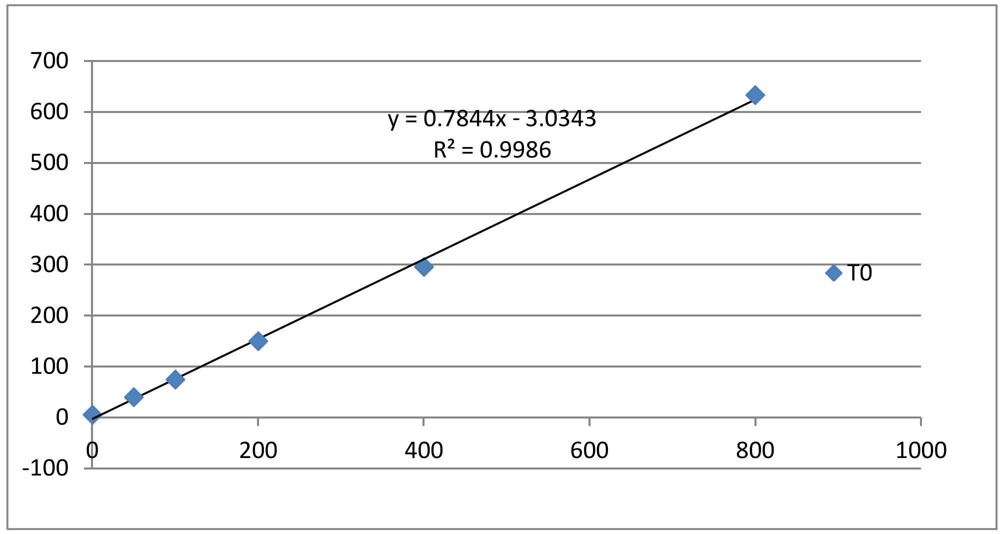
ERDC- EL-EP-C (Environmental Chemistry Branch)
Analytical Testing Report
Work Order: 2112004
Report Date: 3/6/2013 10:11:34 AM

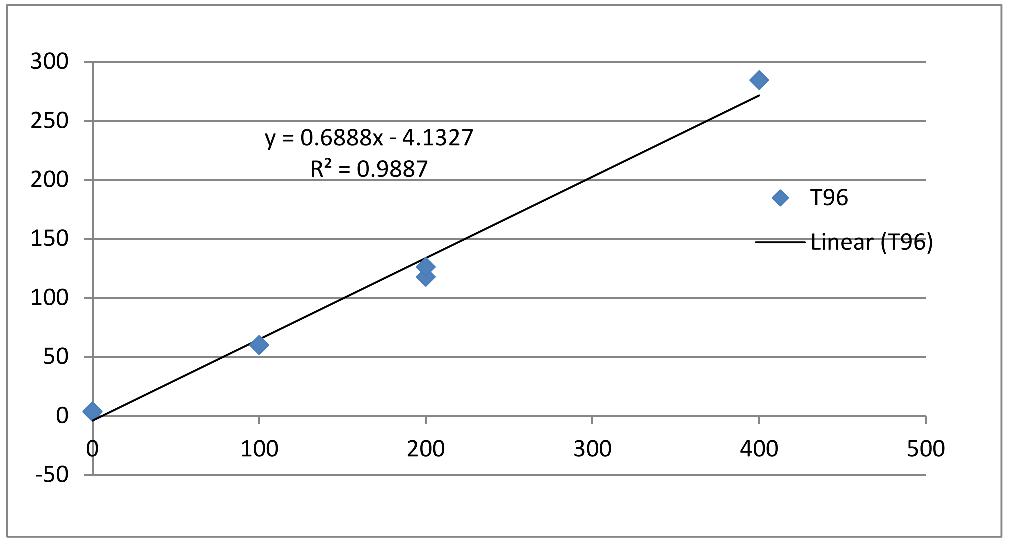
Client Navy -- SPAWAR
Attention Gunther Rosen
Project Name ETV SEA Ring
Project Number [none]

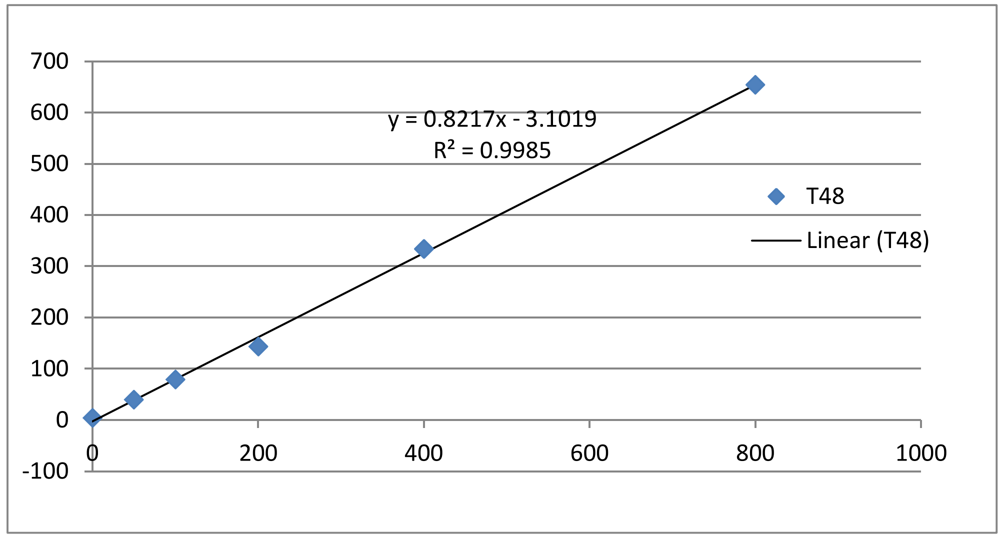
Note: This is not the original data. Please refer to PDF / Hardcopy report.

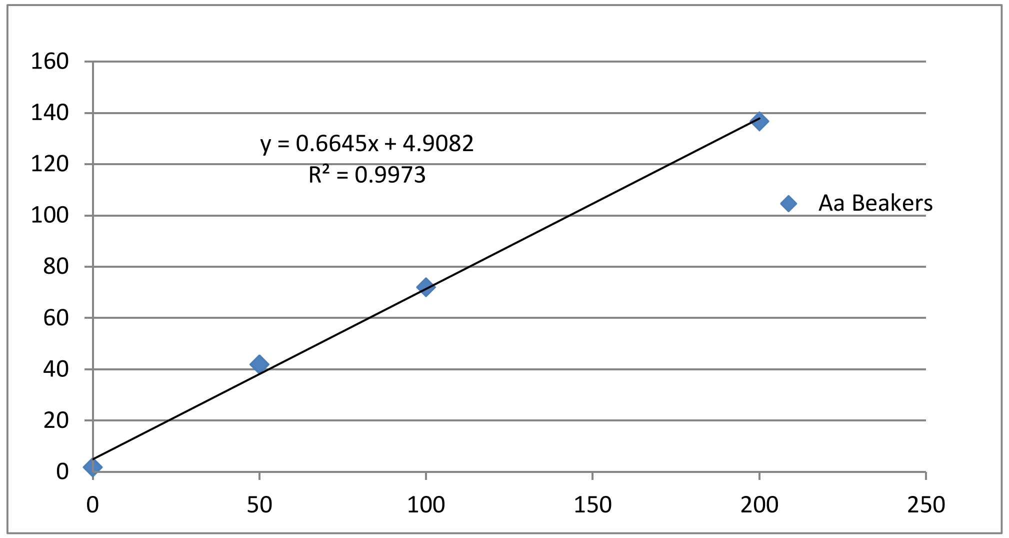
General Method	Analyte	Units	RDL		
LAB ID				2112004-01	2112004-05
CLIENT ID				YB - ETV	MS - ETV
DATE SAMPLED				19-Nov-12	19-Nov-12
DATE RECEIVED				20-Nov-12	20-Nov-12
MATRIX				Soil/Sediment	Soil/Sediment
Metals by EPA 6000/7000 Series Methods	Aluminum	mg/kg	1	1970	22000
Metals by EPA 6000/7000 Series Methods	Mercury	mg/kg	0.00382	<0.00382	0.452
Metals by EPA 6000/7000 Series Methods	Antimony	mg/kg	0.1	<0.100	<0.100
Metals by EPA 6000/7000 Series Methods	Arsenic	mg/kg	0.1	2.34	22.2
Metals by EPA 6000/7000 Series Methods	Barium	mg/kg	0.1	3.11	31.9
Metals by EPA 6000/7000 Series Methods	Beryllium	mg/kg	0.1	<0.100	0.588
Metals by EPA 6000/7000 Series Methods	Cadmium	mg/kg	0.1	<0.100	16.7
Metals by EPA 6000/7000 Series Methods	Calcium	mg/kg	1	733	16800
Metals by EPA 6000/7000 Series Methods	Chromium	mg/kg	0.1	5.71	35.6
Metals by EPA 6000/7000 Series Methods	Cobalt	mg/kg	0.1	1.09	5.63
Metals by EPA 6000/7000 Series Methods	Copper	mg/kg	0.1	1.18	628
Metals by EPA 6000/7000 Series Methods	Iron	mg/kg	1	2970	28400
Metals by EPA 6000/7000 Series Methods	Lead	mg/kg	0.1	1.14	351
Metals by EPA 6000/7000 Series Methods	Magnesium	mg/kg	1	933	27700
Metals by EPA 6000/7000 Series Methods	Manganese	mg/kg	0.1	27.9	496
Metals by EPA 6000/7000 Series Methods	Molybdenum	mg/kg	0.1	<0.100	20.6
Metals by EPA 6000/7000 Series Methods	Nickel	mg/kg	0.1	2.82	27.9
Metals by EPA 6000/7000 Series Methods	Potassium	mg/kg	1	233	3010
Metals by EPA 6000/7000 Series Methods	Selenium	mg/kg	0.1	0.222	3.87
Metals by EPA 6000/7000 Series Methods	Silver	mg/kg	0.1	<0.100	2.46
Metals by EPA 6000/7000 Series Methods	Sodium	mg/kg	1	1360	12500
Metals by EPA 6000/7000 Series Methods	Thallium	mg/kg	0.1	<0.100	0.977
Metals by EPA 6000/7000 Series Methods	Vanadium	mg/kg	0.1	5.13	30.7
Metals by EPA 6000/7000 Series Methods	Zinc	mg/kg	0.1	6.82	3490

Est Conc	Sample ID	Cu (µg L^{-1})
0	T0 0 ppb	5
50	T0 50 ppb	40
100	T0 100 ppb	75
200	T0 200 ppb	150
400	T0 400 ppb	296
800	T0 800 ppb	633
0	T48 0 ppb	4
50	T48 50 ppb	40
100	T48 100 ppb	79
200	T48 200 ppb	143
400	T48 400 ppb	334
800	T48 800 ppb	654
0	T96 0A ppb	3
0	T96 0B ppb	4
100	T96 100 ppb	60
200	T96 200A ppb	118
200	T96 200B ppb	126
400	T96 400 ppb	284
0	T96 Beakers Aa 0	2
50	T96 Beakers Aa 50 ppb	42
100	T96 Beakers Aa 100 ppb	72
200	T96 Beakers Aa 200 ppb	137
0	T96 Beakers My 0	5
50	T96 Beakers My 50 ppb	37
100	T96 Beakers My 100 ppb	68
200	T96 Beakers My 200 ppb	131









QAQC

BLANKS

Sample ID	Cu (µg L^{-1})
0.00 ppb	0.07
0.00 ppb	0.07
0.00 ppb	0.04
0.00 ppb	0.11
0.00 ppb	0.07
0.00 ppb	0.11
0.00 ppb	0.05
0.00 ppb	0.06
0.00 ppb	0.08
Mean Blanks	0.08
Stdev Blanks	0.02
LOD (3*SD)	0.07

DUPLICATES

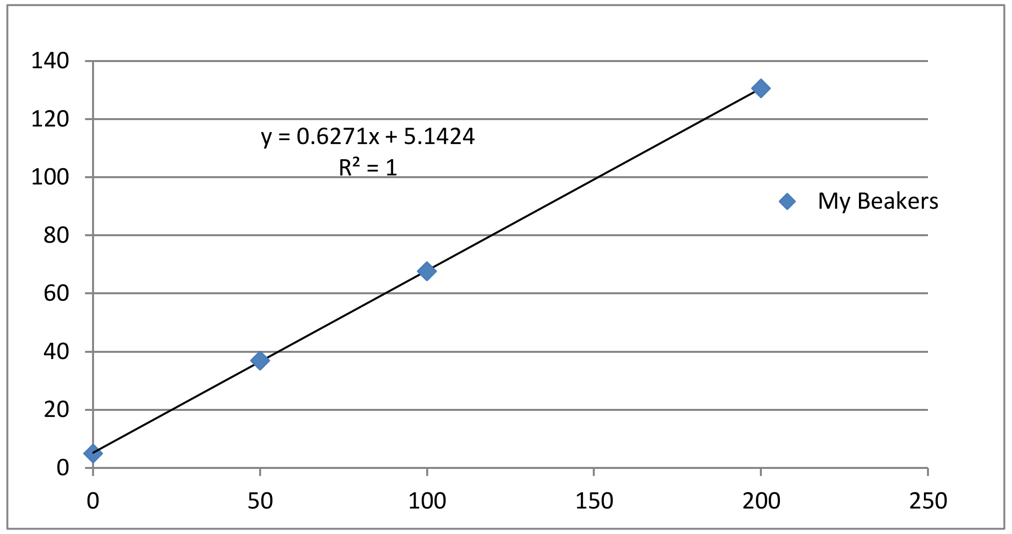
Sample ID	**Cu (µg L^{-1})**	% Difference
T48 100 ppb	79	
T48 100 ppb DUP	72	**9.4**
T48 400 ppb	334	
T48 400 ppb DUP	334	**0.0**
T96 200B ppb	126	
T96 200B ppb DUP	116	**8.0**

SPIKES

	% Recovery
T48 50 ppb Spike	86.6
T96 0A ppb Spike	84.7
T96 Beakers Aa 0 S	85.6

SRM 1643e (22.76 µg L-1 Cu)

	Cu (µg L^{-1})	**% Recovery**
1643e 25 Oct 2012	20.1	88.3
1643e 25 Oct 2012	23.1	101.5
1643e 25 Oct 2012	21.4	94.1
Mean Recover		94.7



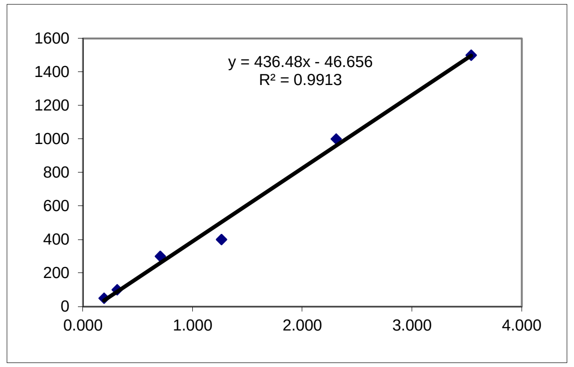
4/16/2012 Photometer

Project/PI	Sample ID	Additional Sample Info	Lipid ID	Absorb	Lipid (ug)	Lipid X 1.5 or 6 (ug)	Total tissue (g)	Total tissue (ug)	Percent	Fixed %	Date
Salmon standard			4	5.411	2405.2	14431.2	0.1468	146780	9.83%		3/22/2013
			5	5.212	2315.1	13890.6	0.1488	148780	9.34%		3/22/2013
			6	5.332	2369.6	14217.6	0.1491	149100	9.54%		3/22/2013
Tilapia standard			T1	1.132	468.5	2811	0.1537	153700	1.83%		3/22/2013
			T2	0.605	230.0	1380	0.1243	124300	1.11%		3/22/2013
			T3	0.662	255.9	1535.4	0.1485	148500	1.03%		3/22/2013
	3022202-25	SR Ee-PSNS1	7	1.041	427.7	641.55	0.0507	50700	1.27%		3/22/2013
	3022202-28	B Ee-PSNS1	8	0.77498	307.1	460.65	0.0381	38100	1.21%		3/22/2013
	3022202-19	B Ee-YB1	9	1.06569	438.7	658.05	0.0448	44800	1.47%		3/22/2013
	3022202-22	SR Ee-YB1	10	1.10604	456.9	685.35	0.0564	56400	1.22%		3/22/2013
	3022202-16	T0-Ee	11	1.32291	555.1	832.65	0.0396	39600	2.10%		3/22/2013
	3022202-02A	BK-MN-DB-B	12	0.76003	300.3	450.45	0.1449	144900	0.31%		3/22/2013
	3022202-06A	BK-MNPSNS-C	13	0.88911	358.8	538.2	0.1591	159100	0.34%		3/22/2013
Gunthers samples	3022202-07A	SRMNDB-A	14	0.82577	330.1	495.15	0.1324	132400	0.37%		3/22/2013
	3022202-10A	SRMNPSNS-A	15	0.91888	372.2	558.3	0.157	157000	0.36%		3/22/2013
	3022202-15A	TO-MN-C	16	0.71645	280.6	420.9	0.1444	144400	0.29%		3/22/2013
		BK Na-YB- C,D, E	1	1.115	588.1	3528.6	0.1661	166100	2.12%		4/3/2013
		SR-Na-YB-A,B,D	2	0.870	430.2	2581.2	0.1373	137300	1.88%		4/3/2013
		SR-Na-PSNS-A,B,D	3	0.929	468.6	2811.6	0.1450	145000	1.94%		4/3/2013
		BK-Na-PSNS-A,B,C	4	0.700	321.3	1927.8	0.0992	99200	1.94%		4/3/2013
		ETV Na Day 0 2/6/13	5	0.697	319.5	958.5	0.0466	46600	2.06%		4/3/2013
		Tilapia Control	6	0.793	380.7	2284.2	0.1283	128300	1.78%		4/3/2013
		Salmon Control	7	4.363	2675.8	16054.8	0.1502	150170	10.69%		4/3/2013

soy 10.3 mg

Standards	Nominal	Calc.	Abs
	51.5	50	0.192
	103	100	0.311
	257.5	300	0.705
	515	400	1.262
	1030	1000	2.308
	1545	1500	3.539

yellow denotes input fields



		Tissue					Sediment			
		tPCB[1] (µg/Kg ww)		% Lipid	Lipid-Normalized tPCB[1] (mg/Kg Lipid)		tPCB[1]	TOC[2]	tPCB[1]	
Species	Sample ID	Mean	SD	(ww)	Mean	SD	(mg/Kg dw)	(%)	(mg/Kg OC)	BSAF
E.e.	Time 0	0	0	2.1	0	0				
	YB Control Lab	0	0	1.47	0	0				
	YB Control SR	0	0	1.22	0	0				
	PSNS Lab	5644	5373	1.21	466	444	1.15	1.90	60	7.72
	PSNS SR	3151	2215	1.27	248	174	1.15	1.90	60	4.11
M.n.	Time 0	0	0	0.29	0	0				
	DB Control Lab	0	0	0.31	0	0				
	DB Control SR	0	0	0.37	0	0				
	PSNS Lab	85	2	0.34	25	0.6	1.15	1.90	60	0.41
	PSNS SR	87	24	0.36	24	6.7	1.15	1.90	60	0.40
N.a.	Time 0	0	0	2.06	0	0				
	YB Control Lab	0	0	2.12	0	0				
	YB Control SR	0	0	1.88	0	0				
	PSNS Lab	367	82	1.94	19	4.2	1.15	1.90	60	0.31
	PSNS SR	379	10	1.94	20	0.5	1.15	1.90	60	0.32

[1] Polychlorinated biphenyls; sum of 18 NOAA Status and Trends congeners.

