EcoAnalysts, Inc.

BIOASSAY TESTING RESULTS

LOWER DUWAMISH WATERWAY: REMEDIAL DESIGN OF UPPER REACH
SEATTLE, WASHINGTON

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All testing reported herein was performed consistent with our laboratory's quality assurance program. All results are intended to be considered in their entirety, and EcoAnalysts is not responsible for use of less than the complete report. The test results summarized in this report apply only to the sample(s) evaluated. This document is uncontrolled when printed or accessed from electronic distribution.

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Appendix A: Test Data, Statistical Comparisons, and Reference-Toxicant Test Results

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ACRONYMS AND ABBREVIATIONS

AFDW:	Ash-free dry weight
AOC4:	Fourth Amendment to Administrative Order on Consent
cm:	Centimeter
CSL:	Cleanup Screening Level
°C:	Degrees Celsius
EC_{50}:	Effective Concentration that results in a 50% reduction in a sub-lethal endpoint
g:	Grams
LC_{50}:	Lethal Concentration that results in a 50% reduction in survival
L:	Liter
LDW:	Lower Duwamish Waterway
µm:	Micrometer
mg:	Milligram
mg/L:	Milligrams per liter
mL:	Milliliter
mm:	Millimeter
NOEC:	No Observed Effect Concentration
OR:	Oregon
PDI:	Pre-Design Investigation
ppt:	parts per thousand
PSEP:	Puget Sound Estuary Protocols (PSEP 1995)
SCO:	Sediment Cleanup Objective
SCUM:	Sediment Cleanup User's Manual
SMS:	Sediment Management Standards
SMARM:	Sediment Management Annual Review Meeting
SOP:	Standard operation procedure
SD:	Standard Deviation
UIA:	Un-ionized ammonia
USACE:	United States Army Corps of Engineers
USEPA:	United States Environmental Protection Agency
WA:	Washington State
WDOE:	Washington (State) Department of Ecology

1. INTRODUCTION

EcoAnalysts conducted biological toxicity testing with sediment samples collected by Windward Environmental LLC (Windward) as part of the pre-design investigation (PDI) supporting the remedial design for the upper reach of the Lower Duwamish Waterway (LDW) as per the Fourth Amendment to the Administrative Order on Consent (AOC4). Sediments were evaluated for biological effects following guidance provided by the Washington State Department of Ecology (WDOE) Sediment Management Standards (SMS) within the Sediment Cleanup User's Manual (SCUM; WDOE 2019). This report presents the results of the bioassay testing portion of the sediment investigation.

2. METHODS

This section summarizes the test methods followed for this biological characterization. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the Sediment Cleanup User's Manual (WDOE 2019), and the various updates presented during the Sediment Management Annual Review Meeting (SMARM). Sediment toxicity was evaluated using three standard PSEP bioassays; the 10-day amphipod test, the 20-day juvenile polychaete survival and growth test, and the benthic larval development test.

2.1 Sample Collection

Two test sediments were collected on July 13 and 14, 2021, received at EcoAnalysts on August 30, 2021, and triggered for bioassay testing. Reference sediment was collected from Carr Inlet, WA on July 28, 2021 and received on the same day as collection. Sediment samples were stored in a walk-in cold room at 4 ± 2°C in the dark. The test sediment was not sieved prior to testing. All tests were conducted within the eight-week holding time.

Native *Eohaustorius estuarius* sand from Yaquina Bay, Oregon was provided by Northwest Amphipod for use as the control sediment treatment for all three tests.

2.2 Sample Grain Size and Reference Comparison

Sediment grain size is one of the characteristics used in selecting the appropriate reference sediment(s) to compare the chemical and biological responses of project sediments. The percent fines value is defined as the amount of sediment that passes through a 62.5-µm sieve, expressed as a percentage of the total sample analyzed (PSEP 1986). This value can also be derived from the sum of the silt and clay fractions of the sample when determined by conventional particle-size determination (Plumb 1981). The reference sediment grain size should have a percent fines value within 20% of the corresponding test sediment to which it is being compared to (SCUM 2019).

Wet-sieve grain size results for the reference sample was conducted in the field (at the time of collection) by EcoAnalysts. The percent-fines determination of the project sediments was conducted by an analytical laboratory and provided by Windward (Table 2-1).