[2] Total organic carbon

Units=ug/kg

🟨 sample concentration is significantly higher than spike concentration

Tissue Sample ID		Detect Limit	Report Limit	Sum NOAA	TMX	8	18	28/31	44	52	66	101/90	105	118	128	138/163	153	170	180	187	195	206	209
T0 EE A	302201-16	0.29	0.86	0	67.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 EE B	-17	0.16	0.49	0	76.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 EE C	-18	0.30	0.9	0	73.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB1 B	-19	0.26	0.79	0	59.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB2 B	-20	0.28	0.83	0	79.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB3 B	-21	0.26	0.78	0	58.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB1 SR	-22	0.31	0.93	0	67.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB2 SR	-23	0.28	0.83	0	67.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
YB3 SR	-24	0.27	0.8	0	68.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PSNS1 SR	-25	0.37	1.1	718.26	62.25	ND	7.07	18.3	39.9	98.4	35.9	126	46.3	116	24.5	102	80.5	7.51	11.4	4.48	ND	ND	ND
PSNS2 SR	-26	0.40	1.2	5051.03	69.75	ND	10.3	20.6	76	180	218	864	217	1024	195	1138	847	93.5	116	44.3	4.61	2.72	ND
PSNS3 SR	-27	0.37	1.1	3684.96	75	ND	8.07	14.8	51.5	126	70.1	620	258	747	146	883	592	59.3	75.8	28.7	2.89	1.8	ND
PSNS1 B	-28	0.33	1	2188.13	73.75	ND	8.73	15.9	59.9	144	72.4	350	176	402	126	425	297	39.2	58.1	13.9	ND	ND	ND
PSNS2 B	-29	0.40	1.2	2908.361	64.75	ND	8.79	19.5	87.8	208	90.5	656	174	624	81.7	554	342	20.6	28.6	12	0.871	ND	ND
PSNS3 B	-30	0.33	1	11834.47	76	ND	16.9	35.5	200	821	289	1946	868	2207	639	2515	1831	173	205	75.6	7.85	4.62	ND
	B	0.33	1		59.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec				75		84.25	82.25	82.25	75.5	85.5	79.5				93.25	91.75	88.25	97	78		91.25	
	BSD %Rec				70.5		88.5	83.5	82	77	85	76.5				89	82.75	81.5	86.25	86.75		74.25	
	MS %Rec				62.25		65.25	70	71.75	64	73.5	74				80.5	77.5	81.75	77.5	77		67.25	
BK MN DB A	3022202-1	0.07	0.2	0	74.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK MN DB B	-2	0.06	0.19	0	74.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK MN DB C	-3	0.07	0.2	0	77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK MN PSNS A	-4	0.06	0.19	84.036	61	ND	ND	2.48	3.42	19.9	6.6	17.4	4.18	12.8	1.79	7.79	6.75	ND	0.577	0.349	ND	ND	ND
BK MN PSNS B	-5	0.07	0.2	86.755	64.25	ND	ND	2.56	0.714	18.9	5.93	18.7	4.49	14.2	2.29	9.6	8.27	ND	0.712	0.389	ND	ND	ND
BK MN PSNS C	-6	0.06	0.19	83.039	69.5	ND	ND	2.88	2.61	14.9	5.52	16.5	4.83	13.8	2.42	9.99	8.42	ND	0.782	0.387	ND	ND	ND
SR MN DB A	-7	0.06	0.17	0	64.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR MN DB B	-8	0.06	0.19	0	62.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR MN DB C	-9	0.06	0.18	0	59.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR MN PSNS A	-10	0.07	0.2	66.665	70.25	ND	ND	3.28	1.86	14.9	5.89	16.7	3.01	9.53	1.27	5.32	4.38	ND	0.332	0.193	ND	ND	ND
SR MN PSNS B	-11	0.06	0.19	113.423	55.25	ND	ND	2.38	1.32	22.4	8.67	25.5	6.21	19	2.72	11.8	12.2	ND	0.765	0.458	ND	ND	ND
SR MN PSNS C	-12	0.06	0.19	80.482	64	ND	ND	2.16	2.5	17	6.64	17.3	4.03	13.6	1.84	7.73	6.87	ND	0.525	0.287	ND	ND	ND
T0 MN A	-13	0.06	0.17	0	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 MN B	-14	0.06	0.18	0	54.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T0 MN C	-15	0.06	0.17	0	75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	B	0.07	0.2		66	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec				67	ND	70.75	76.25	78	74.25	78.25	76				88.5	86.5	86.25	87	83		81	
	BSD %Rec				77.25	ND	75.5	87	84.25	79.75	84.75	80.75				87.5	91.5	88.75	92	80.25		89.75	
	MS %Rec				73.25	ND	72.5	80.5	81.25	76.75	85.75	78.5				95.5	91.5	87.5	92.75	85.5		83.25	

Units=ug/kg

🟨 sample concentration is significantly higher than spike concentration

Tissue Sample ID		Detect Limit	Report Limit	Sum NOAA	TMX	8	18	28/31	44	52	66	101/90	105	118	128	138/163	153	170	180	187	195	206	209
BK NA YB C	3022802-1	0.33	1	0	60.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK NA YB D	-2	0.33	1	0	58.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BK NA YB E	-3	0.47	1.4	0	54.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA YB A	-4	0.31	0.93	0	55.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA YB B	-5	0.33	1	0	57.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA YB D	-6	0.33	0.99	0	66.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SR NA PSNS A	-7	0.31	0.92	390.5	76.3	ND	ND	10.2	12.5	46.4	41.7	93.6	19.2	65	11	48.1	37.2	ND	2.7	2.9	ND	ND	ND
SR NA PSNS B	-8	0.33	1	374.11	62.3	ND	ND	8.94	14.3	51.1	29.4	91.6	16.5	64.1	10	44.6	37.7	ND	3.62	2.25	ND	ND	ND
SR NA PSNS D	-9	0.33	1	373.42	68.8	ND	ND	8.37	15.7	55.5	30.7	88.6	16.8	61	9.65	43.3	37.3	ND	4.39	2.11	ND	ND	ND
BK NA PSNS A	-10	0.37	1.11	290.54	64.8	ND	ND	9.14	7.09	31.3	28.3	74	14.7	53.1	7.25	32.8	29.2	ND	2.16	1.5	ND	ND	ND
BK NA PSNS B	-11	0.43	1.3	355.78	54.5	ND	ND	7.48	5.54	26.7	29.2	89.2	20.9	70.5	11.3	48.1	41.9	ND	2.97	1.99	ND	ND	ND
BK NA PSNS C	-12	0.43	1.3	454.08	67.5	ND	ND	8.28	9.84	36.8	34.8	105	29.6	81.2	15.3	68.5	54.6	ND	5.64	4.52	ND	ND	ND
ETV NA DAY0 A	-13	0.47	1.4	0	60.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETV NA DAY0 B	-14	0.50	1.5	0	62.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	B	0.33	1	0	63.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec				57.8		72.5	81.5	80.8	76.0	86.3	77.3				89	88.5	89.5	89	82		82	
	BSD %Rec				53.0		69.8	81.5	80.3	75.0	84.8	77.8				89.5	89.25	86.75	89	82.75		80.25	
	MS %Rec				63.5		63.9	58.2	65.5	51.4	46.4	32.7				57.3	87.0	77.0	72.3	65.5		66.1	
Sediment Sample ID																							
PSNS	3022201-01	0.09	0.28	1147.508	11	ND	9.7	10.6	47.3	109.0	50.8	195.0	82	196	44.5	199.0	153.0	17.3	22.2	9.3	0.638	1.1	ND
	B	0.04	0.13		11.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BS %Rec				10.7		92.5	99.5	96.5	91.5	102	94				105	104.5	92	98.5	96		88	
	BSD %Rec				10.8		94.5	97.5	99	94	87.5	97.5				97.5	104.5	96	103	99.5		91.5	
	MS %Rec				12		70.9	37.5	55.4	🟨	47.8	🟨				🟨	🟨	25.0	75.0	67.1		63.2	
	MSD %Rec				12.7		79.8	53.6	94.6	🟨	55.4	🟨				🟨	🟨	152	198	97.5		71.4	

Sample ID	Sediment				
	Grain Size				TOC
	% Gravel	**% Sand**	**% Silt**	**% Clay**	**(%)**
Yaquina Bay Sediment	0.0	97.4	3.1	-0.5	0.02
Discovery Bay Sediment	18.4	78.7	3.3	-0.4	0.06
MS Sediment	0.1	24.4	57.8	17.7	1.40
PSNS Sediment Round 1	0.0	48.3	10.9	10.8	2.20
PSNS Sediment Round 2	0.0	51.1	38.4	10.5	1.90

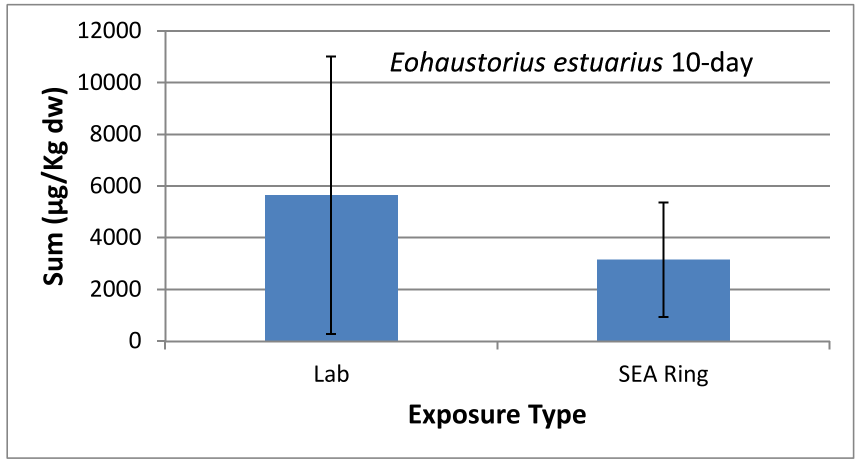
Units=ug/kg

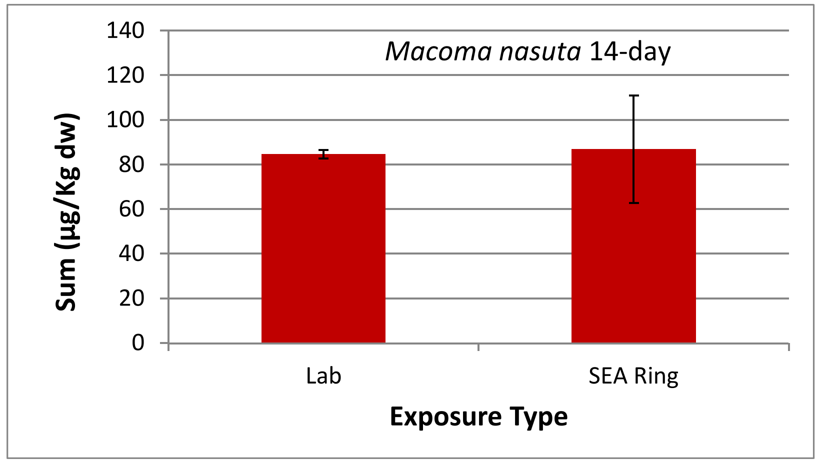
		Detect Limit	Report Limit	Sum NOAA (ug/Kg)
T0 EE A	302201-16	0.29	0.86	0
T0 EE B	-17	0.16	0.49	0
T0 EE C	-18	0.30	0.9	0
YB1 B	-19	0.26	0.79	0
YB2 B	-20	0.28	0.83	0
YB3 B	-21	0.26	0.78	0
YB1 SR	-22	0.31	0.93	0
YB2 SR	-23	0.28	0.83	0
YB3 SR	-24	0.27	0.8	0
PSNS1 SR	-25	0.37	1.1	718.26
PSNS2 SR	-26	0.40	1.2	5051.03
PSNS3 SR	-27	0.37	1.1	3684.96
PSNS1 B	-28	0.33	1	2188.13
PSNS2 B	-29	0.40	1.2	2908.361
PSNS3 B	-30	0.33	1	11834.47
	B	0.33	1	
	BS %Rec			
	BSD %Rec			
	MS %Rec			

BK MN DB A	3022202-1	0.07	0.2	0
BK MN DB B	-2	0.06	0.19	0
BK MN DB C	-3	0.07	0.2	0
BK MN PSNS A	-4	0.06	0.19	84.036
BK MN PSNS B	-5	0.07	0.2	86.755
BK MN PSNS C	-6	0.06	0.19	83.039
SR MN DB A	-7	0.06	0.17	0
SR MN DB B	-8	0.06	0.19	0
SR MN DB C	-9	0.06	0.18	0
SR MN PSNS A	-10	0.07	0.2	66.665
SR MN PSNS B	-11	0.06	0.19	113.423
SR MN PSNS C	-12	0.06	0.19	80.482
T0 MN A	-13	0.06	0.17	0
T0 MN B	-14	0.06	0.18	0
T0 MN C	-15	0.06	0.17	0
	B	0.07	0.2	
	BS %Rec			
	BSD %Rec			
	MS %Rec			

Lab
SEA Ring

Species	**Sample**	**Mean Sum NOAA (ug/Kg)**	SD	CV	n	**% Lipid (wet wt)**	**Mean Sum NOAA (ug/Kg Lipid)**	**Mean Sum NOAA (mg/Kg Lipid)**	SD	Sediment Sum NOAA (ug/Kg dw)	Sediment Sum NOAA (mg/Kg dw)	% TOC*	Sediment Sum NOAA (mg/Kg OC)	**BSAF**
E.e.	**Time 0**	**0**	0	0	3	**2.1**	**0**	**0.0**	0.0	0				
	YB Control Lab	**0**	0	0	3	**1.47**	**0**	**0.0**	0.0	0				
	YB Control SR	**0**	0	0	3	**1.22**	**0**	**0.0**	0.0	0				
	PSNS Lab	**5644**	5373	95	3	**1.21**	**466418**	**466.4**	444.1	653	0.653	1.9	34.35832	**13.5751**
	PSNS SR	**3151**	2215	70	3	**1.27**	**248143**	**248.1**	174.4	653	0.653	1.9	34.35832	**7.222212**
M.n.	**Time 0**	**0**	0	0	3	**0.29**	**0**	**0.0**	0.00	0				
	DB Control Lab	**0**	0	0	3	**0.31**	**0**	**0.0**	0.00	0				
	DB Control SR	**0**	0	0	3	**0.37**	**0**	**0.0**	0.00	0				
	PSNS Lab	**85**	1.9	2	3	**0.34**	**24885**	**24.9**	0.57	1148	1.148	1.9	60.39516	**0.412041**
	PSNS SR	**87**	24	28	3	**0.36**	**24127**	**24.1**	6.67	1148	1.148	1.9	60.39516	**0.399483**
N.a.	**Time 0**	**0**	0	0	3	**2.06**	**0**	**0.0**	0.00	0				
	YB Control Lab	**0**	0	0	3	**2.12**	**0**	**0.0**	0.00	0				
	YB Control SR	**0**	0	0	3	**1.88**	**0**	**0.0**	0.00	0				
	PSNS Lab	**367**	82	22	3	**1.94**	**18907**	**18.9**	4.24	1148	1.148	1.9	60.39516	**0.313058**
	PSNS SR	**379**	10	3	3	**1.94**	**19554**	**19.6**	0.50	1148	1.148	1.9	60.39516	**0.323764**





Figures represent summ of NOAA 18 PCB congeners in tissues for each species.
Time 0 and Control Sediments resulted in non-detects for all species.
MDLs ranged from 0.06 to 0.50 ug/Kg dw.
N=3 for all samples

Potential Summary Table Suggestion

Updated sediment PCB concentration to reflect Round 1 sediments used with this species. 6/13/2013 MAC

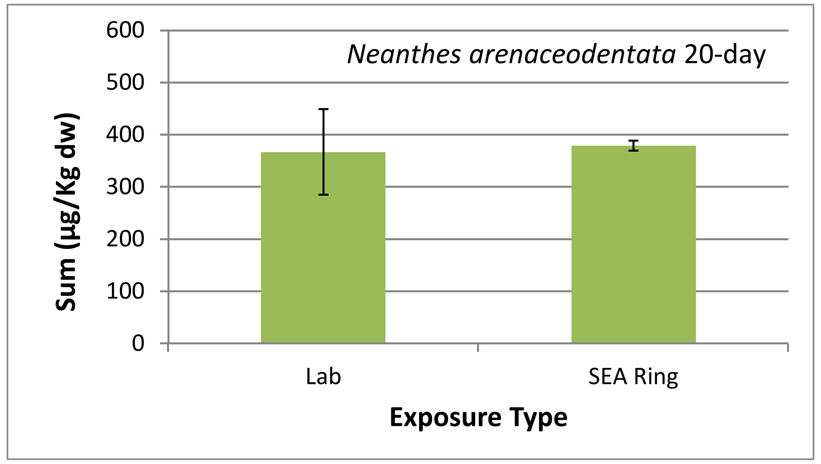
BK NA YB C	3022802-1	0.33	1	0
BK NA YB D	-2	0.33	1	0
BK NA YB E	-3	0.47	1.4	0
SR NA YB A	-4	0.31	0.93	0
SR NA YB B	-5	0.33	1	0
SR NA YB D	-6	0.33	0.99	0
SR NA PSNS A	-7	0.31	0.92	390.5
SR NA PSNS B	-8	0.33	1	374.11
SR NA PSNS D	-9	0.33	1	373.42
BK NA PSNS A	-10	0.37	1.11	290.54
BK NA PSNS B	-11	0.43	1.3	355.78
BK NA PSNS C	-12	0.43	1.3	454.08
ETV NA DAY0 A	-13	0.47	1.4	0
ETV NA DAY0 B	-14	0.50	1.5	0
	B	0.33	1	0
	BS %Rec			
	BSD %Rec			
	MS %Rec			

PSNS	3022201-01	0.09	0.28	1147.508
	B	0.04	0.13	
	BS %Rec			
	BSD %Rec			
	MS %Rec			
	MSD %Rec			

*Grain size analysis showed 48.9% silt and clay, 51.1% sand

🟨 sample concentration is significantly higher than spike concentration

TMX	8	18	28/31	44	52	66	101/90	105	118	128	138/163	153	170	180	187	195	206	209
67.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
76.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
73.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
59.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
79.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
58.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
67.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
67.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
68.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
62.25	ND	7.07	18.3	39.9	98.4	35.9	126	46.3	116	24.5	102	80.5	7.51	11.4	4.48	ND	ND	ND
69.75	ND	10.3	20.6	76	180	218	864	217	1024	195	1138	847	93.5	116	44.3	4.61	2.72	ND
75	ND	8.07	14.8	51.5	126	70.1	620	258	747	146	883	592	59.3	75.8	28.7	2.89	1.8	ND
73.75	ND	8.73	15.9	59.9	144	72.4	350	176	402	126	425	297	39.2	58.1	13.9	ND	ND	ND
64.75	ND	8.79	19.5	87.8	208	90.5	656	174	624	81.7	554	342	20.6	28.6	12	0.871	ND	ND
76	ND	16.9	35.5	200	821	289	1946	868	2207	639	2515	1831	173	205	75.6	7.85	4.62	ND
59.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75		84.25	82.25	82.25	75.5	85.5	79.5				93.25	91.75	88.25	97	78		91.25	
70.5		88.5	83.5	82	77	85	76.5				89	82.75	81.5	86.25	86.75		74.25	
62.25		65.25	70	71.75	64	73.5	74				80.5	77.5	81.75	77.5	77		67.25	
74.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
74.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
61	ND	ND	2.48	3.42	19.9	6.6	17.4	4.18	12.8	1.79	7.79	6.75	ND	0.577	0.349	ND	ND	ND
64.25	ND	ND	2.56	0.714	18.9	5.93	18.7	4.49	14.2	2.29	9.6	8.27	ND	0.712	0.389	ND	ND	ND
69.5	ND	ND	2.88	2.61	14.9	5.52	16.5	4.83	13.8	2.42	9.99	8.42	ND	0.782	0.387	ND	ND	ND
64.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
62.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
59.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
70.25	ND	ND	3.28	1.86	14.9	5.89	16.7	3.01	9.53	1.27	5.32	4.38	ND	0.332	0.193	ND	ND	ND
55.25	ND	ND	2.38	1.32	22.4	8.67	25.5	6.21	19	2.72	11.8	12.2	ND	0.765	0.458	ND	ND	ND
64	ND	ND	2.16	2.5	17	6.64	17.3	4.03	13.6	1.84	7.73	6.87	ND	0.525	0.287	ND	ND	ND
79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
54.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
66	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
67	ND	70.75	76.25	78	74.25	78.25	76				88.5	86.5	86.25	87	83		81	
77.25	ND	75.5	87	84.25	79.75	84.75	80.75				87.5	91.5	88.75	92	80.25		89.75	
73.25	ND	72.5	80.5	81.25	76.75	85.75	78.5				95.5	91.5	87.5	92.75	85.5		83.25	



60.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
58.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
54.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
55.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
57.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
66.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
76.3	ND	ND	10.2	12.5	46.4	41.7	93.6	19.2	65	11	48.1	37.2	ND	2.7	2.9	ND	ND	ND
62.3	ND	ND	8.94	14.3	51.1	29.4	91.6	16.5	64.1	10	44.6	37.7	ND	3.62	2.25	ND	ND	ND
68.8	ND	ND	8.37	15.7	55.5	30.7	88.6	16.8	61	9.65	43.3	37.3	ND	4.39	2.11	ND	ND	ND
64.8	ND	ND	9.14	7.09	31.3	28.3	74	14.7	53.1	7.25	32.8	29.2	ND	2.16	1.5	ND	ND	ND
54.5	ND	ND	7.48	5.54	26.7	29.2	89.2	20.9	70.5	11.3	48.1	41.9	ND	2.97	1.99	ND	ND	ND
67.5	ND	ND	8.28	9.84	36.8	34.8	105	29.6	81.2	15.3	68.5	54.6	ND	5.64	4.52	ND	ND	ND
60.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
62.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
63.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
57.8		72.5	81.5	80.8	76.0	86.3	77.3				89	88.5	89.5	89	82		82	
53.0		69.8	81.5	80.3	75.0	84.8	77.8				89.5	89.25	86.75	89	82.75		80.25	
63.5		63.9	58.2	65.5	51.4	46.4	32.7				57.3	87.0	77.0	72.3	65.5		66.1	
11	ND	9.7	10.6	47.3	109.0	50.8	195.0	82	196	44.5	199.0	153.0	17.3	22.2	9.3	0.638	1.1	ND
11.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10.7		92.5	99.5	96.5	91.5	102	94				105	104.5	92	98.5	96		88	
10.8		94.5	97.5	99	94	87.5	97.5				97.5	104.5	96	103	99.5		91.5	
12		70.9	37.5	55.4		47.8							25.0	75.0	67.1		63.2	
12.7		79.8	53.6	94.6		55.4							152	198	97.5		71.4	

Appendix C
Performance Evaluation Audit

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1974b

Organics in Mussel Tissue (*Mytilus edulis*)

Standard Reference Material (SRM) 1974b is a frozen mussel tissue homogenate intended for use in evaluating analytical methods for the determination of selected polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, and chlorinated pesticides in marine bivalve mollusk tissue and similar matrices. All of the constituents for which certified and reference values are provided in SRM 1974b were naturally present in the tissue material before processing. A unit of SRM 1974b consists of five bottles each containing approximately 8 g to 10 g (wet basis) of frozen tissue homogenate.

Certified Concentration Values: Certified values for concentrations, expressed as mass fractions, for 22 PAHs, 31 PCB congeners, and 7 chlorinated pesticides are provided in Tables 1 to 3. The certified values for the PAHs, PCB congeners, and chlorinated pesticides are based on the agreement of results obtained at NIST from two or more chemically independent analytical techniques along with results from an interlaboratory comparison study [1,2]. A certified value for the concentration of total mercury, based on results from NIST and collaborating laboratories, is provided in Table 4. A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or accounted for by NIST.

Reference Concentration Values: Reference values for concentrations, expressed as mass fractions, are provided for 16 additional PAHs (some in combination), 8 additional PCB congeners plus total PCBs, 6 additional chlorinated pesticides, total extractable organics (TEO), methylmercury, and 11 trace elements in Tables 4 to 8. Reference values are noncertified values that are the best estimate of the true value. However, the values do not meet the NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision, may not include all sources of uncertainty, or may reflect a lack of sufficient statistical agreement among multiple analytical methods.

Expiration of Certification: The certification of this SRM lot is valid until **01 March 2013**, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate. However, the certification is invalid if the SRM is damaged, contaminated, or modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive changes occur which affect the certification before the expiration of this certificate, NIST will notify the purchaser. Return of the attached registration card will facilitate notification.

The coordination of the technical measurements leading to the certification of this material was under the leadership of M.M. Schantz and S.A. Wise of the NIST Analytical Chemistry Division.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by J.C. Colbert and B.S. MacDonald of the NIST Measurement Services Division.

Willie E. May, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 01 July 2003

John Rumble, Jr., Chief
Measurement Services Division

Consultation on the statistical design of the experimental work and evaluation of the data were provided by S.D. Leigh of the NIST Statistical Engineering Division.

Collection and preparation of SRM 1974b were performed by M.P. Cronise and C.N. Fales of the NIST Standard Reference Materials Program and P.R. Becker, E.A. Mackey, B.J. Porter, R.S. Pugh, and W.D.J. Struntz of the NIST Analytical Chemistry Division. The mussels were collected with the assistance of W. Truly of Battelle Ocean Sciences Laboratory in Duxbury, MA.

Analytical measurements for the certification of SRM 1974b were performed at NIST by J.R. Kucklick, S.E. Long, B.J. Porter, D.L. Poster, and M.M. Schantz of the NIST Analytical Chemistry Division. Results were also used from laboratories that participated in the 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] coordinated by M.M. Schantz and from selected laboratories that participated in the 14th Intercomparison for Trace Elements in Marine Sediments and Biological Tissues [4] coordinated by S. Willie of the National Research Council (NRC) of Canada (see Appendix A for participating laboratories). Measurements for selected trace elements were performed at NRC Canada by J.W.H. Lam, C. Scriver, S. Willie, and L. Yang. Measurements for total mercury and methylmercury were performed at the Jožef Stefan Institute (Ljubljana, Slovenia) by M. Horvat, D. Gibiĉar, and Z. Kljakovic.

NOTICE AND WARNING TO USERS

Storage: SRM 1974b is packaged as a frozen tissue homogenate in glass bottles. The tissue homogenate should not be allowed to thaw prior to subsampling for analysis. If the tissue homogenate does thaw, the entire bottle should be used for analysis. This material has been stored at NIST at -80 °C (or lower) since it was prepared and should be stored by the user at this temperature, if possible, since the validity of the certified values is unknown when stored at higher temperatures.

Handling: This material is a frozen tissue homogenate. After extended storage at temperatures of -25 °C or higher, or if allowed to warm, the tissue homogenate will lose its powder-like form. For the handling of this material during sample preparation, the following procedures and precautions are recommended. If weighing relatively large quantities, remove a portion from the bottle and reweigh the bottle to determine the weight of the subsample. (Avoid heavy frost buildup by handling the bottles rapidly and wiping them prior to weighing.) For weighing, transfer subsamples to a pre-cooled thick-walled glass container rather than a thin-walled plastic container to minimize heat transfer to the sample. If possible, use a cold work space, e.g., an insulated container with dry ice or liquid nitrogen coolant on the bottom and pre-cooled implements, such as Teflon© coated spatulas, for transferring the powder. Normal biohazard safety precautions for the handling of biological tissues should be exercised.

Instructions for Use: Subsamples of this SRM for analysis should be withdrawn from the bottle immediately after opening and used without delay for the certified values listed in Tables 1 to 3 to be valid within the stated uncertainties. The concentrations of constituents in SRM 1974b are reported on both a wet-mass and a dry-mass basis for user convenience. The SRM tissue homogenate, as received, contains approximately 90 % moisture. A separate subsample of the SRM should be removed from the bottle at the time of analysis and dried to determine the concentration on a dry-mass basis.

PREPARATION AND ANALYSIS[1]

Sample Collection and Preparation: The mussels (*Mytilus edulis*) used for the preparation SRM 1974b were collected October 27, 1999 from Dorchester Bay within Boston (MA) Harbor (42°18.25'N and 72°02.31'W) following the same procedures as described previously for the collection of mussels for SRM 1974 and SRM 1974a [5,6]. Approximately 6300 individual mussels were collected by hand at low tide. The samples were transported to the Battelle Ocean Sciences Laboratory (Duxbury, MA) where the mussels were rinsed with water to remove rocks and other debris. The samples were placed in insulted Teflon©-lined wooden containers, frozen, and transported to NIST on dry ice. The samples were transferred to Teflon© bags and stored in a liquid nitrogen vapor freezer (-120 °C) until they were shucked.

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[1] Certain commercial equipment, instruments, or materials are identified in this certificate in order to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Sample Preparation: The mussel tissue was removed from the shell using the following procedure. The mussels were allowed to warm up to about 0 °C; the tissue was removed from the shell using a titanium knife and placed in Teflon$^{©}$ bags (approximately 0.5 kg per bag) and immediately returned to a liquid nitrogen freezer. Approximately 59 kg of mussel tissue was prepared for use as the SRM. The frozen mussel tissue was pulverized in batches of approximately 700 g each using a cryogenic procedure described previously [7]. The pulverized material was then homogenized in an aluminum mixing drum in two batches of approximately 30 kg each. The mixing drum was designed to fit inside the liquid nitrogen vapor freezer and to rotate in the freezer thereby mixing the frozen tissue powder. After mixing for 2 h, subsamples (approximately 8 g to 10 g) of the mussel tissue homogenate were aliquoted into cleaned, pre-cooled glass bottles.

Conversion to Dry-Mass Basis: The moisture content of the mussel homogenate was determined by measuring the mass loss after freeze drying. Ten bottles of SRM 1974b were selected according to a stratified randomization scheme for the drying study. The entire contents of each glass bottle were transferred to a Teflon$^{©}$ bottle and dried for seven days at 1 Pa with a -20 °C shelf temperature and a -50 °C condenser temperature. The moisture content in SRM 1974b at the time of the certification analyses was 89.87 % ± 0.05 % (95 % confidence level). Analytical results for the organic constituents were determined on a wet-mass basis and then converted to a dry-mass basis by dividing by the conversion factor of 0.1013 (g dry mass/g wet mass). The trace elements, other than mercury, were determined on a dry-mass basis and then converted to a wet-mass basis by multiplying by the conversion factor of 0.1013 (g dry mass/g wet mass).

Polycyclic Aromatic Hydrocarbons: The general approach used for the value assignment of the PAHs in SRM 1974b was similar to that reported for the recent certification of several environmental matrix SRMs [6,8,9,10] and consisted of combining results from analyses using various combinations of different extraction techniques and solvents, cleanup/isolation procedures, and chromatographic separation and detection techniques. This approach consisted of Soxhlet extraction and pressurized fluid extraction (PFE) using dichloromethane (DCM) or a hexane/acetone mixture, cleanup of the extracts using size exclusion chromatography (SEC) and/or solid phase extraction (SPE), followed by analysis using gas chromatography/mass spectrometry (GC/MS) analysis of the PAH fraction on two stationary phases of different selectivity, i.e., a 50 % (mole fraction) phenyl-substituted methylpolysiloxane phase and a relatively non-polar proprietary phase.

Six sets of GC/MS results, designated as GC/MS (I) through GC/MS (V) were obtained using two columns with different selectivities for the separation of PAHs. For GC/MS (I) analyses, duplicate subsamples of between 2 g and 3 g from 10 bottles of SRM 1974b were extracted using PFE with 50 % hexane and 50 % acetone (volume fraction) [11]. The concentrated extract was passed through a silica SPE cartridge and eluted with 10 % DCM in hexane. Following concentration, the silica SPE step was repeated. The processed extract was then analyzed by GC/MS using a 0.25 mm i.d. × 60 m fused silica capillary column with a relatively non-polar proprietary phase (0.25 µm film thickness) (DB-XLB, J&W Scientific, Folsom, CA). This method is designated as GC/MS (Ia). For GC/MS (1b), the same extracts were analyzed by GC/MS using a 0.25 mm i.d. × 60 m fused silica capillary column with 50 % (mole fraction) phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-17MS, J&W Scientific, Folsom, CA). The GC/MS (II) analyses were performed using subsamples of 8 g to 10 g from six bottles of SRM 1974b. These samples were extracted using PFE with DCM. The high molecular mass compounds (i.e, lipids and biogenic material) were removed from the extracts using SEC with a preparative-scale divinylbenzene-polystyrene column (10 µm particle size with 100 Å diameter pores), and the concentrated extract was passed through an aminopropyl SPE cartridge and eluted with 10 % DCM in hexane. GC/MS analysis was performed using a 0.25 mm i.d. × 60 m fused silica capillary column with a 50 % phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-17MS). For the GC/MS (III) analyses, approximately 10 g subsamples from six bottles of SRM 1974b were Soxhlet extracted for 18 h with 250 mL of DCM. The extracts was cleaned up using SEC as described above, and the concentrated extract was passed through a silica SPE cartridge and eluted with 2 % DCM in hexane. The processed extract was then analyzed by GC/MS using a 0.25 mm i.d. × 60 m fused silica capillary column with a relatively non-polar proprietary phase (0.25 µm film thickness) (DB-XLB) and a 50 % phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-17 MS). The GC/MS (IV) method used 9 g subsamples from three bottles of SRM 1974b with the same clean-up and analysis method as GC/MS (Ia) while the GC/MS (V) method used 9 g subsamples from three bottles of SRM 1974b with the same clean-up and analysis method as GC/MS (II). For the GC/MS measurements described above, selected perdeuterated PAHs were added to the mussel tissue homogenate prior to solvent extraction for use as internal standards for quantification purposes.

In addition to the analyses performed at NIST, SRM 1974b was used in an interlaboratory comparison exercise in 2000 as part of the NIST Intercomparison Exercise Program for Organic Contaminants in the Marine Environment [3]. Results from 16 laboratories that participated in this exercise were used as the seventh data set in the determination of the certified values for PAHs in SRM 1974b. The laboratories participating in this exercise employed the analytical procedures routinely used in their laboratories to measure PAHs.

Homogeneity Assessment for PAHs: The homogeneity of SRM 1974b was assessed by analyzing duplicate samples of between 2 g and 3 g from 10 bottles selected by stratified random sampling. Samples were extracted, processed, and analyzed as described above for GC/MS (Ia and Ib). No statistically significant differences among bottles were observed for the PAHs at this sample size.

PCBs and Chlorinated Pesticides: The general approach used for the determination of PCBs and chlorinated pesticides in SRM 1974b was similar to that reported for the recent certification of several environmental matrix SRMs [6,8-10,12-14], and consisted of combining results from analyses using various combinations of different extraction techniques and solvents, cleanup/isolation procedures, and chromatographic separation and detection techniques. This approach consisted of Soxhlet extraction and PFE using DCM or a hexane/acetone mixture, cleanup/isolation using SEC, SPE or liquid chromatography (LC), followed by analysis using GC/MS and gas chromatography with electron capture detection (GC-ECD) on three columns with different selectivity for the separation of PCBs and chlorinated pesticides.

Eight sets of results were obtained designated as GC/MS (Ia and Ib), GC/MS (II), GC-ECD (Ia and Ib), GC-ECD (II), GC-ECD (III), and Interlaboratory Comparison Exercise. For GC/MS (Ia and Ib), duplicate subsamples of between 2 g and 3 g from 10 bottles of SRM 1974b were extracted using PFE with 50 % hexane and 50 % acetone (volume fraction). The concentrated extract was passed through a silica SPE cartridge and eluted with 10 % DCM in hexane. Following concentration of the extract, the silica SPE step was repeated. The processed extract was then analyzed by GC/MS using a 0.25 mm i.d. × 60 m fused silica capillary column with a relatively non-polar proprietary phase (0.25 µm film thickness) (DB-XLB). This method is designated as GC/MS (Ia). For GC/MS (1b), the same extracts were analyzed by GC/MS using a 0.25 mm i.d. × 60 m fused silica capillary column with 50 % (mole fraction) phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-17MS). For GC/MS (II), subsamples of 9 g from three bottles of SRM 1974b were extracted using Soxhlet extraction with DCM. The concentrated extracts were processed as described above for GC/MS I and then analyzed by GC/MS using a 0.25 mm i.d. × 60 m fused silica capillary column with a relatively nonpolar proprietary phase (0.25 µm film thickness) (DB-XLB, J&W Scientific, Folsom, CA). For the GC/MS analyses, selected carbon-13 labeled PCB congeners and chlorinated pesticides were added to the mussel tissue homogenate prior to extraction for use as internal standards for quantification purposes.

For GC-ECD (Ia and Ib), subsamples of between 8 g and 10 g from six bottles of SRM 1974b were extracted using PFE with DCM, followed by SEC, as described above for the PAHs, to remove the high molecular mass compounds. The concentrated extracts were then passed through an aminopropyl SPE cartridge and eluted with 10 % DCM in hexane. The concentrated extract was fractionated on a semi-preparative aminopropylsilane LC column to isolate two fractions containing: (1) the PCBs and lower polarity pesticides and, (2) the more polar pesticides. GC-ECD analyses of the two fractions were performed on two columns of different selectivities for PCB separations: 0.25 mm × 60 m fused silica capillary column with a 5 % phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-5, J&W Scientific, Folsom, CA) and a 0.25 mm × 60 m fused silica capillary column with a nonpolar proprietary phase (0.25 µm film thickness) (DB-XLB). The results from the 5 % phenyl phase are designated as GC-ECD (Ia) and the results from the proprietary phase are designated as GC-ECD (Ib). The GC-ECD (II) analyses used Soxhlet extraction with DCM followed by SEC to remove the high molecular mass compounds and fractionation of the extract using the semi-preparative aminopropylsilane LC column described for GC-ECD (I). The GC-ECD analysis used a 0.25 mm × 60 m fused silica capillary column with a 5 % phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-5). The GC-ECD (III) method used 9 g subsamples from three bottles of SRM 1974b extracted, processed, and analyzed as described above for GC-ECD (I). For the GC-ECD analyses, two PCB congeners that are not significantly present in the mussel tissue extract (PCB 103 and PCB 198 [25,26]), and endosulfan I-d_4, 4,4’-DDE-d_8, 4,4’-DDD-d_8, and 4,4'-DDT-d_8 were added to the mussel tissue homogenate prior to extraction for use as internal standards for quantification purposes.

In addition to the analyses performed at NIST, SRM 1974b was used in an interlaboratory comparison exercise in 2000 as part of the NIST Intercomparison Exercise Program for Organic Contaminants in the Marine Environment [3]. Results from 16 laboratories that participated in this exercise were used as the eighth data set in the determination of the certified values for PCB congeners and chlorinated pesticides in SRM 1974b. The laboratories participating in this exercise employed the analytical procedures routinely used in their laboratories to measure PCB congeners and chlorinated pesticides.

The reference value for PCB 77 (3,3’,4,4’-tetrachlorobiphenyl) was determined from the GC-ECD (I) samples. The first fraction (PCBs and lower polarity pesticides) from the semi-preparative aminopropylsilane column was further fractionated using a Cosmosil PYE column (5 µm particle size, 4.6 mm i.d. × 25 cm, Phenomenex, Torrance, CA) [15].

Three fractions were collected: the first fraction contained the pesticides and multi-*ortho* PCBs, the second fraction contained the polychlorinated naphthalenes, non-*ortho* PCB congeners, and some mono-*ortho* PCB congeners, and the third fraction removed the residual planar compounds from the column. The second fraction was analyzed by GC/MS using a 0.25 mm × 60 m fused silica capillary column with a 5 % phenyl-substituted methylpolysiloxane phase (0.25 µm film thickness) (DB-5MS, J&W Scientific, Folsom, CA). Carbon-13 labeled PCB 77 was used as an internal standard for quantification purposes.

Homogeneity Assessment for PCBs and Chlorinated Pesticides: The homogeneity of SRM 1974b was assessed by analyzing duplicate samples of between 2 g and 3 g from 10 bottles selected by stratified random sampling. Samples were extracted, processed, and analyzed as described above for GC/MS (Ia and Ib). No statistically significant differences among bottles were observed for the chlorinated analytes at this sample size.

Total PCBs and Total Extractable Organics: A subset of laboratories participated in an interlaboratory comparison study for total PCBs and total extractable organics (TEO) in SRM 1974b. The methods used by the four laboratories reporting total PCBs were: sum of congeners using GC/MS; determination of 112 congeners using GC-ECD; calibration of GC-ECD using Aroclors 1242, 1248, 1254, and 1260; and use of an individual congener for each homolog group to calibrate the GC/MS and then summing the homolog groups.

The TEO values were determined gravimetrically by six laboratories after extraction using the following conditions: PFE with DCM (2 laboratories), Soxhlet extraction with DCM (2 laboratories), Soxhlet extraction with hexane (1 laboratory), and PFE with a DCM/acetone mixture (1 laboratory).

Methylmercury and Total Mercury: The certified value for total mercury is based on results of analyses of SRM 1974b at NIST, the Jožef Stefan Institute (Ljubljana, Slovenia), NRC Canada, and selected participants in an interlaboratory comparison exercise coordinated by NRC Canada. For total mercury measurements at NIST, subsamples of ≈500 mg from six bottles of SRM 1974b were analyzed. The analytical procedure consisted of spiking with ^{201}Hg as an internal standard, microwave-assisted acid digestion of the tissue, followed by cold vapor generation coupled with inductively coupled plasma mass spectrometry (CV-ICP-MS) isotope ratio measurements as described previously [16]. At the Jožef Stefan Institute triplicate subsamples (≈500 mg) from six bottles of SRM 1974b were digested with acid and analyzed by cold vapor atomic absorption spectrometry (CVAAS) [17,18]. At NRC Canada, total mercury was determined by analyzing five subsamples (≈250 mg dry mass) using microwave-assisted acid digestion followed by CVAAS. Results from four selected laboratories participating in the NRC Canada intercomparison exercise [4] (see below) were also used in the value assignment for total mercury.

The reference value for methylmercury is based on results from two methods performed at the Jožef Stefan Institute. For the first method, triplicate subsamples (≈500 mg) from six bottles of SRM 1974b were analyzed using solid-liquid extraction into toluene followed by GC-ECD [19,20]. The second analytical method for methylmercury (subsamples of ≈500 mg from six bottles) consisted of acid digestion, anion exchange chromatographic separation of inorganic mercury and methylmercury, followed by CVAAS detection before and after ultraviolet radiation [21,22].

Additional Trace Element Analyses: SRM 1974b was freeze-dried and used in an interlaboratory comparison study coordinated by the NRC Canada [4]. The laboratories participating in this exercise employed the analytical procedures routinely used in their laboratories to measure the selected trace elements. Value assignment for the concentrations of the trace elements was accomplished by combining the results from the analyses of the freeze-dried sample of SRM 1974b from (1) NRC Canada using isotope dilution ICP-MS, graphite furnace atomic absorption spectrometry (GFAAS), and/or inductively coupled plasma atomic emission spectroscopy (ICP-AES) and (2) the mean of the results from six selected laboratories that participated in the NRC Canada interlaboratory study [4] using a variety of analytical techniques (laboratories listed in Appendix A).

Table 1. Certified Concentrations for Selected PAHs in SRM 1974b

	Mass Fractions in µg/kg[a]	
	Wet-Mass Basis	Dry-Mass Basis
Naphthalene[d,e,f,g,h,i,j]	2.43 ± 0.12[b]	24.0 ± 1.2[b]
Fluorene[d,e,f,g,h,i,j]	0.494 ± 0.036[b]	4.88 ± 0.36[b]
Phenanthrene[d,e,f,g,h,i ,j]	2.58 ± 0.11[b]	25.5 ± 1.1[b]
Anthracene[d,e,f,g,h,i,j]	0.527 ± 0.071[c]	5.20 ± 0.71[c]
1-Methylphenanthrene[d,e,f,g,h,i,j]	0.98 ± 0.13[c]	9.66 ± 1.3[c]
2-Methylphenathrene[d,e,f,g]	1.28 ± 0.31[b]	24.0 ± 1.2[b]
3-Methylphenanthrene[d,e,g]	1.27 ± 0.04[c]	12.5 ± 0.4[c]
Fluoranthene[d,e,f,g,h,i,j]	17.1 ± 0.7[b]	169 ± 7[b]
Pyrene[d,e,f,g,h,i,j]	18.04 ± 0.6[b]	178 ± 6[b]
Benz[*a*]anthracene[d,e,f,g,h,i,j]	4.74 ± 0.53[b]	46.8 ± 5.2[b]
Chrysene[d,g,h]	6.3 ± 1.0[b]	62.2 ± 9.9[b]
Triphenylene[d,g,h]	4.33 ± 0.72[b]	42.7 ± 7.1[b]
Benzo[*b*]fluoranthene[e,f,g,h,i,j]	6.46 ± 0.59[b]	63.8 ± 5.8[b]
Benzo[*j*]fluoranthene[e,f,g,h,i]	2.99 ± 0.29[b]	29.5 ± 2.9[b]
Benzo[*k*]fluoranthene[d,e,f,g,h,i,j]	3.16 ± 0.18[b]	31.2 ± 1.8[b]
Benzo[*a*]fluoranthene[d,e,f,g]	0.634 ± 0.074[b]	6.26 ± 0.73[b]
Benzo[*e*]pyrene[d,e,f,g,h,i,j]	10.3 ± 1.1[b]	102 ± 11[b]
Benzo[*a*]pyrene[d,e,f,g,h,i,j]	2.80 ± 0.38[b]	27.6 ± 3.8[b]
Perylene[d,e,f,g,h,i,j]	0.99 ± 0.14[b]	9.8 ± 1.4[b]
Benzo[*ghi*]perylene[d,e,f,g,h,i,j]	3.12 ± 0.33[b]	30.8 ± 3.3[b]
Indeno[1,2,3-*cd*]pyrene[d,e,f,g,h,i,j]	2.14 ± 0.11[b]	21.1 ± 1.1[b]
Dibenz[*a,h*]anthracene[e,f,g,h,i]	0.327 ± 0.031[c]	3.23 ± 0.31[c]

[a] Concentrations reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[b] Certified values are weighted means of the results from three to seven analytical methods [23]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-method variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[c] The certified value is an unweighted mean of the results from three to seven analytical methods. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2]. Note for anthracene and 1-methylphenanthrene the within method variance for the interlaboratory study was not used for the calculation of the expanded uncertainty.