Table 2-1. Sample and Reference Grain Size Comparison

Sample ID	Sample Abbreviation	Percent Fines[1]	Treatment Compared To
CARR32-REF		32	
LDW21-IT682	IT682	33.2	CARR32-REF
LDW21-SS682	SS682	33	CARR32-REF

[1] Wet-sieve results

Grain size is an important factor in selecting the appropriate reference sample to compare against, especially for the amphipod test (SCUM 2019). Samples were compared to the Carr Inlet reference "CARR32-REF" for the purposes of evaluating the sediment under the sediment management standards. The percent fines of the reference sediment was within 1% of the test sample values, well within the ≤20% objective.

Station coordinates for the reference sample are summarized in Table 2-2.

Table 2-2. Reference Station Coordinates

Reference Sample	Station	Latitude	Longitude
CARR32-REF	CR20	47.33199	-122.67065

Sediment grain size is also one of the characteristics used in selecting the appropriate amphipod test species to use for the program (*Ampelisca abdita*, *Eohaustorius estuarius*, or *Rhepoxynius abronius*). The species *A. abdita* is often recommended when sediments are composed of greater than 60% fines whereas the species *E. estuarius* prefers medium to fine sand sediments and is often recommended when sediments are composed of less than 60% fines (PSEP 1995). *E. estuarius* is recommended for use when porewater salinities are less than 25 ppt, as their tolerance for low salinity is better. Due to the low percentage of fine grain sediments and low salinity in the samples, the amphipod *E. estuarius* was selected for this program.

2.3 Bulk Sample Porewater Ammonia and Water Quality Measurements

Prior to testing, bulk sediment porewater ammonia concentrations and salinity were measured to determine whether any methods modifications or supplemental testing would be required (Table 2-3). Bulk sediments are homogenized test samples that have not been further processed for bioassay testing.

Table 2-3. Bulk Sediment Porewater Measurements

Sample	Matrix: Bulk Porewater					
	Total Ammonia (mg/L)	Unionized Ammonia (mg/L)	Salinity (ppt)	pH	Total Sulfides (mg/L)	Hydrogen Sulfide (mg/L)
IT682	8.52	0.052	11	7.2	0.001	0.000
SS682	15.9	0.097	21	7.2	0.000	0.000

For the purposes of evaluating the potential toxicity of sediment under guidelines established in the Sediment Cleanup User's Manual (SCUM 2019), factors such and ammonia and sulfides are considered an inherent component of the in-situ sediment conditions. As such, these factors are usually not removed through manipulations such as purging. However, for the Lower Duwamish project, ammonia and sulfide purging measures were to follow the Seattle Dredged Material Evaluation and Disposal Procedures User Manual (DMMP 2021). If anticipated ammonia and sulfide measurements at test initiation will be above DMMP published species thresholds (Table 2-4), purging procedures are to be followed.

Table 2-4. Threshold Ammonia Concentrations for Benthic Test Species

Parameter	Amphipod (*Eohoustorius estuarius*)	Polychaete	Larval (Bivalve)
Total Ammonia	<60 mg/L[1] 88.6 mg/L[2]	164 mg/L[2]	3.40 mg/L[2]
Unionized Ammonia	0.8 mg/L[3] Purging Trigger	0.46[3] mg/L Purging Trigger	0.04 mg/L[3] Purging Trigger
Hydrogen Sulfide	0.122[3] mg/L Purging Trigger	3.4 mg/L[3] Purging Trigger	0.0025 mg/L[3] Purging Trigger

[1] EPA 1994
[2] Mean NOEC (Internal Lab Derived)
[3] Inouye et al. 2015

The bulk porewater analysis represents a potential worst-case scenario for ammonia and sulfide exposure. In the actual solid phase test exposures, the sediment is established with overlying water (175mL sediment/775mL overlying water) and aeration and allowed to acclimate until test initiation on the subsequent day. A different setup is prepared for the sediment larval test that includes 18g sediment and 900mL of overlying water that is agitated for 10 seconds and allowed to settle for four hours before test initiation. Based on the low values in the bulk porewater, purging of ammonia and/or sulfides was not deemed necessary for the tests. To determine whether the low salinity (11 ppt) in sample IT682 would be a concern for the sediment larval test, a mock setup was conducted on August 31, 2021. Salinity and pH in the mock larval overlying water was within recommended test parameters at 30 ppt and a pH of 7.5.

2.4 10-day Amphipod Bioassay

The 10-day amphipod acute toxicity test was conducted with *Eohaustorius estuarius*. Test organisms were supplied by Northwest Amphipod in Newport, Oregon and held in native sediment. The organisms were acclimated to, and held at, 15 ± 1°C prior to test initiation. Native sediment from Yaquina Bay, Oregon was provided by Northwest Amphipod for use as the control treatment sediment in the test. This matrix has been used successfully in prior tests with this species and is known to support positive organism health and survival.