[d] GC/MS (Ia) on a relatively nonpolar proprietary phase after PFE with 50 % hexane/50 % acetone mixture.

[e] GC/MS (Ib) on 50 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC/MS (Ia).

[f] GC/MS (II) on 50 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[g] GC/MS (III) on a relatively nonpolar proprietary phase and 50 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

[h] GC/MS (IV) on a relatively nonpolar proprietary phase after Soxhlet extraction with DCM.

[i] GC/MS (V) on 50 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[j] 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] with 16 laboratories submitting data.

Table 2. Certified Concentrations for Selected PCB Congeners[a] in SRM 1974b

		Mass Fractions in µg/kg[b]	
		Wet-Mass Basis	Dry-Mass Basis
PCB 18	(2,2',5-Trichlorobiphenyl)[e,f,g,h,i,j,k,l]	0.84 ± 0.13[c]	8.30 ± 1.3[c]
PCB 28	(2,4,4'-Trichlorobiphenyl)[e,f,g,h,j.k.l]	3.43 ± 0.25[c]	33.9 ± 2.5[c]
PCB 31	(2,4',5-Trichlorobiphenyl)[e,f,g,h,i,j,k,l]	2.88 ± 0.23[c]	28.4 ± 2.3[c]
PCB 44	(2,2'3,5'-Tetrachlorobiphenyl)[e,f,g,h,i,j,k,l]	3.85 ± 0.20[c]	38.0 ± 2.0[c]
PCB 49	(2,2'4,5'-Tetrachlorobiphenyl)[e,f,g,h,i,j,k,l]	5.66 ± 0.23[c]	55.9 ± 2.3[c]
PCB 52	(2,2',5,5'-Tetrachlorobiphenyl)[e,f,g,h,i,j,k,l]	6.26 ± 0.37[c]	61.8 ± 3.7[c]
PCB 66	(2,3',4,4'-Tetrachlorobiphenyl)[e,f,g,h,j,k,l]	6.37 ± 0.37[c]	62.9 ± 3.7[c]
PCB 70	(2,3’,4’,5-Tetrachlorobiphenyl)[e,f,h,i]	6.01 ± 0.22[d]	59.3 ± 2.2[d]
PCB 74	(2,4,4’,5-Tetrachlorobiphenyl)[e,f,h,i]	3.55 ± 0.23[c]	35.0 ± 2.3[c]
PCB 82	(2,2’,3,3’,4-Pentachlorobiphenyl)[e,f,g,i]	1.16 ± 0.14[c]	11.5 ± 1.4[c]
PCB 87	(2,2',3,4,5'-Pentachlorobiphenyl)[e,f,i]	4.33 ± 0.36[d]	42.7 ± 3.6[d]
PCB 95	(2,2',3,5',6-Pentachlorobiphenyl)[e,f,g,h,j,k,l]	6.04 ± 0.36[c]	59.6 ± 3.6[c]
PCB 99	(2,2',4,4',5-Pentachlorobiphenyl)[e,f,g,h,i,j,k,l]	5.92 ± 0.27[c]	58.4 ± 2.7[c]
PCB 101	(2,2',4,5,5'-Pentachlorobiphenyl)[e,f,h,i,j,k,l]	10.7 ± 1.1[c]	106 ± 11[c]
PCB 105	(2,3,3',4,4'-Pentachlorobiphenyl)[e,f,g,h,i,j,k,l]	4.00 ± 0.18[c]	39.5 ± 1.8[c]
PCB 107	(2,3,3’,4,5’-Pentachlorobiphenyl)[e,f,g,h,i]	1.03 ± 0.12[c]	10.2 ± 1.2[c]
PCB 110	(2,3,3',4',6-Pentachlorobiphenyl)[e,f,h]	10.0 ± 0.7[c]	99.1 ± 7.1[c]
PCB 118	(2,3',4,4',5-Pentachlorobiphenyl)[e,f,g,h,i,j,k,l]	10.3 ± 0.4[c]	102 ± 4[c]
PCB 128	(2,2',3,3',4,4'-Hexachlorobiphenyl)[e,f,g,h,i,j,k,l]	1.79 ± 0.12[c]	17.7 ± 1.2[c]
PCB 132	(2,2’,3,3’,4,6’-Hexachlorobiphenyl)[e,f,g,h,i]	2.43 ± 0.25[c]	24.0 ± 2.5[c]
PCB 138	(2,2',3,4,4',5'-Hexachlorobiphenyl)[e,f,h,j,k,l]	9.2 ± 1.4[c]	91 ± 14[c]
PCB 146	(2,2’,3,4’,5,5’-Hexachlorobiphenyl)[e,f,g,h]	1.92 ± 0.16[c]	19.0 ± 1.6[c]
PCB 149	(2,2',3,4',5',6-Hexachlorobiphenyl)[e,f,h,i,j,k,l]	7.01 ± 0.28[c]	69.2 ± 2.8[c]
PCB 151	(2,2’,3,5,5’,6-Hexachlorobiphenyl)[e,f,g,i]	1.86 ± 0.16[c]	18.4 ± 1.6[c]
PCB 153	(2,2',4,4',5,5'-Hexachlorobiphenyl)[e,f,g,h,i,j,k,l]	12.3 ± 0.8[c]	121 ± 8[c]
PCB 156	(2,3,3',4,4',5-Hexachlorobiphenyl)[e,f,h,j,k,l]	0.718 ± 0.080[c]	7.09 ± 0.79[c]
PCB 158	(2,3,3’,4,4’,6-Hexachlorobiphenyl)[e,g,h,i]	0.999 ± 0.096[c]	9.86 ± 0.95[c]
PCB 170	(2,2',3,3',4,4',5-Heptachlorobiphenyl)[e,f,h,j,k,l]	0.269 ± 0.034[c]	2.66 ± 0.34[c]
PCB 180	(2,2',3,4,4',5,5'-Heptachlorobiphenyl)[e,f,g,h,i,j,k,l]	1.17 ± 0.10[c]	11.5 ± 1.0[c]
PCB 183	(2,2',3,4,4',5',6-Heptachlorobiphenyl)[e,f,g,h,i]	1.25 ± 0.03[c]	12.3 ± 0.3[c]
PCB 187	(2,2',3,4',5,5',6-Heptachlorobiphenyl)[e,f,g,h,i,j,k,l]	2.94 ± 0.15[c]	29.0 ± 1.5[c]

[a] PCB congeners are numbered according to the scheme proposed by Ballschmiter and Zell [25] and later revised by Schulte and Malisch [26] to conform with IUPAC rules; for the specific congeners mentioned in this SRM, only PCB 107 is different in the numbering systems. Under the Ballschmiter and Zell numbering system, the IUPAC PCB 107 is listed as PCB 108.

[b] Concentrations reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[c] Certified values are weighted means of the results from three to eight analytical methods [23]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-method variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[d] The certified value is an unweighted mean of the results from three analytical methods. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2].

[e] GC/MS (Ia) on a relatively nonpolar proprietary phase after PFE with 50 % hexane/50 % acetone mixture.

[f] GC/MS (Ib) on 50 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC/MS (Ia).

[g] GC-ECD (Ia) on 5 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[h] GC-ECD (Ib) on a relatively nonpolar proprietary phase; same extracts as GC-ECD (Ia).

[i] GC-ECD (II) on a 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

[j] GC/MS (II) on a relatively nonpolar proprietary phase after Soxhlet extraction with DCM.

[k] GC-ECD (III) on a 5 % phenyl-substituted methylpolysiloxane phase and a relatively non-polar proprietary phase after PFE with DCM.

[l] 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] with 16 laboratories submitting data.

Table 3. Certified Concentrations for Selected Chlorinated Pesticides in SRM 1974b

	Mass Fractions in µg/kg[a,b]					
	Wet-Mass Basis			Dry-Mass Basis		
cis-Chlordane[c,d,e,f,g,h,i,j]	1.36	±	0.10	13.4	±	1.0
trans-Chlordane[c,d,e,f,g,h,i,j]	1.14	±	0.17	11.3	±	1.7
trans-Nonachlor[c,d,e,f,g,h,i,j]	1.30	±	0.14	12.8	±	1.4
2,4'-DDE[c,d,h,i,j]	0.336	±	0.044	3.32	±	0.43
4,4'-DDE[c,d,e,f,g,h,i,j]	4.15	±	0.38	41.0	±	3.8
2,4'-DDD[c,d,e,f,h,i,j]	1.09	±	0.16	10.8	±	1.6
4,4'-DDD[c,d,e,f,g,h,i,j]	3.34	±	0.22	33.0	±	2.2

[a] Concentrations reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[b] Certified values are weighted means of the results from five to eight analytical methods [23]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-source variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[c] GC/MS (Ia) on a relatively non-polar proprietary phase after PFE with 50 % hexane/50 % acetone mixture.

[d] GC/MS (Ib) on 50 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC/MS (Ia).

[e] GC-ECD (Ia) on 5 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[f] GC-ECD (Ib) on a relatively non-polar proprietary phase; same extracts as GC-ECD (Ia).

[g] GC-ECD (II) on a 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

[h] GC/MS (II) on a relatively non-polar proprietary phase after Soxhlet extraction with DCM.

[i] GC-ECD (III) on a 5 % phenyl-substituted methylpolysiloxane phase and a relatively non-polar proprietary phase after PFE with DCM.

[j] 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] with 16 laboratories submitting data.

Table 4. Certified and Reference Concentrations for Total Mercury and Methylmercury in SRM 1974b

	Mass Fraction in µg/kg[a]					
	Wet-Mass Basis			Dry-Mass Basis		
Total Mercury[b]	17.0	±	1.1[b]	167	±	11[b]
Methylmercury[c]	7.05	±	0.44[c]	69.6	±	4.3[c]

[a] The concentrations are reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[b] The certified value for total mercury is the weighted mean of four results [23] from the following: (1) ICP-MS analyses performed at NIST, (2) ICP-MS analyses performed at NRC Canada, (3) the mean of results from four selected laboratories participating in the NRC Canada 14th Intercomparison for Trace Elements in Marine Sediments and Biological Tissues [4], and (4) results from CV-AAS performed at the Jožef Stefan Institute. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-source variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[c] The reference value for methylmercury is an unweighted mean of the results from CV-AAS and GC-ECD performed at the Jožef Stefan Institute. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2].

Table 5. Reference Concentrations for Selected PAHs in SRM 1974b

	Mass Fractions in µg/kg[a]	
	Wet-Mass Basis	Dry-Mass Basis
1-Methylnaphthalene[e,f,g,h,i,j,k]	0.614 ± 0.050[b]	6.06 ± 0.49[b]
2-Methylnaphthalene[e,f,g,h,i,j,k]	1.25 ± 0.09[b]	12.3 ± 0.9[b]
2,6-Dimethylnaphthalene[e,f,g,h,i,j,k]	0.33 ± 0.16[b]	3.3 ± 1.6[b]
2,3,5-Trimethylnaphthalene[e,f,g,h,i,j,k]	0.400 ± 0.032[b]	3.95 ± 0.32[b]
Biphenyl[e,f,g,h,i,j,k]	0.61 ± 0.14[b]	6.0 ± 1.4[b]
Acenaphthylene[e,f,g,h,i,j,k]	0.48 ± 0.12[b]	4.7 ± 1.2[b]
Acenaphthene[e,f,g,h,i,j,k]	0.274 ± 0.054[b]	2.70 ± 0.53[b]
4-Methylphenanthrene and 9-Methylphenanthrene[g,h]	1.60 ± 0.18[b]	15.8 ± 1.8[b]
2-Methylanthracene[e,f]	0.232 ± 0.004[c]	2.29 ± 0.04[c]
Cyclopenta[*cd*]pyrene[h]	0.227 ± 0.010[d]	2.24 ± 0.10[d]
Benzo[*c*]phenanthrene[e,f,h]	1.85 ± 0.21[b]	18.3 ± 2.1[b]
Benzo[*b*]chrysene[h]	0.507 ± 0.030[d]	5.00 ± 0.30[d]
Benzo[*c*]chrysene[g,h]	0.318 ± 0.042[b]	3.14 ± 0.42[b]
Dibenz[*a,c*]anthracene[f,g]	0.212 ± 0.013[c]	2.09 ± 0.13[c]
Dibenz[*a,j*]anthracene[g,h]	0.467 ± 0.048[b]	4.61 ± 0.47[b]
Picene[g,h]	0.75 ± 0.16[b]	7.4 ± 1.6[b]

[a] Concentrations reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[b] The reference value is a weighted mean of the results from two to seven analytical methods [23]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-source variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[c] The reference value is an unweighted mean of the results from two analytical methods. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2].

[d] The reference value is the mean of results obtained by NIST using one analytical technique. The expanded uncertainty, U, is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined standard uncertainty calculated according to the ISO Guide [2]. The coverage factor, k, is determined from the Student's t-distribution corresponding to the appropriate associated degrees of freedom and 95 % confidence for each analyte.

[e] GC/MS (Ia) on a relatively nonpolar proprietary phase after PFE with 50 % hexane/50 % acetone mixture.

[f] GC/MS (Ib) on 50 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC/MS (Ia).

[g] GC/MS (II) on 50 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[h] GC/MS (III) on a relatively nonpolar proprietary phase and 50 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

[i] GC/MS (IV) on a relatively nonpolar proprietary phase after Soxhlet extraction with DCM.

[j] GC/MS (V) on 50 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[k] 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] with 16 laboratories submitting data.

Table 6. Reference Concentrations for Selected PCB Congeners[a] and Total PCBs in SRM 1974b

		Mass Fractions in µg/kg [b]	
		Wet-Mass Basis	Dry-Mass Basis
PCB 8	(2,4’-Dichlorobiphenyl)[f,g]	0.37 ± 0.11[c]	3.7 ± 1.1[c]
PCB 45	(2,2’,3,6-Tetrachlorobiphenyl)[f,h,i,j]	0.50 ± 0.18[d]	4.9 ± 1.8[d]
PCB 56	(2,3,3’,4-Tetrachlorobiphenyl)[f,h,i,k]	2.82 ± 0.56[d]	27.8 ± 5.5[d]
PCB 63	(2,3,4’,5-Tetrachlorobiphenyl)[f,h,j,k]	0.46 ± 0.14[d]	4.5 ± 1.4[d]
PCB 77	(3,3’,4,4’-Tetrachlorobiphenyl)[l]	0.563 ± 0.023[e]	5.56 ± 0.23[e]
PCB 92	(2,2’,3,5,5’-Pentachlorobiphenyl)[f,h,i,k]	2.76 ± 0.58[d]	27.2 ± 5.7[d]
PCB 157	(2,3,3’,4,4’,5’-Hexachlorobiphenyl)[f,h,i]	0.236 ± 0.024[d]	2.33 ± 0.24[d]
PCB 163	(2,3,3’,4’,5,6-Hexachlorobiphenyl)[f,h,i]	2.02 ± 0.05[c]	19.9 ± 0.5[c]
Total PCBs[m]		205 ± 42	2020 ± 420

[a] PCB congeners are numbered according to the scheme proposed by Ballschmiter and Zell [25] and later revised by Schulte and Malisch [26] to conform with IUPAC rules; for the specific congeners mentioned in this SRM, only PCB 107 (Table 2) is different in the numbering systems. Under the Ballschmiter and Zell numbering system, the IUPAC PCB 107 is listed as PCB 108.

[b] Concentrations reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[c] The reference value is an unweighted mean of the results from two to three analytical methods. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2].

[d] The reference value is a weighted mean of the results from three to four analytical methods [23]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-method variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[e] The reference value is the mean of results obtained by NIST using one analytical technique. The expanded uncertainty, U, is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined standard uncertainty calculated according to the ISO Guide [2]. The coverage factor, k, is determined from the Student’s t-distribution corresponding to the appropriate associated degrees of freedom and 95 % confidence for the analyte.

[f] GC-ECD (Ib) on a relatively nonpolar proprietary phase; same extracts as GC-ECD (Ia).

[g] 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] with 16 laboratories submitting data.

[h] GC/MS (Ia) on a relatively nonpolar proprietary phase after PFE with 50 % hexane/50 % acetone mixture.

[i] GC/MS (Ib) on 50 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC/MS (Ia).

[j] GC-ECD (Ia) on 5 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[k] GC-ECD (II) on a 5% phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

[l] GC/MS on a 5 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC-ECD (I) fractionated using a PYE column.

[m] Interlaboratory comparison study with four laboratories submitting data (See Preparation and Analysis for definition of total PCBs.). The expanded uncertainty, U, is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined standard uncertainty calculated according to the ISO Guide [2]. The coverage factor, k, is determined from the Student’s t-distribution corresponding to the appropriate associated degrees of freedom and 95 % confidence for the total PCBs.

Table 7. Reference Concentrations for Selected Chlorinated Pesticides and Total Extractable Organics in SRM 1974b

	Mass Fractions in µg/kg[a]	
	Wet-Mass Basis	Dry-Mass Basis
Heptachlor[d,e]	0.212 ± 0.084[b]	2.09 ± 0.83[b]
Oxychlordane[d,e]	0.362 ± 0.072[b]	3.57 ± 0.71[b]
Dieldrin[d,e,f,g,h,i]	0.62 ± 0.13[c]	6.1 ± 1.3[c]
cis-Nonachlor[d,e,f,g,h,i,j]	0.64 ± 0.16[c]	6.3 ± 1.6[c]
2,4’-DDT[e,h,i]	0.894 ± 0.057[b]	8.83 ± 0.56[b]
4,4’-DDT[d,e,f,g,h,i,j,k]	0.396 ± 0.096[c]	3.91 ± 0.94[c]
	Percent	
Total Extractable Organics (TEO)[l]	0.64 ± 0.13	6.3 ± 1.3

[a] Concentrations reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water.

[b] The reference value is an unweighted mean of the results from two to three analytical methods. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2].

[c] The reference value is a weighted mean of the results from six to eight analytical methods [23]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-method variance incorporating inter-method bias with a pooled within-source variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurements [2].

[d] GC-ECD (Ib) on a relatively nonpolar proprietary phase; same extracts as GC-ECD (Ia).

[e] GC-ECD (III) on a 5 % phenyl-substituted methylpolysiloxane phase and a relatively non-polar proprietary phase after PFE with DCM.

[f] GC/MS (Ib) on 50 % phenyl-substituted methylpolysiloxane phase; same extracts analyzed as in GC/MS (Ia).

[g] GC-ECD (Ia) on 5 % phenyl-substituted methylpolysiloxane phase after PFE with DCM.

[h] GC/MS (II) on a relatively nonpolar proprietary phase after Soxhlet extraction with DCM.

[i] 2000 NIST Intercomparison Exercise for Organic Contaminants in the Marine Environment [3] with 16 laboratories submitting data.

[j] GC/MS (Ia) on a relatively nonpolar proprietary phase after PFE with 50 % hexane/50 % acetone mixture.

[k] GC-ECD (II) on a 5 % phenyl-substituted methylpolysiloxane phase after Soxhlet extraction with DCM.

[l] Interlaboratory comparison study with six laboratories submitting data. The expanded uncertainty, U, is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined standard uncertainty calculated according to the ISO Guide [2]. The coverage factor, k, is determined from the Student’s t-distribution corresponding to the appropriate associated degrees of freedom and 95 % confidence for the TEO.

Table 8. Reference Concentrations for Additional Trace Elements in SRM 1974b

	Mass Fraction in mg/kg[a,b]	
	Wet-Mass Basis	Dry-Mass Basis
Arsenic[c]	0.796 ± 0.049	7.86 ± 0.48
Cadmium[c,d]	0.155 ± 0.005	1.53 ± 0.05
Chromium[c]	0.233 ± 0.010	2.30 ± 0.10
Copper[c,d]	0.967 ± 0.016	9.55 ± 0.16
Iron[e]	55.1 ± 3.4	544 ± 34
Lead[d]	0.752 ± 0.026	7.42 ± 0.26
Nickel[c,d]	0.109 ± 0.005	1.08 ± 0.05
Selenium[c]	0.224 ± 0.015	2.21 ± 0.15
Silver[c,d]	0.028 ± 0.003	0.280 ± 0.033
Tin[d]	0.028 ± 0.002	0.273 ± 0.018
Zinc[c,d]	12.3 ± 0.3	121 ± 3

[a] The concentrations are reported on both wet- and dry-mass basis; material as received contains 89.87 % ± 0.05 % (95 % confidence level) water. These elements were determined in freeze-dried samples on a dry-mass basis.

[b] The reference values are the means of results obtained from NRC Canada using one or two analytical techniques and the consensus mean from six laboratories participating in the NRC Canada 14th Intercomparison for Trace Elements in Marine Sediments and Biological Tissues [4]. The uncertainty listed with the value is an expanded uncertainty about the mean, with coverage factor 2, calculated by combining a between-method variance [24] with a pooled, within method variance following the ISO/NIST Guide to the Expression of Uncertainty in Measurement [2].

[c] Determined at NRC Canada using GFAAS.

[d] Determined at NRC Canada using ID-ICP-MS.

[e] Determined at NRC Canada using ICP-AES.

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APPENDIX A

The laboratories listed below performed measurements that contributed to the certification of SRM 1974b Organics in Mussel Tissue (*Mytilus edulis*).

Arthur D. Little, Inc; Cambridge, MA, USA
Australian Nuclear Science and Technology Organization; Menai, NSW, Australia
B & B Laboratories; College Station, TX, USA
BWPC Laboratory; San Francisco, CA, USA
Battelle Pacific Northwest; Sequim, WA, USA
California Department of Fish and Game; Rancho Cordova, CA, USA
City of San Jose Environmental Services Department Laboratory; San Jose, CA, USA
Environment Canada; Moncton, New Brunswick, Canada
Manchester Environmental Laboratory; Port Orchard, WA, USA
NOAA, National Ocean Service, Center for Coastal Environmental Health and Biomolecular Research; Charleston, SC, USA
NOAA, NMFS, Sandy Hook Marine Laboratory; Highlands, NJ, USA
NOAA, NMFS, Northwest Fisheries Science Center; Seattle, WA, USA
Orange County Sanitation District; Fountain Valley, CA, USA
Resource Sciences Centre Department of Natural Resources; Indooroopillly, Queensland, Australia
STL Sacramento; Sacramento, CA, USA
Texas Parks and Wildlife Department; San Marcos, TX, USA
Texas A&M University College of Veterinary Medicine; College Station, TX, USA
University of Connecticut Environmental Research Institute; Storrs, CT, USA
University of Rhode Island Graduate School of Oceanography; Narragansett, RI, USA
US Department of Agriculture, Environmental Chemistry Laboratory; Beltsville, MD, USA
US Geological Survey, National Water Quality Laboratory; Denver, CO, USA
Wright State University; Dayton, OH, USA

Appendix D:
Water Quality Comparisons

Appendix D Water Quality Parameters

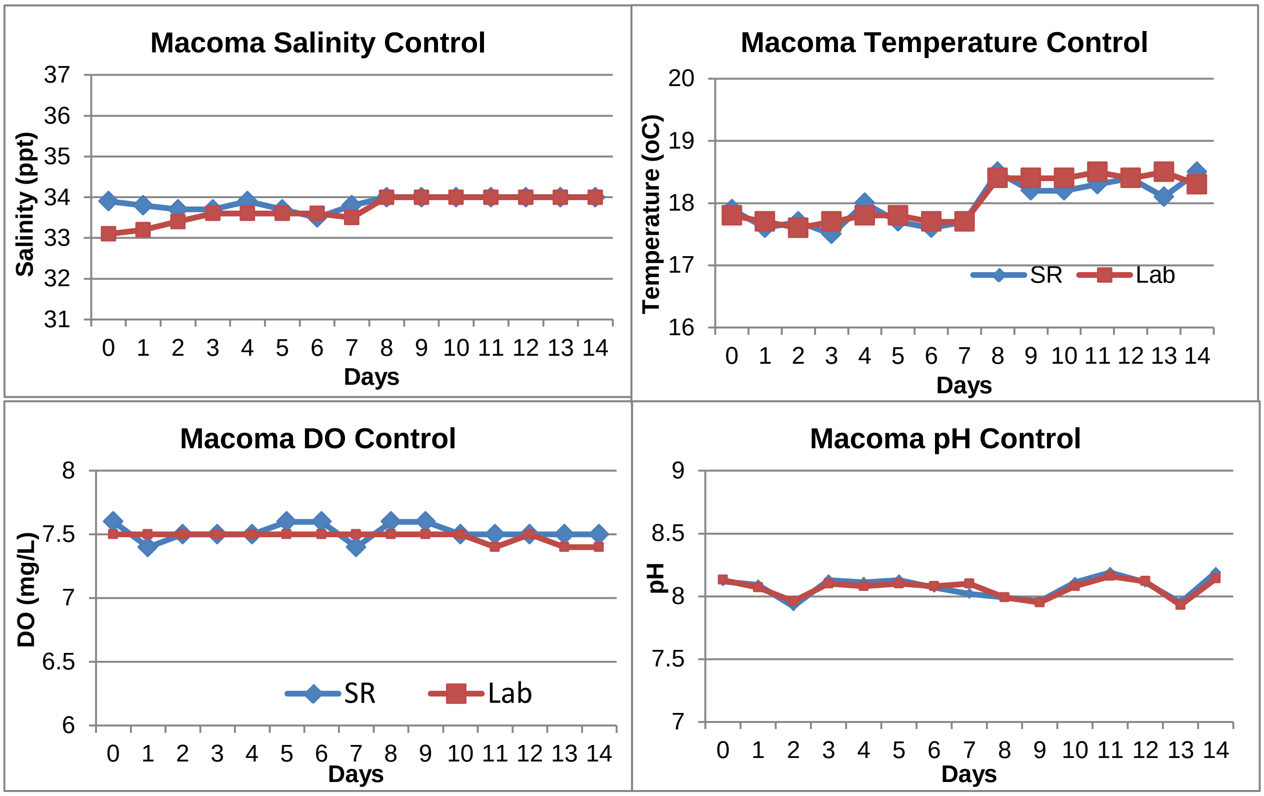


Figure D-1 Comparison of Water Quality Parameters During the Macoma Control Sediment Toxicity and Bioaccumulation tests

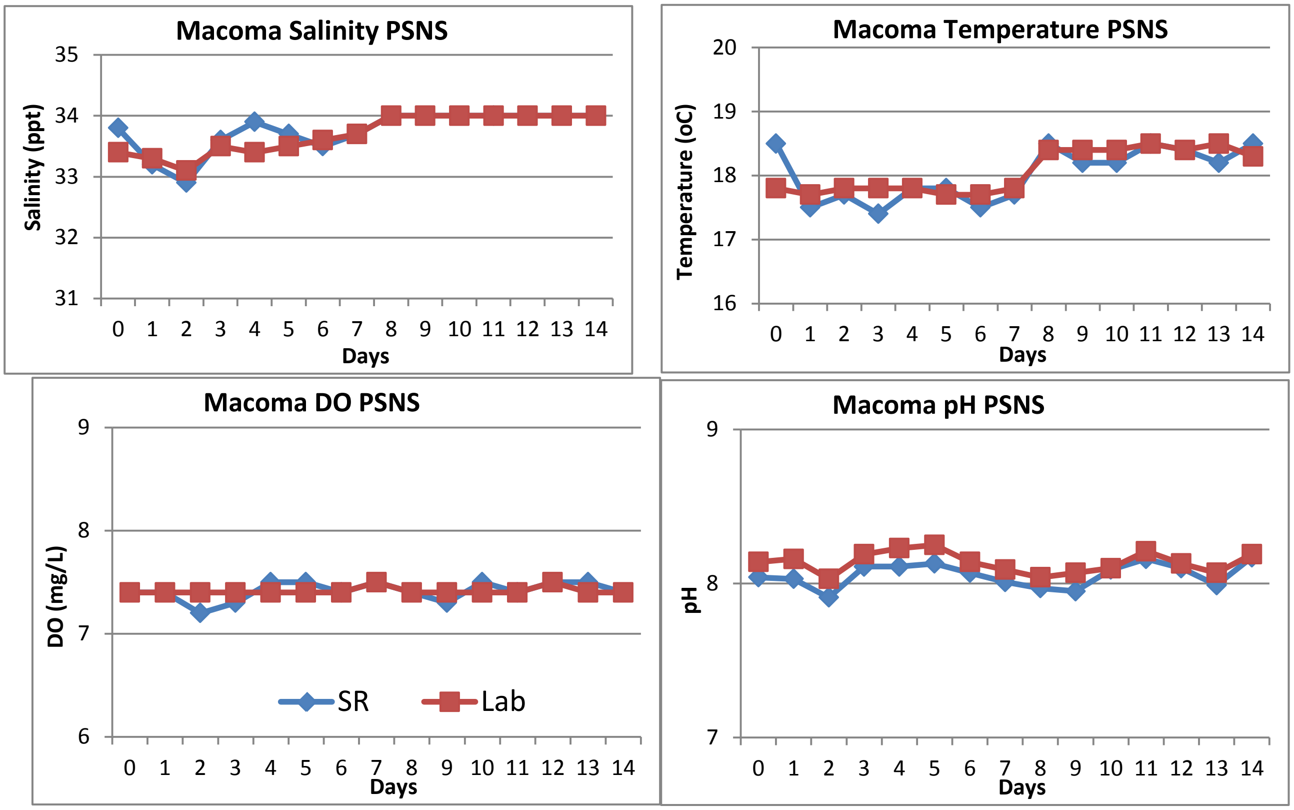


Figure D-2 Comparison of Water Quality Parameters During the Macoma PSNS Sediment Toxicity and Bioaccumulation tests

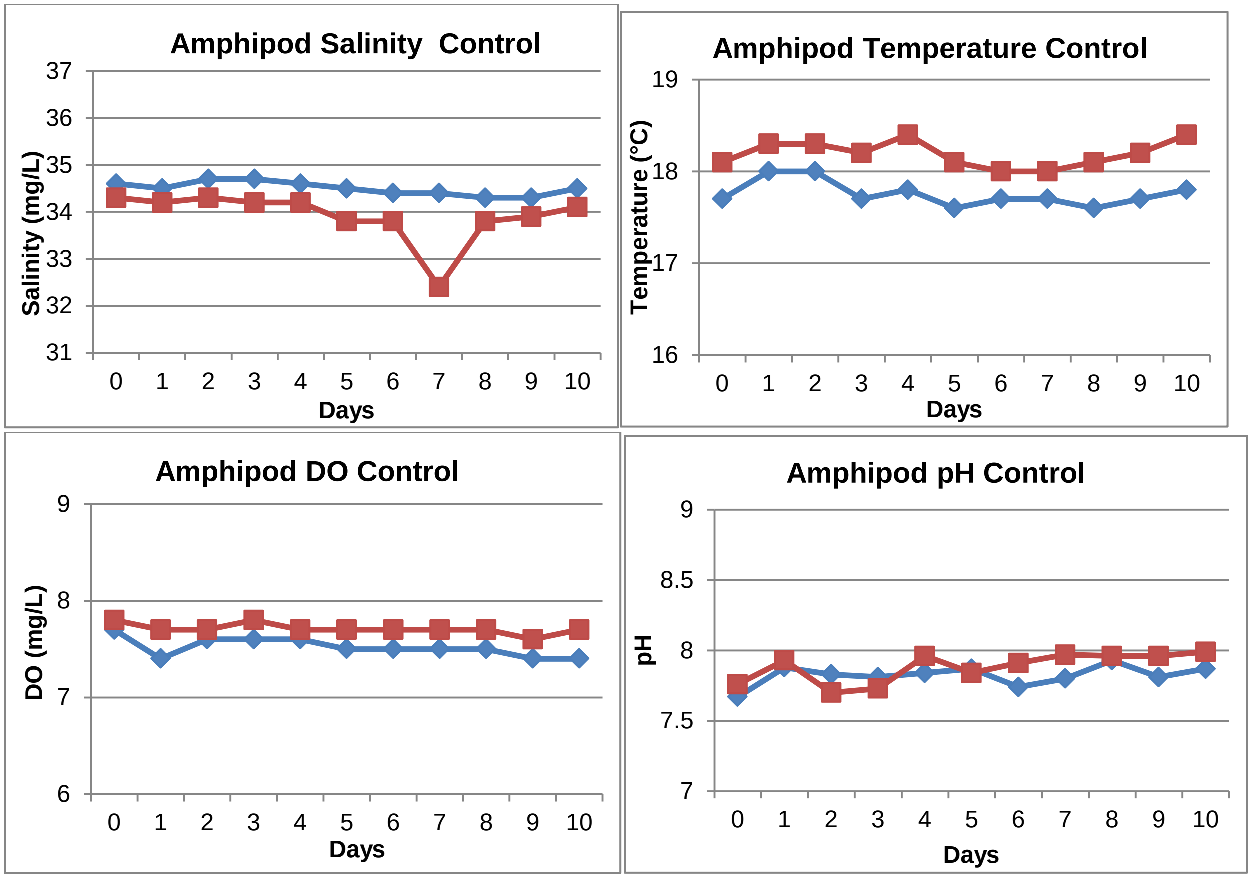


Figure D-3 Comparison of Water Quality Parameters During the Amphipod Control Sediment Toxicity and Bioaccumulation tests

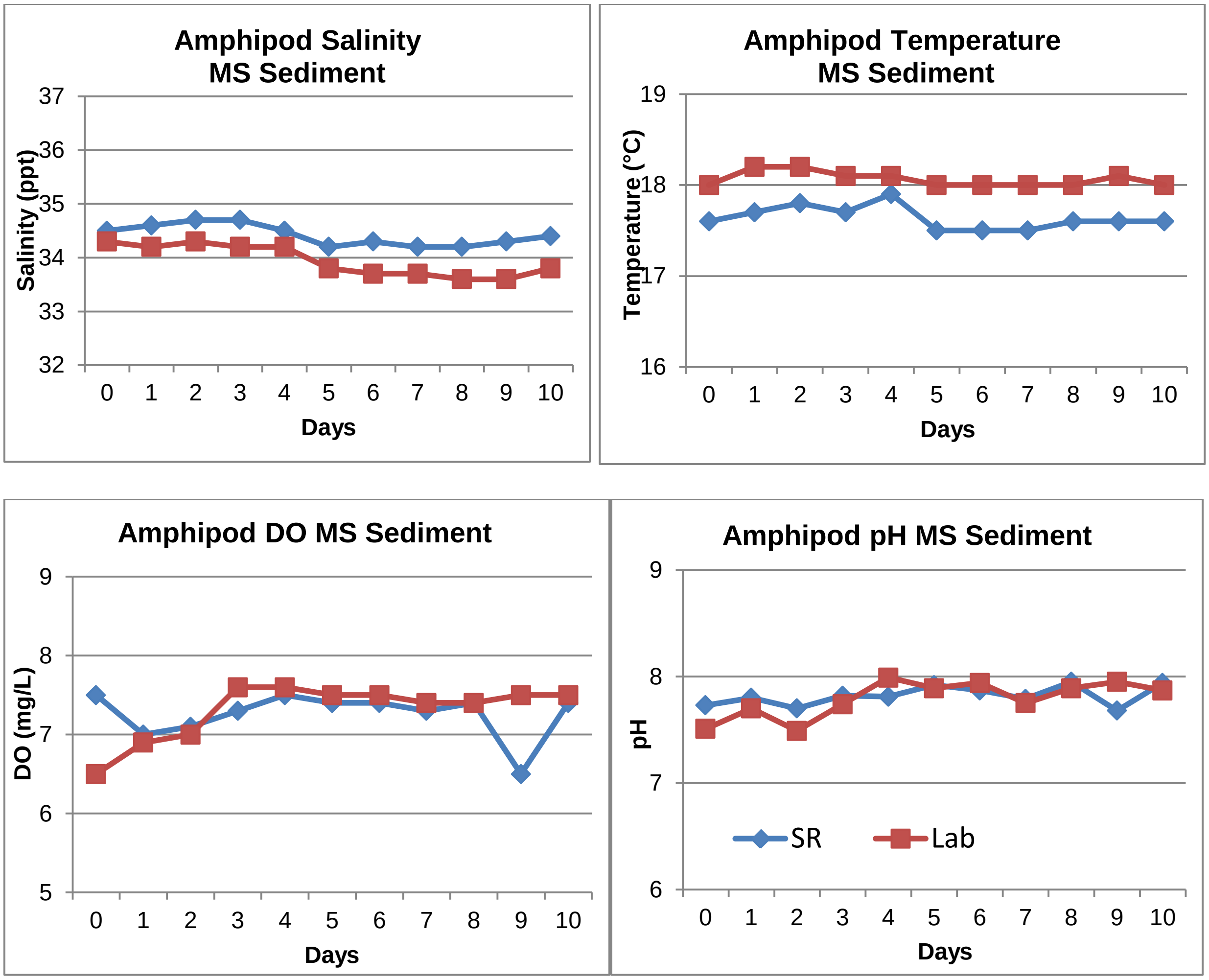


Figure D-4 Comparison of Water Quality Parameters During the Amphipod MS Sediment Toxicity and Bioaccumulation tests

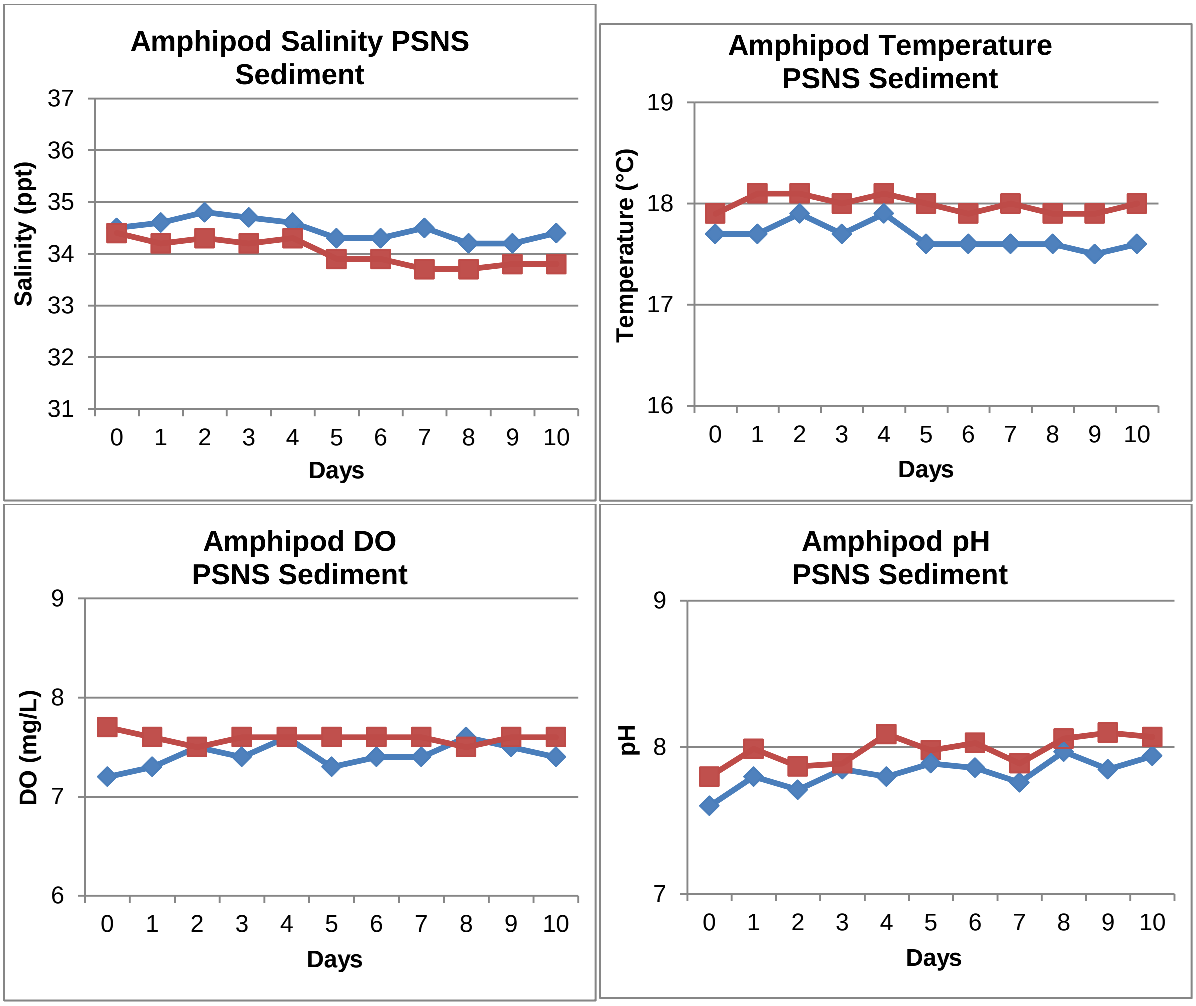


Figure D-5 Comparison of Water Quality Parameters During the Amphipod PSNS Sediment Toxicity and Bioaccumulation tests

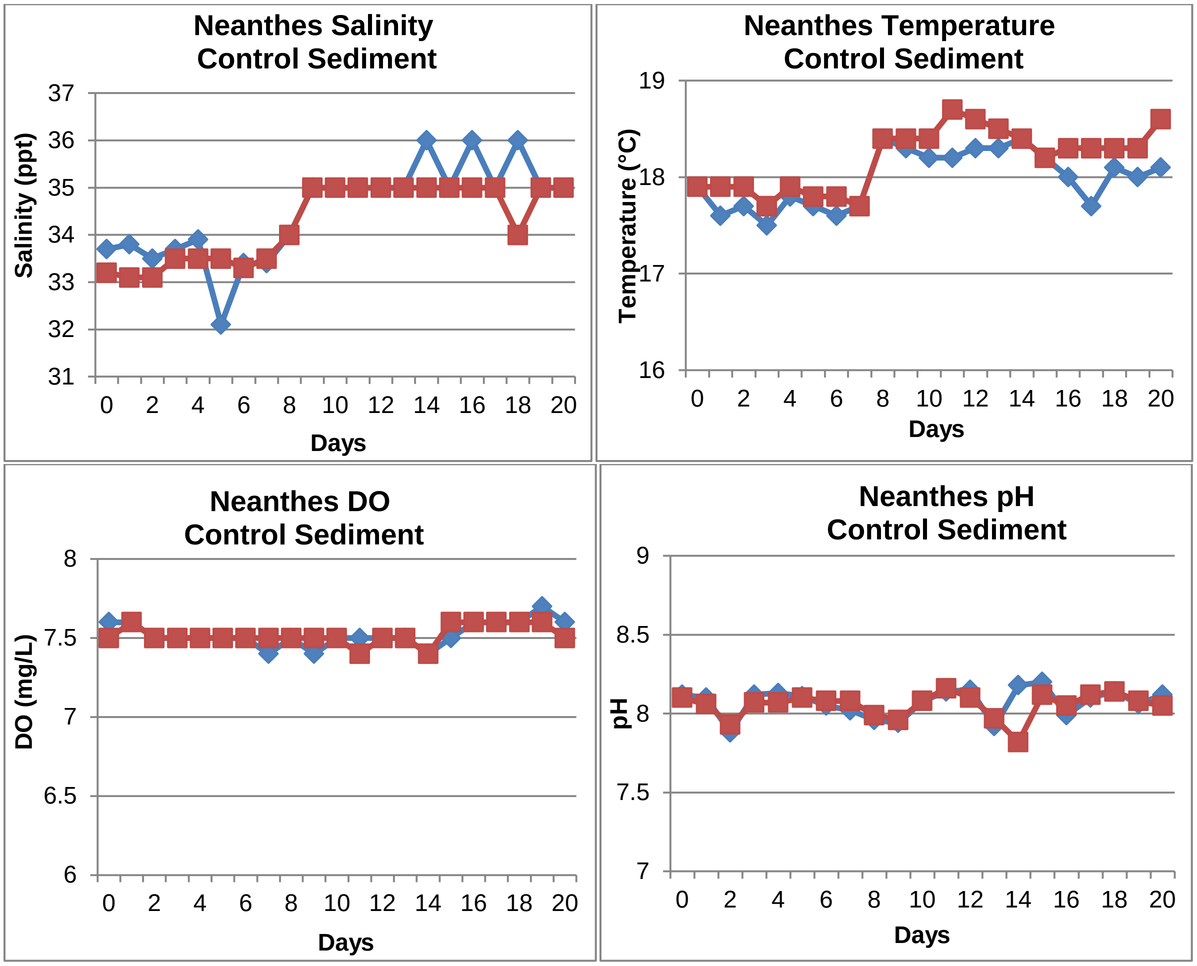


Figure D-6 Comparison of Water Quality Parameters During the Neanthes Control Sediment Toxicity and Bioaccumulation tests

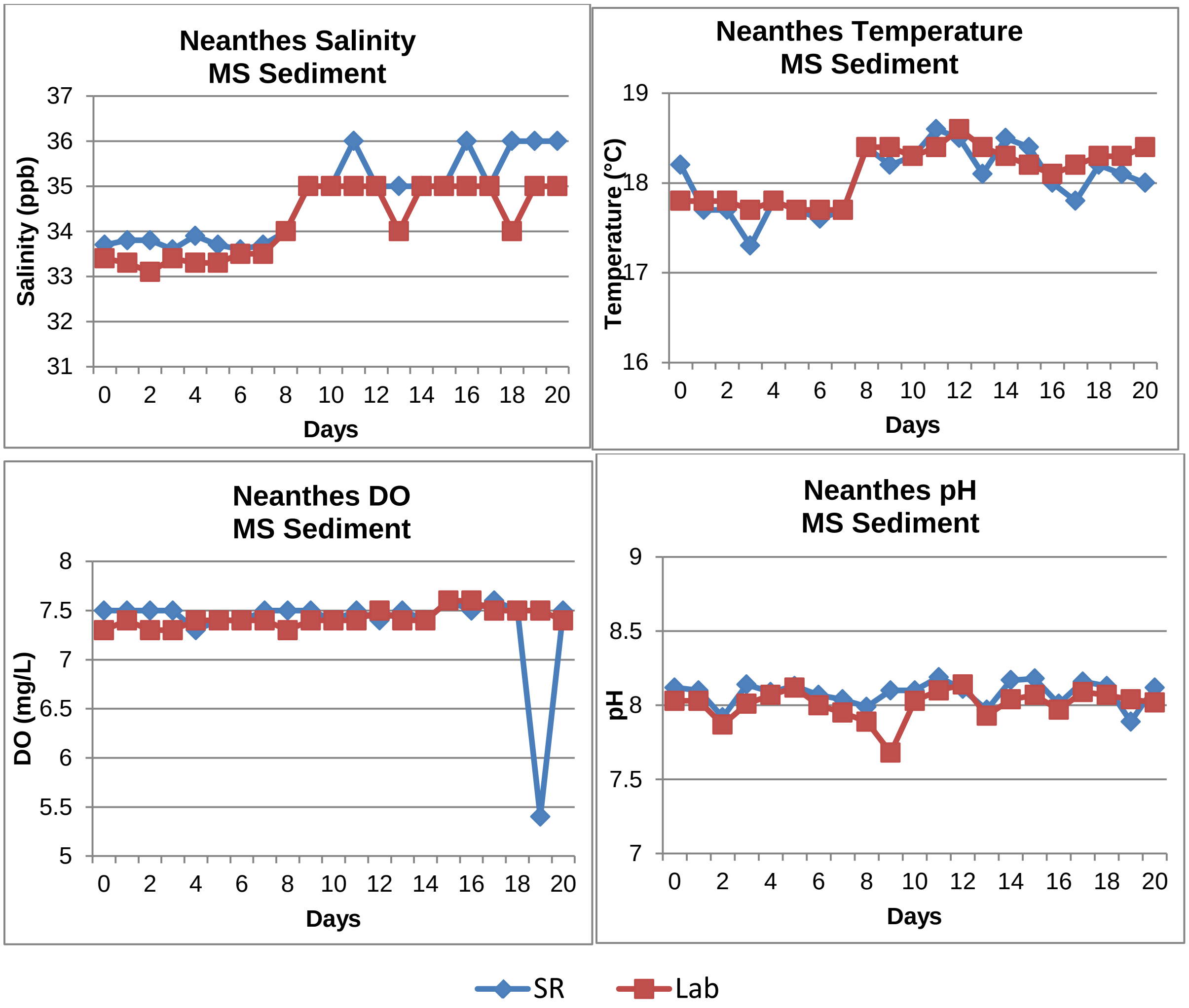
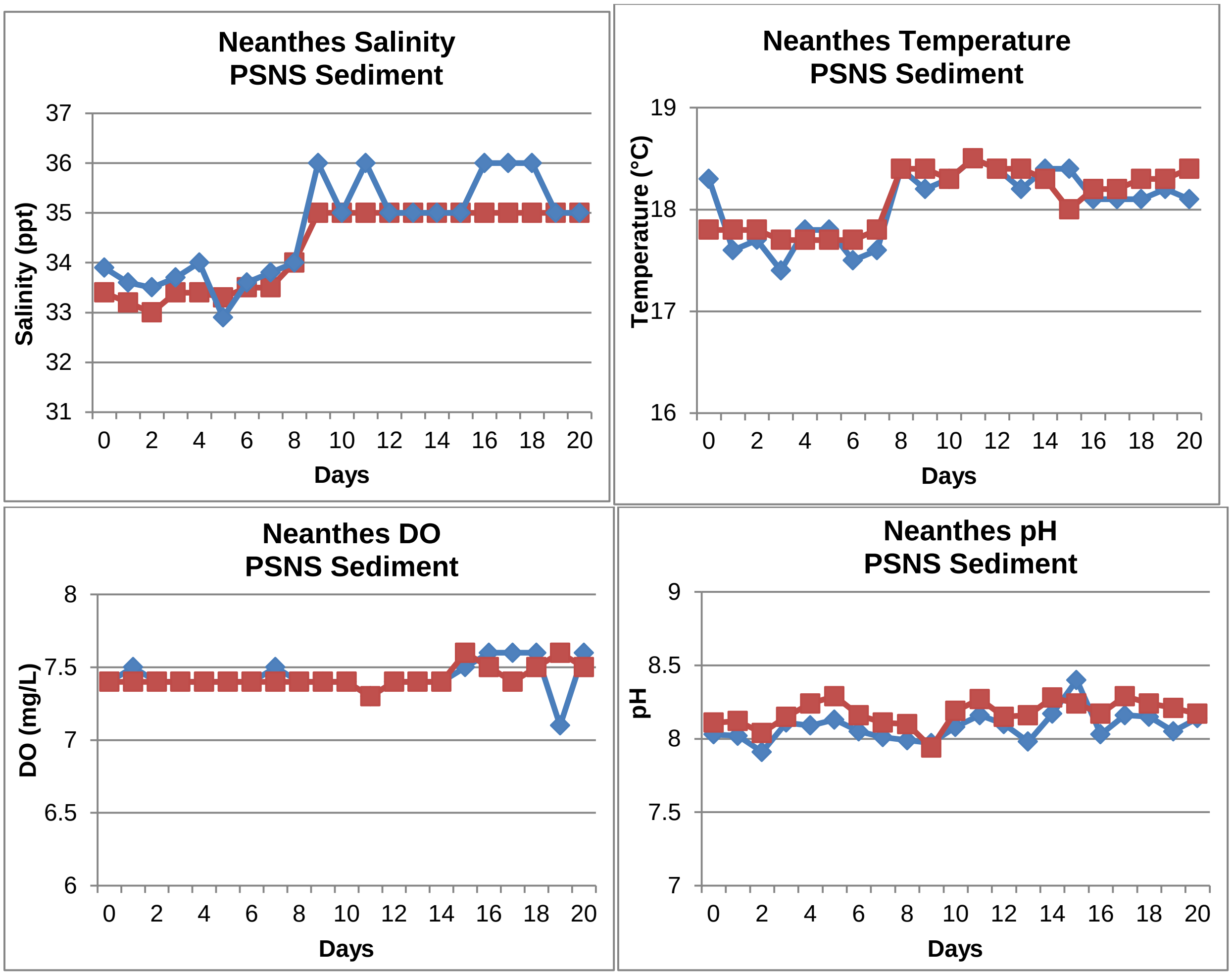


Figure D-7 Comparison of Water Quality Parameters During the Neanthes MS Sediment Toxicity and Bioaccumulation tests



Neanthes Salinity PSNS Sediment

Neanthes Temperature PSNS Sediment

Neanthes DO PSNS Sediment

Neanthes pH PSNS Sediment

Figure D-8 Comparison of Water Quality Parameters During the Neanthes PSNS Sediment Toxicity and Bioaccumulation tests

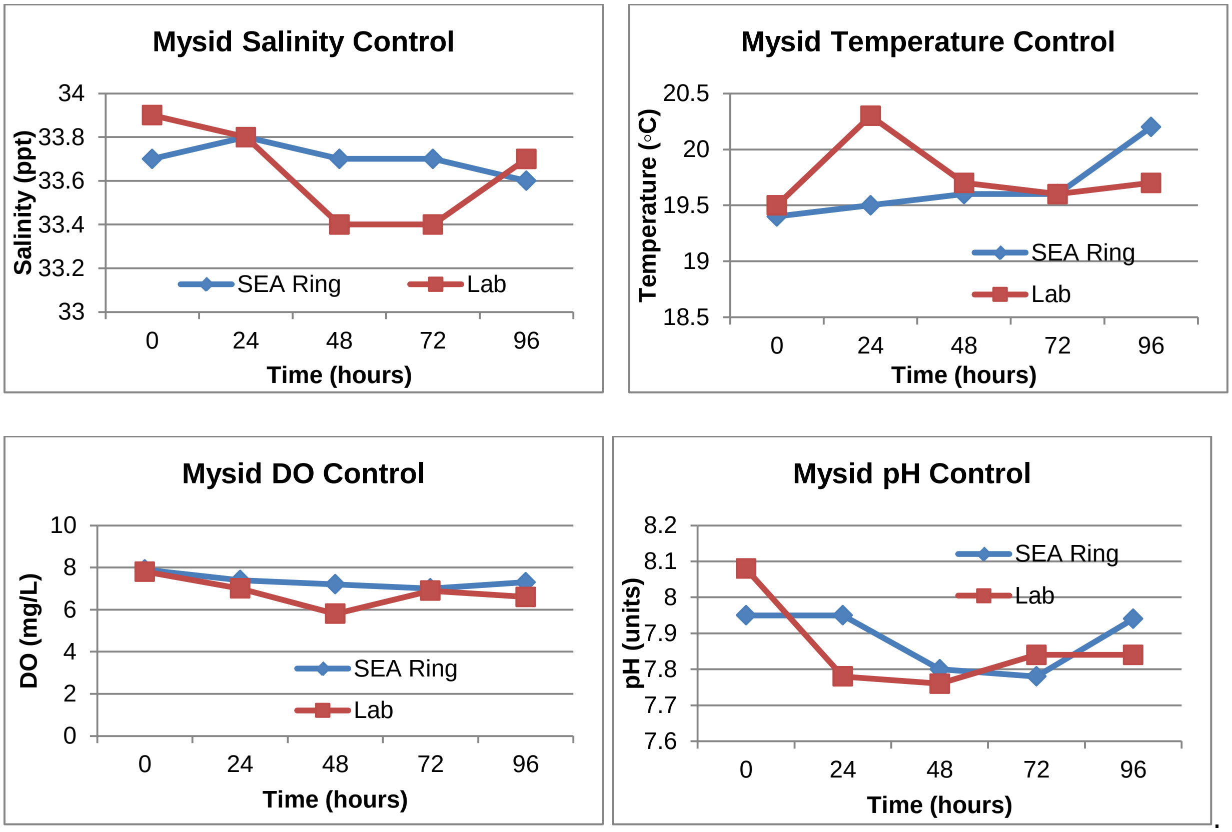


Figure D-9 Comparison of Water Quality Parameters for Mysid Shrimp at 0 μg/L of CuSO4

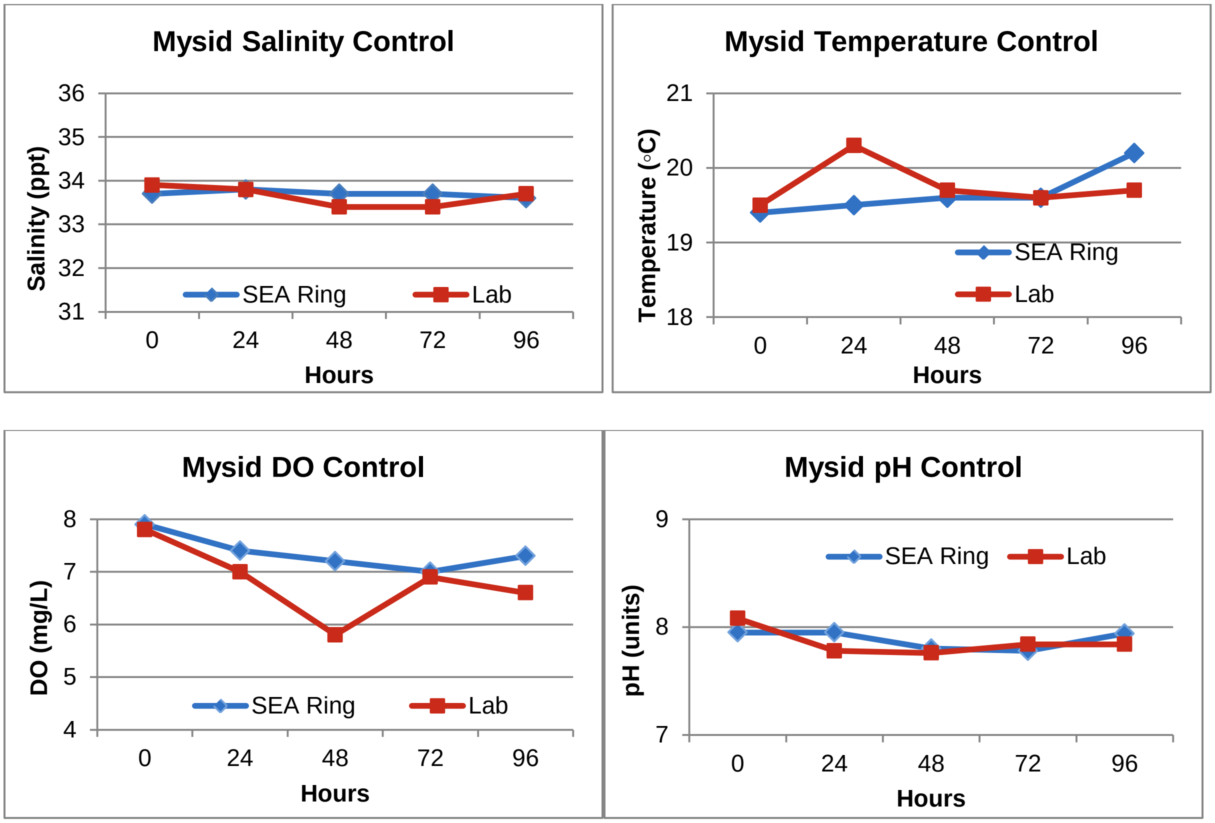


Figure D-10 Comparison of Water Quality Parameters for Mysid Shrimp at 100 µg/L of CuSO4

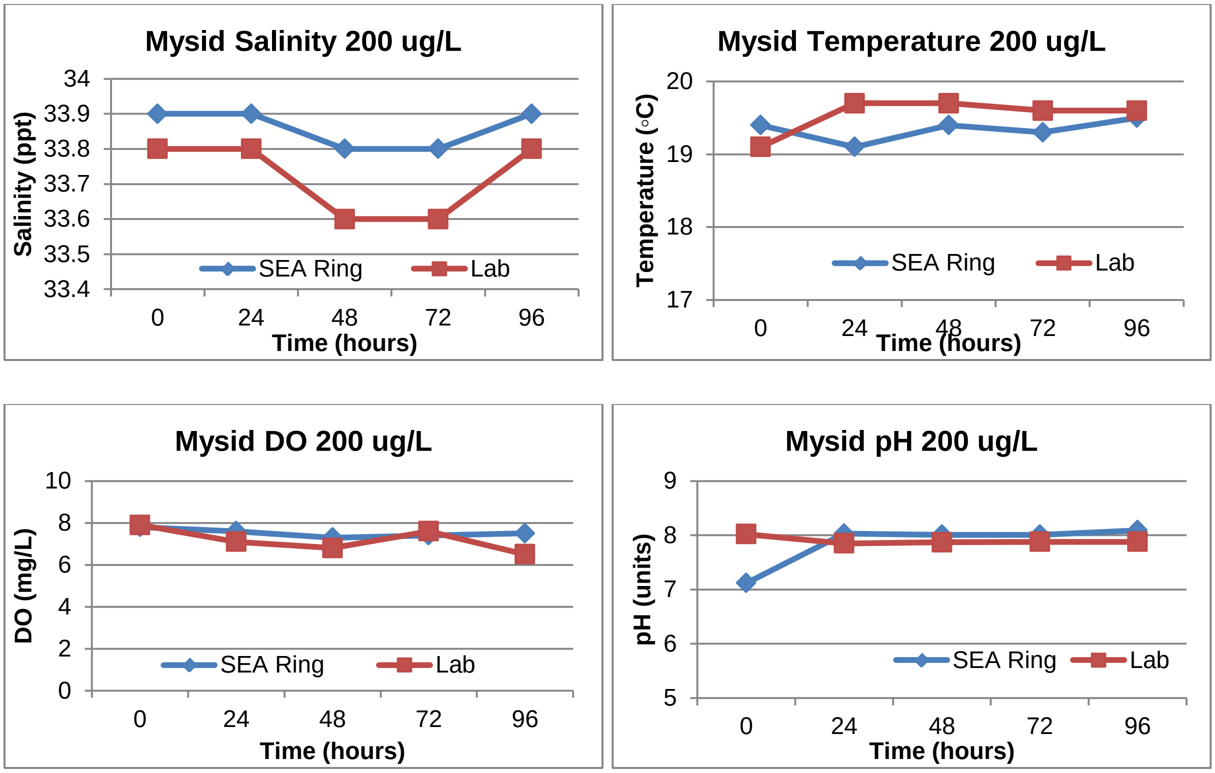


Figure D-11 Comparison of Water Quality Parameters for Mysid Shrimp at 200 µg/L of CuSO4

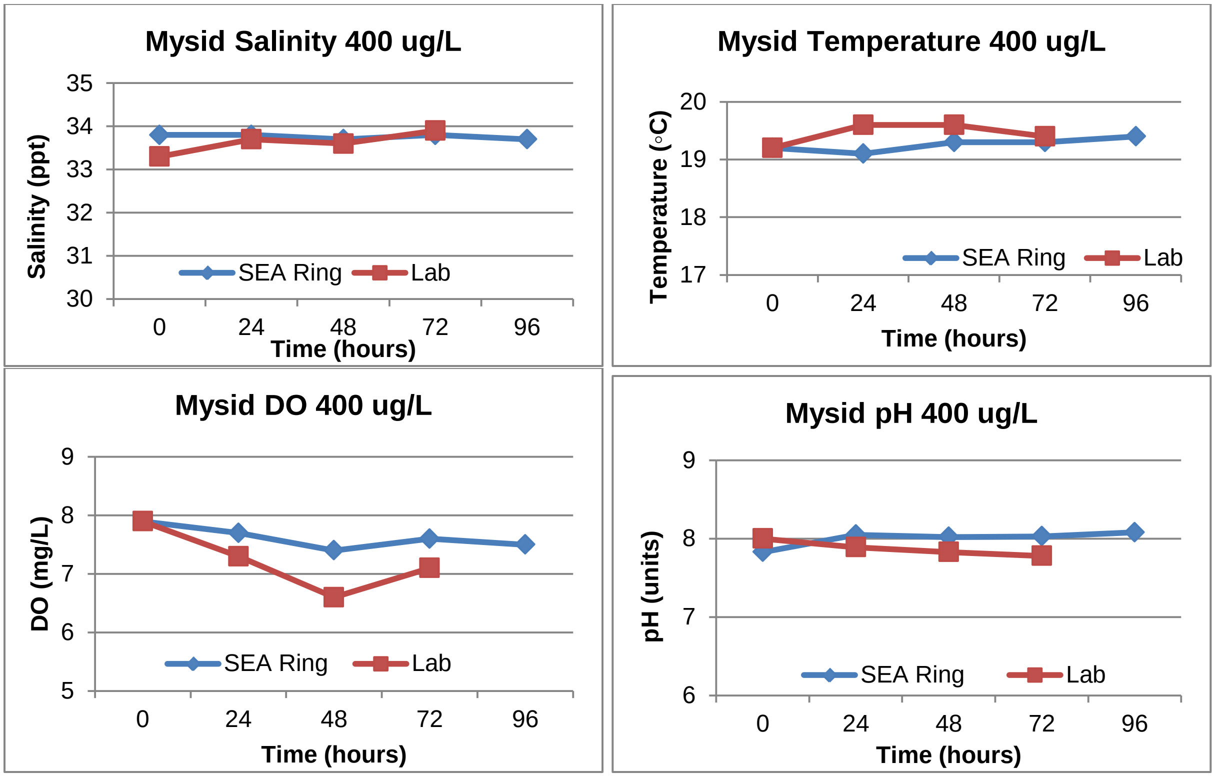


Figure D-12: Comparison of Water Quality Parameters for Mysid Shrimp at 400 µg/L of CuSO4

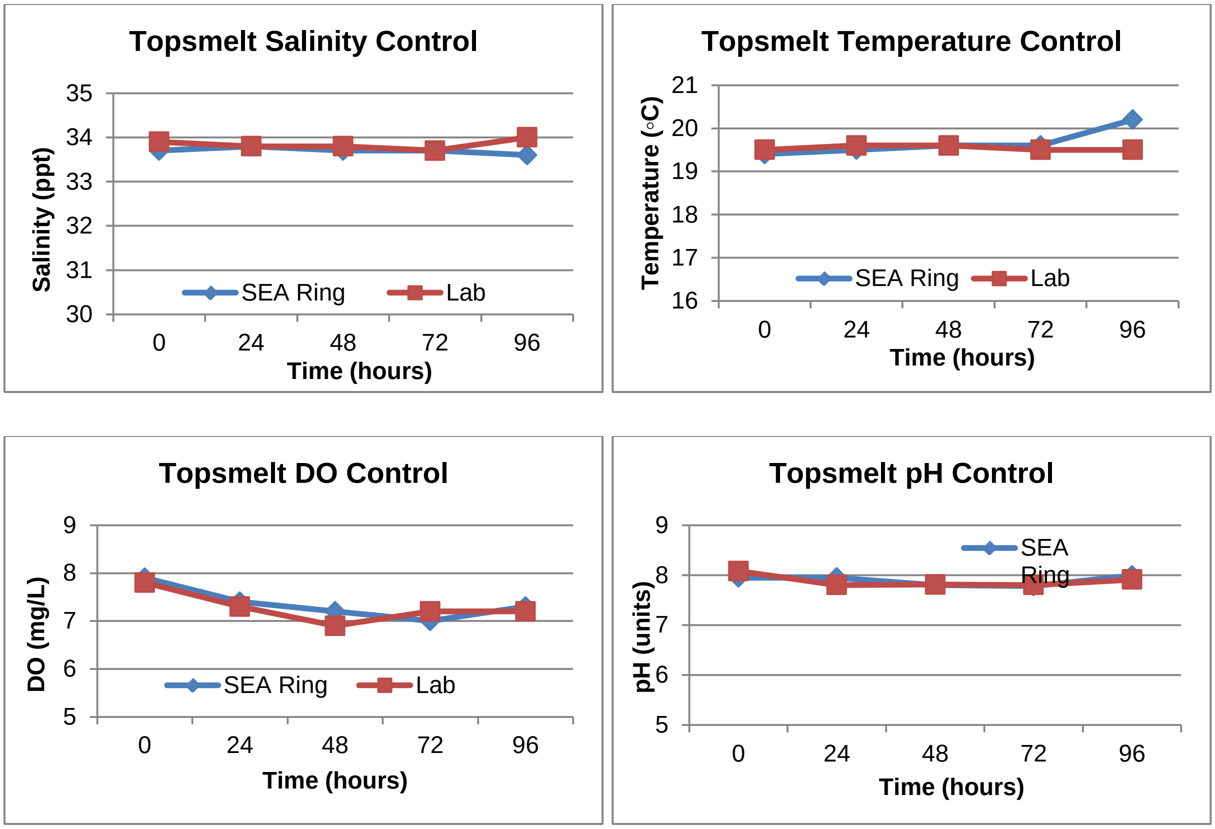


Figure D-13 Comparison of Water Quality Parameters for Topsmelt at 0 µg/L of CuSO4

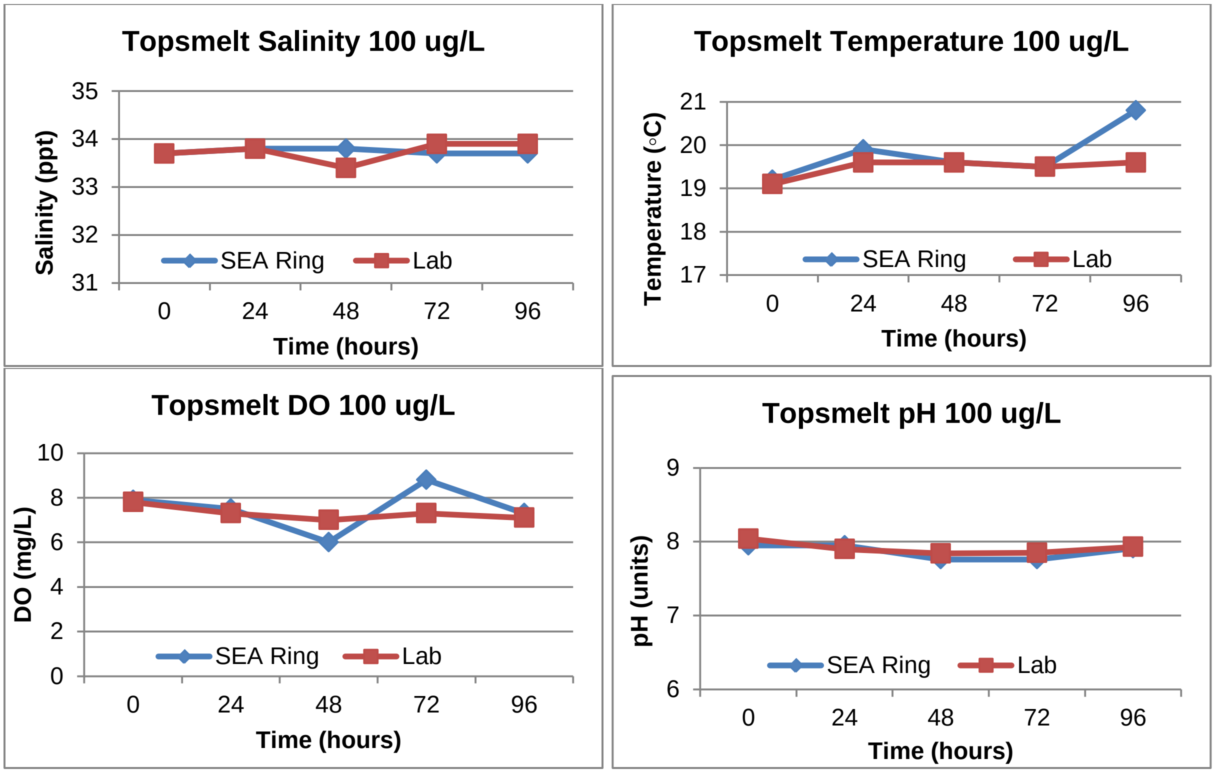
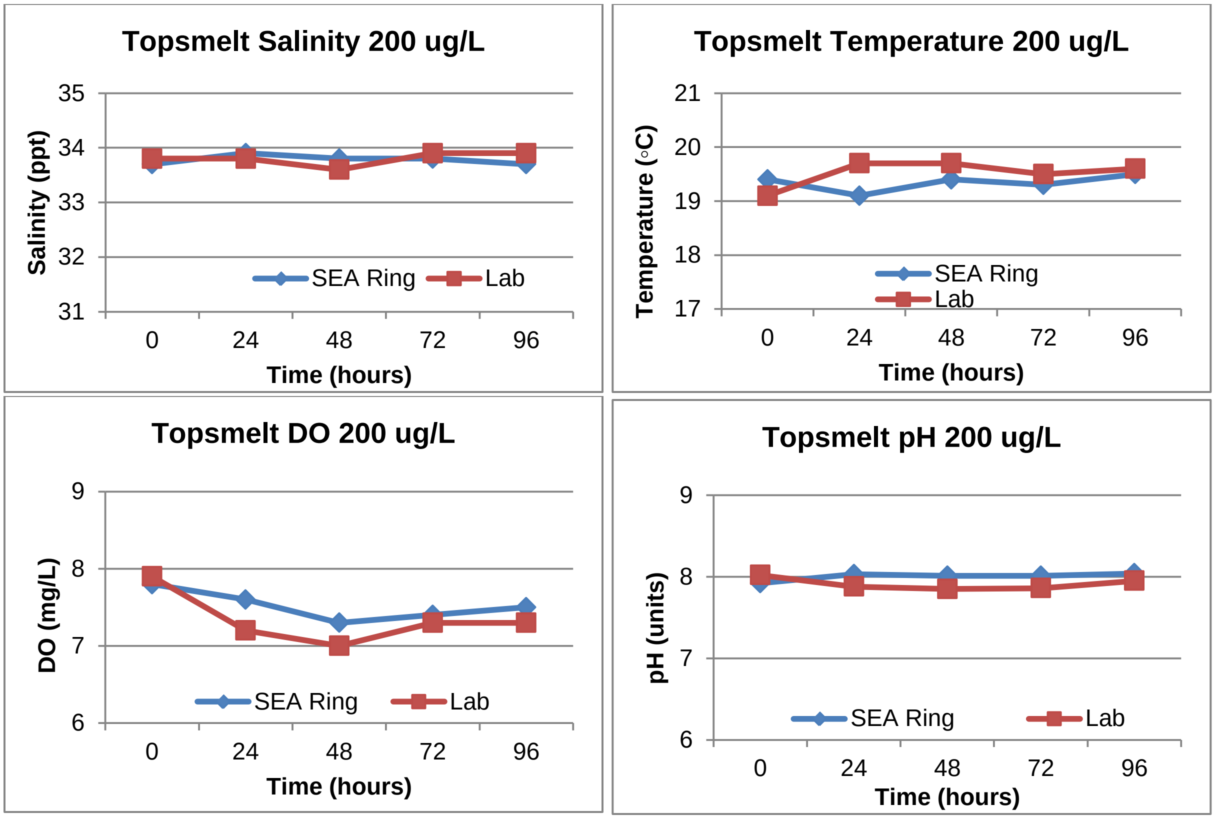


Figure D-14 Comparison of Water Quality Parameters for Topsmelt at 100 µg/L of CuSO4



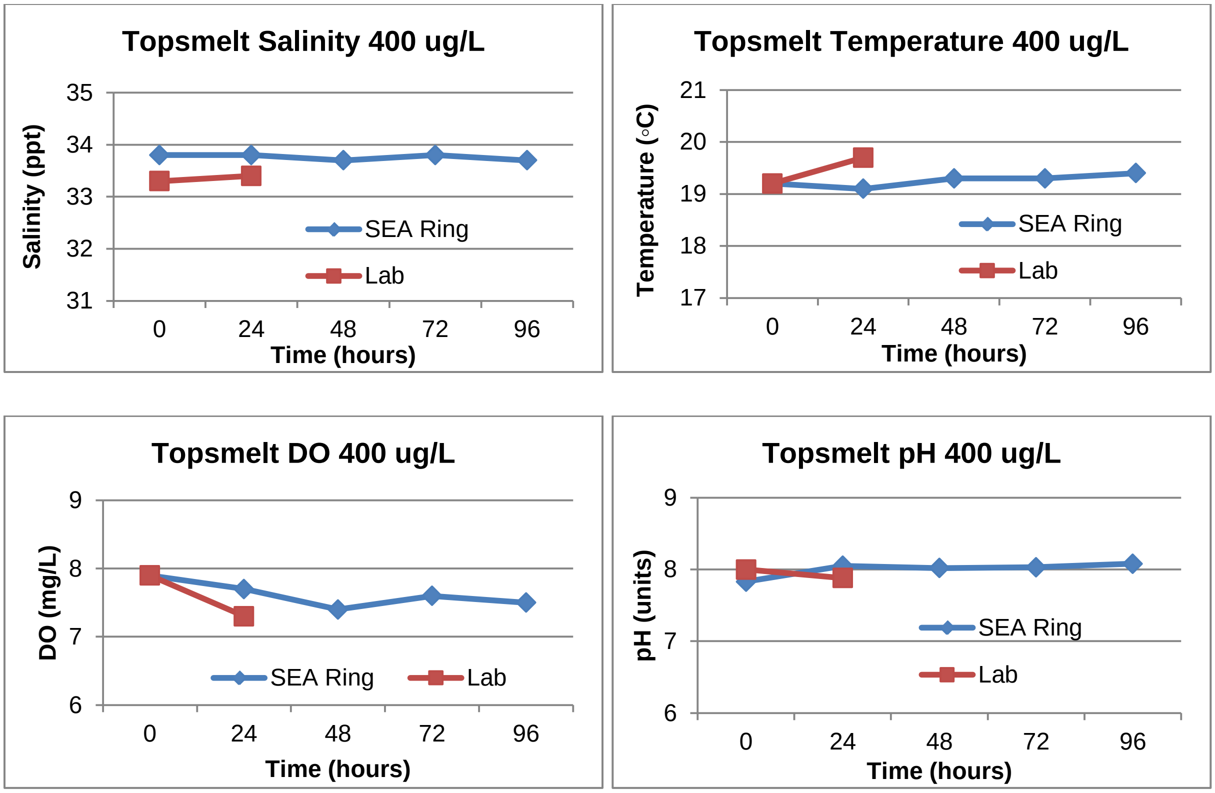
Topsmelt Salinity 200 ug/L

Topsmelt Temperature 200 ug/L

Topsmelt DO 200 ug/L

Topsmelt pH 200 ug/L

Figure D-15 Comparison of Water Quality Parameters for Topsmelt at 200 µg/L of CuSO4



Topsmelt Salinity 400 ug/L

Topsmelt Temperature 400 ug/L

Topsmelt DO 400 ug/L

Topsmelt pH 400 ug/L

Figure D-16 Comparison of Water Quality Parameters for Topsmelt at 400 µg/L of CuSO4

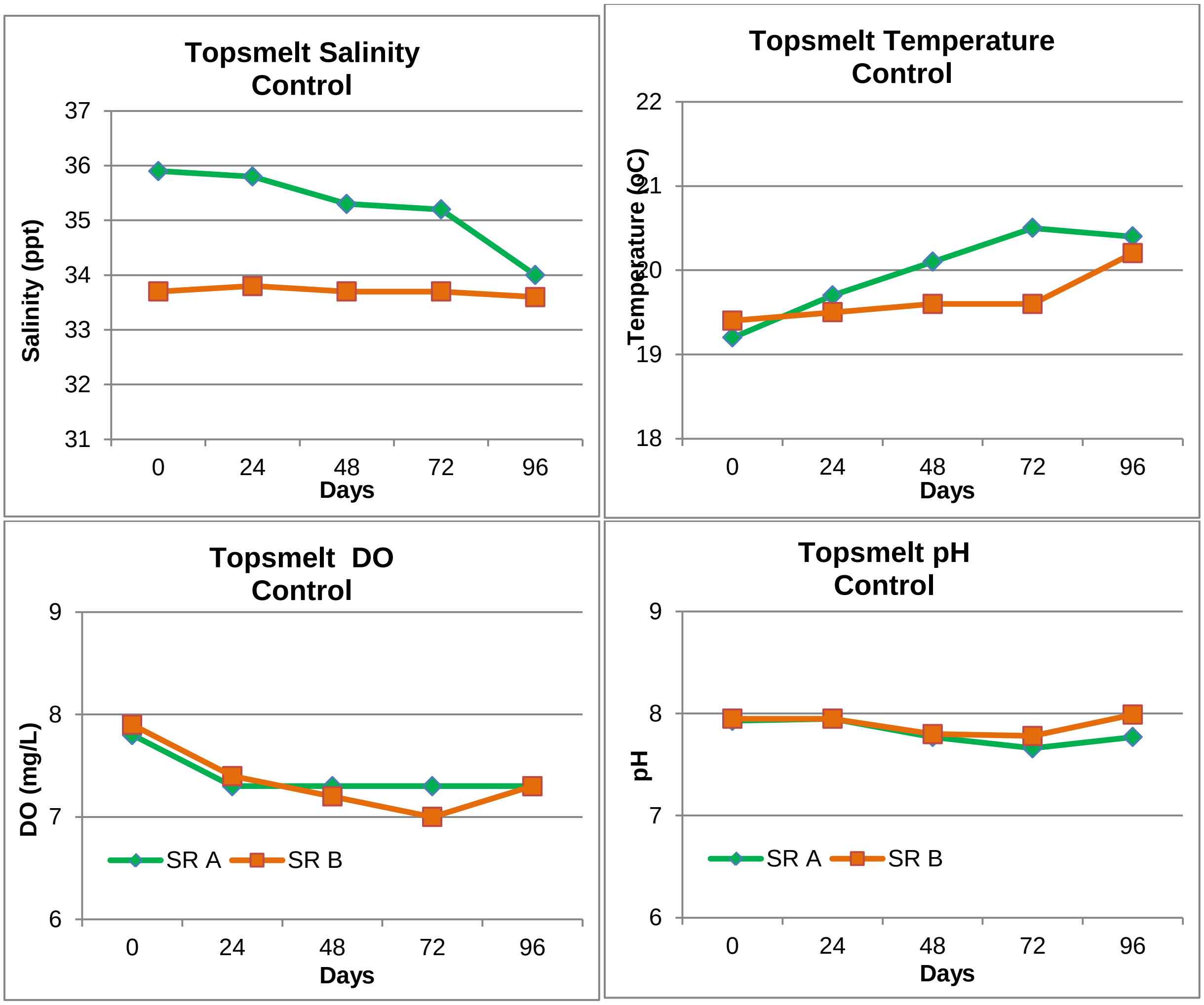


Figure D-17 Reproducibility of Water Quality Parameters During the Mysid Control Water Toxicity Tests in Sea Ring A and B

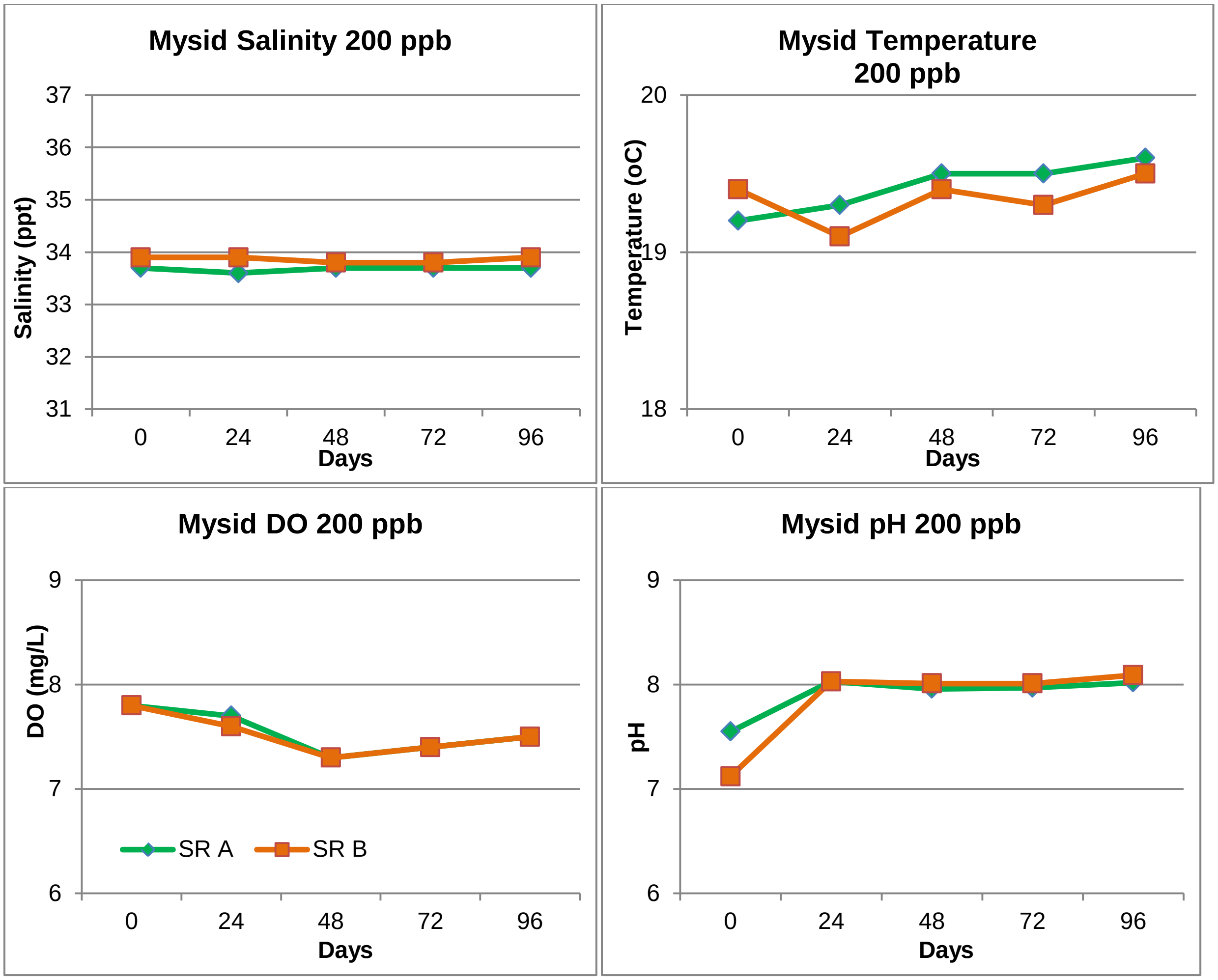
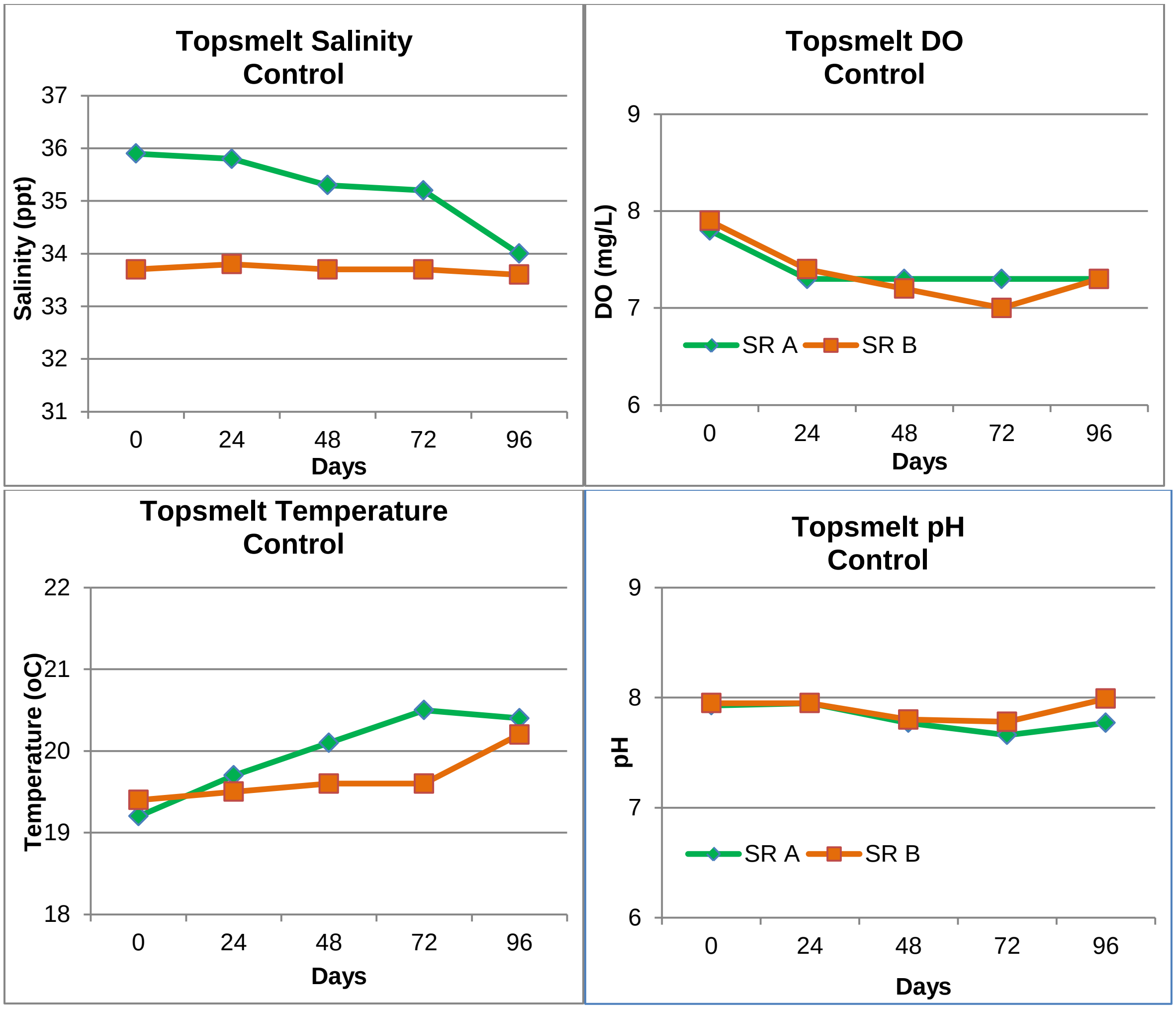


Figure D-18 Reproducibility of Water Quality Parameters During the Mysid 200 ppb Water Toxicity Tests in Sea Ring A and B



Topsmelt Salinity Control

Topsmelt DO Control

Topsmelt Temperature Control

Topsmelt pH Control

Figure D-19 Reproducibility of Water Quality Parameters During the Topsmelt Control Water Toxicity Tests in Sea Ring A and B

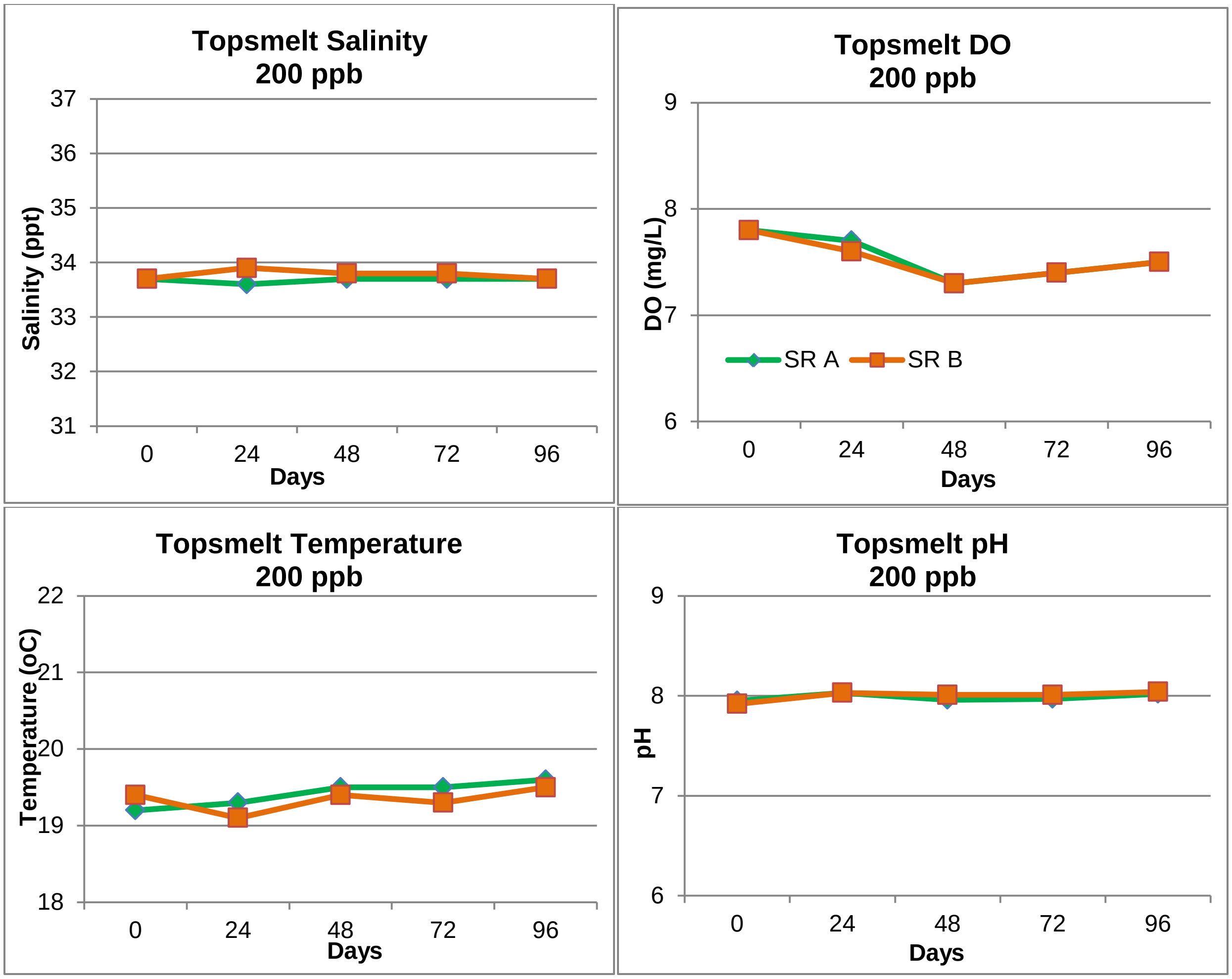


Figure D-20 Reproducibility of Water Quality Parameters During the Topsmelt 200 ppb Water Toxicity Tests in Sea Ring A and B

Appendix E:
Data Used for Statistical Analysis

Appendix E
Data Used For Statistical Analysis

Amphipod Survival – Sea Ring

Sample ID	Rep	Initial # Organisms	Final # Organisms	Percent Survival
Yaquina Bay Control Sediment	A	20	20	100
	B	20	17	85
	C	20	20	100
	D	20	19	95
	E	20	20	100
MS Sediment	A	20	17	85
	B	20	19	95
	C	20	16	80
	D	20	17	85
	E	20	17	85
PSNS Sediment	A	20	16	80
	B	20	15	75
	C	20	15	75
	D	20	16	80
	E	20	17	85

Amphipod Survival - Laboratory

Sample ID	Rep	Initial # Organisms	Final # Organisms	Percent Survival (%)
Yaquina Bay Control Sediment	A	20	19	95
	B	20	20	100
	C	20	19	95
	D	20	17	85
	E	20	19	95
MS Sediment	A	20	17	85
	B	20	18	90
	C	20	19	95
	D	20	19	95
	E	20	17	85
PSNS Sediment	A	20	16	80
	B	20	14	70
	C	20	16	80
	D	20	13	65
	E	20	17	85

Clam Survival – SEA Ring and Laboratory

Chamber Type	Sediment Type	Sample ID	Initial #	# Recovered	% Survival
SEA Ring	DB Control Sediment	A	3	3	100
		B	3	3	100
		C	3	3	100
		D	3	3	100
		E	3	3	100
Beaker		A	3	3	100
		B	3	3	100
		C	3	3	100
		D	3	3	100
		E	3	3	100
SEA Ring	PSNS Sediment	A	3	3	100
		B	3	3	100
		C	3	3	100
		D	3	3	100
		E	3	3	100
Beaker		A	3	3	100
		B	3	3	100
		C	3	3	100
		D	3	3	100
		E	3	3	100

Polychaete Survival – SEA Ring

Sediment Type	Rep	Initial # Organisms	Final # Organisms	% Survival
Yaquina Bay Control Sediment	A	20	20	100
	B	20	19	95
	C	Replicate was dropped on termination and several animals were lost, so not included.		
	D	20	16	80
	E	20	20	100
MS Sediment	A	20	16	80
	B	20	20	100
	C	20	20	100
	D	20	20	100
	E	20	19	95
PSNS Sediment	A	20	20	100
	B	20	20	100
	C	20	17	85
	D	20	20	100
	E	20	19	95

Polychaete Survival - Laboratory

Sediment Type	Rep	Initial # Organisms	Final # Organisms	% Survival
Yaquina Bay Control Sediment	A	20	16	80
	B	20	20	100
	C	20	19	95
	D	20	20	100
	E	20	20	100
MS Sediment	A	20	18	90
	B	20	19	95
	C	20	20	100
	D	20	20	100
	E	20	17	85
PSNS Sediment	A	20	20	100
	B	20	20	100
	C	20	20	100
	D	20	18	90
	E	20	20	100

Polychaete Growth Data

			#	Pan	Pan+Tot.	Rep Tot. Wet	Ind. Wet	Mean Ind	Pan+Tot.	Org. Total	Ind Dry	Mean Ind
Chamber Type	**Sediment Type-Chamber**	**Initial #**	**Recovered**	**Weight (g)**	**Wet Wt (g)**	**Wt (g)**	**Wt (mg)**	**Wet Wt (mg)**	**Dry Wt (g)**	**Dry Wt (g)**	**Wt (mg)**	**Dry Wt (mg)**
SEA Ring	YB-A	20	20	1.1964	1.3811	0.1847	9.235	8.983	-	-		
	YB-B	20	19	1.2299	1.4081	0.1782	9.379		-	-		
	YB-C	Replicate was dropped on termination and several animals were lost, so not included.							-	-		
	YB-D	20	16	1.1961	1.3642	0.1681	10.506		-	-		
	YB-E	20	20	1.2298	1.366	0.1362	6.810		-	-		
Beaker	YB-A	20	16	1.241	1.3597	0.1187	7.419	8.235	-	-		
	YB-B	20	20	1.2087	1.3426	0.1339	6.695		-	-		
	YB-C	20	19	1.1962	1.4186	0.2224	11.705		-	-		
	YB-D	20	20	1.2072	1.3739	0.1667	8.335		-	-		
	YB-E	20	20	1.2036	1.344	0.1404	7.020		-	-		
SEA Ring	MS-A	20	16	0.531	0.6971	0.1661	10.381	8.710	0.5637	0.0327	2.044	1.874
	MS-B	20	20	0.5373	0.6948	0.1575	7.875		0.5726	0.0353	1.765	
	MS-C	20	20	0.5269	0.6909	0.164	8.200		0.5671	0.0402	2.010	
	MS-D	20	20	0.5197	0.6827	0.163	8.150		0.5533	0.0336	1.680	
	MS-E	20	19	0.5265	0.6964	0.1699	8.942		0.5621	0.0356	1.874	
Beaker	MS-A	20	18	0.5257	0.648	0.1223	6.794	6.779	0.5516	0.0259	1.439	1.586
	MS-B	20	19	0.5373	0.6539	0.1166	6.137		0.5611	0.0238	1.253	
	MS-C	20	20	0.5263	0.6699	0.1436	7.180		0.5578	0.0315	1.575	
	MS-D	20	20	0.5275	0.6652	0.1377	6.885		0.5564	0.0289	1.445	
	MS-E	20	17	0.5275	0.6448	0.1173	6.900		0.5652	0.0377	2.218	

Polychaete Growth Data cont’d

			#	Pan	Pan+Tot.	Rep Tot. Wet	Ind. Wet	Mean Ind	Pan+Tot.	Org. Total	Ind Dry	Mean Ind
Chamber Type	**Sediment Type-Chamber**	**Initial #**	**Recovered**	**Weight (g)**	**Wet Wt (g)**	**Wt (g)**	**Wt (mg)**	**Wet Wt (mg)**	**Dry Wt (g)**	**Dry Wt (g)**	**Wt (mg)**	**Dry Wt (mg)**
SEA Ring	PSNS-A	20	20	1.2035	1.4232	0.2197	10.985	10.875	-	-		
	PSNS-B	20	20	1.1981	1.4148	0.2167	10.835		-	-		
	PSNS-C	20	17	1.2297	1.4309	0.2012	11.835		-	-		
	PSNS-D	20	20	1.1933	1.416	0.2227	11.135		-	-		
	PSNS-E	20	19	1.2033	1.3854	0.1821	9.584		-	-		
Beaker	PSNS-A	20	20	1.2297	1.374	0.1443	7.215	6.767	-	-		
	PSNS-B	20	20	1.1981	1.3357	0.1376	6.880		-	-		
	PSNS-C	20	20	1.1796	1.314	0.1344	6.720		-	-		
	PSNS-D	20	18	1.2295	1.3524	0.1229	6.828		-	-		
	PSNS-E	20	20	1.23	1.3538	0.1238	6.190		-	-		

Bioaccumulation Data – SEA Ring

Sediment	**PCB (µg/kg)**	**% lipid**	**PCB normalized to percent lipid (mg/kg)**
Amphipod			
YB control sediment	0	**1.22**	**0**
	0		**0**
	0		**0**
PSNS Sediment	718.3	**1.27**	**56.6**
	5,051.0		**397.7**
	3,685.0		**290.2**
Clam			
DB control sediment	0	**0.37**	**0**
	0		**0**
	0		**0**
PSNS Sediment	66.7	**0.36**	**18.5**
	113.4		**31.5**
	80.5		**22.4**
Polychaete			
YB control sediment	0	**1.88**	**0**
	0		**0**
	0		**0**
PSNS Sediment	390.5	**1.94**	**20.1**
	374.1		**19.3**
	373.4		**19.2**

Bioaccumulation Data – Laboratory

Sediment	PCB (µg/kg)	% lipid	PCB normalized to percent lipid (mg/kg)
Amphipod			
YB control sediment	0	**1.47**	**0**
	0		**0**
	0		**0**
PSNS Sediment	2,188	**1.21**	**180.8**
	2,908		**240.4**
	11,834		**978.1**
Clam			
DB control sediment	0	**0.31**	**0**
	0		**0**
	0		**0**
PSNS Sediment	84.0	**0.34**	**24.7**
	86.7		**25.5**
	83.0		**24.4**
Polychaete			
YB control sediment	0	**2.12**	**0**
	0		**0**
	0		**0**
PSNS Sediment	290.5	**1.94**	**15.0**
	355.8		**18.3**
	454.0		**23.4**

Mysid Survival – SEA Ring

Nominal Concentration (µg/L $CuSO_4$)	Replicate	Number Exposed	96 Hour Survival	% Survival
Lab Control A	A	10	8	80
	B	10	*	-
	C	10	8	80
	D	10	10	100
	E	10	10	100
Lab Control B	A	10	10	100
	B	10	10	100
	C	10	10	100
	D	10	9	90
	E	10	10	100
100	A	10	9	90
	B	10	10	100
	C	10	9	90
	D	10	10	100
	E	10	10	100
200 A	A	10	9	90
	B	10	8	80
	C	10	6	60
	D	10	5	50
	E	10	3	30
200 B	A	10	8	80
	B	10	9	90
	C	10	9	90
	D	10	9	90
	E	10	6	60
400	A	10	0	0
	B	10	0	0
	C	10	0	0
	D	10	0	0
	E	10	1	10

*Replicate dropped no data

Mysid Survival – Laboratory

Nominal Concentration (μg/L $CuSO_4$)	**Replicate**	**Number Exposed**	**96 Hour Survival**	**% Survival (96-hr)**
Lab Control	A	10	10	100
	B	10	10	100
	C	10	10	100
	D	10	10	100
	E	10	10	100
50	A	10	10	100
	B	10	10	100
	C	10	10	100
	D	10	10	100
	E	10	10	100
100	A	10	10	100
	B	10	10	100
	C	10	10	100
	D	10	10	100
	E	10	9	90
200	A	10	10	100
	B	10	8	80
	C	10	8	80
	D	10	6	60
	E	10	4	40
400	A	10	0	0
	B	10	0	0
	C	10	0	0
	D	10	0	0
	E	10	0	0
800	A	10	0	0
	B	10	0	0
	C	10	0	0
	D	10	0	0
	E	10	0	0

Topsmelt Survival – SEA Ring

Nominal Concentration (μg/L $CuSO_4$)	Replicate	Number Exposed	96 Hour Survival	% Survival
Lab Control A	A	5	5	100
	B	5	5	100
	C	5	5	100
	D	5	4	80
	E	5	5	100
Lab Control B	A	5	5	100
	B	5	5	100
	C	5	5	100
	D	5	5	100
	E	5	5	100
100	A	5	1	20
	B	5	1	20
	C	5	1	20
	D	5	4	80
	E	5	1	20
200 A	A	5	0	0
	B	5	0	0
	C	5	1	20
	D	5	0	0
	E	5	0	0
200 B	A	5	0	0
	B	5	1	20
	C	5	1	20
	D	5	1	20
	E	5	0	0
400	A	5	0	0
	B	5	0	0
	C	5	0	0
	D	5	0	0
	E	5	0	0

Topsmelt Survival – Laboratory

Nominal Concentration (µg/L $CuSO_4$)	Replicate	Number Exposed	96 Hour Survival	% Survival (96-hr)
Lab Control	A	5	5	100
	B	5	5	100
	C	5	5	100
	D	5	5	100
	E	5	5	100
50	A	5	5	100
	B	5	5	100
	C	5	5	100
	D	5	4	80
	E	5	5	100
100	A	5	1	20
	B	5	1	20
	C	5	1	20
	D	5	1	20
	E	5	1	20
200	A	5	0	0
	B	5	0	0
	C	5	1	20
	D	5	0	0
	E	5	0	0
400	A	5	0	0
	B	5	0	0
	C	5	0	0
	D	5	0	0
	E	5	0	0
800	A	5	0	0
	B	5	0	0
	C	5	0	0
	D	5	0	0
	E	5	0	0