The amphipod bioassay was conducted as 10-day static exposures with five replicates for each test treatment, reference treatment, and control. Two centimeters of sediment (approximately 175 mL) were placed into each 1-L glass chamber with 775 mL of overlying water. Trickle-flow aeration was provided through glass pipettes, and care was taken to avoid disturbing the sediment surface. Test chambers were placed into randomly assigned positions and allowed to equilibrate to test conditions overnight.

Prior to the test initiation, water quality measurements were taken in a surrogate replicate for each test treatment and included dissolved oxygen, temperature, salinity, and pH. Ammonia and sulfide concentrations were measured in both interstitial (porewater) and overlying water at initiation and termination. These measurements were made from a sacrificial surrogate chamber for each test treatment. Sediment porewater was extracted via centrifugation. During the test, water quality was monitored daily in one surrogate replicate per treatment. All water quality instruments were calibrated daily or on their recommended schedule. Records of instrument calibration were retained in the laboratory logs.

To initiate the test, organisms were randomly allocated to each of the test chambers. Initial stocking densities were 20 organisms per test chamber. Amphipods that did not bury within approximately one hour were replaced with healthy amphipods. No food was provided during the 10-day exposure for the amphipod test.

At test termination, sediment from each test chamber was sieved through a 0.5-mm screen to recover all organisms. The number of surviving and dead amphipods was then enumerated.

2.5 20-day Juvenile Polychaete Bioassay

The 20-day polychaete survival and growth test was conducted with juvenile polychaete worms (*Neanthes arenaceodentata*). Test organisms were obtained from Aquatic Toxicology Support in Bremerton, Washington and held in seawater at 20°C (Neanthes were cultured in water-only and were not held in sediment prior to testing). Native sediment of the amphipod *E.s estuarius* from Yaquina Bay, Oregon was provided by Northwest Amphipod for use as the control treatment sediment for the test. This coarse sand control sediment has been routinely tested in conjunction with this species at this laboratory and results from historical testing have demonstrated acceptable organism health and sediment quality.

The polychaete bioassay was conducted as a 20-day static-renewal test, with overlying exchanges of 300 mL of water occurring every third day. Each test treatment, reference treatment, and control consisted of five replicates of 1-L glass chambers, which were filled with two centimeters of sediment (approximately 175 mL) and 775 mL of overlying water. Trickle-flow aeration was provided through glass pipettes, and care was taken to avoid disturbing the sediment surface. Test chambers were then randomly assigned positions and allowed to equilibrate to test conditions overnight.

Prior to the test initiation, water quality measurements were taken in a surrogate chamber for each test treatment and included dissolved oxygen, temperature, salinity, and pH. Ammonia and sulfide concentrations were measured in both interstitial (porewater) and overlying water at initiation and termination. These measurements were made from a sacrificial surrogate chamber for each test treatment. Sediment porewater was extracted via centrifugation. During the test, water quality was monitored daily in one surrogate replicate per treatment. All water quality instruments were calibrated daily or on their recommended schedule. Records of instrument calibration were retained in the laboratory logs.

To initiate the test, organisms were randomly allocated to each of the test chambers. Initial stocking densities were five worms per test chamber. During the test, organisms were fed a diet of 40-mg of TetraMin® slurry every other day (approximately 8-mg dry weight per worm). Pre-test initial biomass was determined by taking dry weight and ash-free dry weight (AFDW) measurements of three replicates of five worms each on Day 0.

At test termination, sediment from each test chamber was sieved through a 0.5-mm screen. All worms were recovered, enumerated, rinsed in deionized water (to remove salt), and transferred to pre-weighed aluminum foil weigh boats. After drying in an oven at 60°C for approximately 24 hours, each weigh boat was removed, cooled in a desiccator and weighed to obtain dry weight measurements. They were then heated to 550°C for two hours to determine the ashed weight. AFDW were calculated to correct for the influence of sediment grain size differences between treatments:

$$\text{AFDW}=\text{Dry weight}-\text{Ashed weight}$$

Both dry weight and AFDW were used to determine individual worm weight and growth rates. The dry weight growth rate is calculated using the following equation:

$$G = (DWTt_2 - DWTt_1) \div (t_2 - t_1)$$

Where: $DWTt_2$ = individual dry weight of surviving adults at test termination

$DWTt_1$ = mean individual dry weight of organisms at test initiation

$t_2 – t_1$ = duration of test (e.g. days)

The AFDW growth rate is calculated using the following equations:

AFDW = (Final Dry Weight – Final Ashed Weight) ÷ #Survivors

$G = (AFDWt_2 – AFDWt_1) \div (t_2 – t_1)$

Where: $AFDWt_2$ = individual ash-free dry weight of surviving adults at test termination

$AFDWt_1$ = mean individual ash-free dry weight of organisms at test initiation

t2 – t1 = duration of test (e.g. days)

2.6 Larval Developmental Bioassay

The bivalve larval development test was conducted with the mussel, *Mytilus galloprovincialis*. Adult organisms were obtained from Taylor Shellfish in Shelton, Washington and were held under flowing natural seawater at 16±2°C prior to spawning induction. Adult mussels were fed during the holding period a marine algal suspension ad libitum. The control treatments consisted of both a clean seawater-only control and a clean sand control with the addition of sediment similar to the reference and test treatments. Sand control sediment was collected from Yaquina Bay, Oregon and provided by Northwest Amphipod. This coarse sediment has been routinely tested in conjunction with this species at this laboratory and results from historical testing have demonstrated acceptable organism health and sediment quality. The reference treatment was compared against both seawater and sand controls to determine test acceptability criteria.

The larval development bioassay was conducted as a static exposure with five replicates for each test treatment, reference treatment, and control. Approximately 18 g (±1 g) of sediment was placed into each 1-L glass chamber with 900 mL of overlying water. Test chambers were then shaken for 10 seconds and placed into randomly assigned positions. The larval test was performed without aeration unless dissolved oxygen levels fell below threshold levels for action. If required, trickle-flow aeration was provided through glass pipettes, and care was taken to avoid disturbing the sediment surface.

Prior to the test initiation, water quality measurements were taken in the surrogate chamber for each test treatment and included dissolved oxygen, temperature, salinity, and pH. Ammonia and sulfide concentrations were measured in the overlying water at initiation and termination. These measurements were made from a sacrificial surrogate chamber for each test treatment. During the test, water quality was monitored daily in one surrogate replicate per treatment. All water quality instruments were calibrated daily or on their recommended schedule. Records of instrument calibration were retained in the laboratory logs.

To obtain gametes for testing, adult mussels to be spawned were placed in clean seawater at 16°C (culture temperature) for approximately 30 – 60 minutes in the presence of dense marine algal suspension. The mussels were then transferred to containers with culture water adjusted to 20 -23°C for the purpose of inducing the release of gametes. The animals were held at the shocking temperature and were monitored for spawning individuals. Spawning females and males were removed from the water bath and placed in individual containers with seawater. These individuals were allowed to spawn until sufficient gametes were available to initiate the test. After the spawning period, eggs were transferred to fresh seawater and filtered through a 0.5 mm Nitex® mesh screen to remove large debris, feces, and

excess gonadal matter. A composite was made of the sperm and diluted with fresh seawater. The fertilization process was initiated by adding sperm to the isolated egg containers. Egg-sperm solutions were periodically homogenized with a perforated plunger during the fertilization process and sub-samples observed under the microscope for egg and sperm viability. Approximately one to one and a half hours after fertilization, embryo solutions were checked for fertilization rate. Only those embryo stocks with >90% fertilization were used to initiate the tests. Embryo solutions were rinsed free of excess sperm and then combined to create one embryo stock solution. Density of the embryo stock solution was determined by counting the number of embryos in a subsample of homogenized stock solution. This was used to determine the volume of embryo stock solution to deliver approximately 27,000 embryos to each test chamber.

The protocol calls for test termination when 95% of the embryos in the control have reached the prodissoconch I stage (approximately 48-60 hours). Prior to test termination, larvae within each chamber were gently resuspended with a perforated plunger following the SMARM resuspension protocol update (Gardiner 2010) to free any larvae trapped in sediment fines or wood debris. At termination, the overlying seawater was decanted into a clean 1-L jar and mixed with a perforated plunger. From this container, a 10 mL subsample was transferred to a scintillation vial and preserved in 10% buffered formalin. Larvae were subsequently stained with a dilute solution of Rose Bengal in 70% ethanol to help visualization of larvae. The number of normal and abnormal larvae was enumerated on an inverted microscope. Normal larvae included all D-shaped prodissoconch I stage larvae. Abnormal larvae included abnormally shaped prodissoconch I larvae and all early stage larvae.

2.7 Data Analysis and QA/QC

All water quality and endpoint data were entered into Excel spreadsheets. Water quality parameters were summarized by calculating the mean, minimum, and maximum values for each test treatment. Endpoint data were calculated for each replicate and the mean values and standard deviations were determined for each test treatment.

All hand-entered data was reviewed for data entry errors, which were corrected prior to summary calculations. A minimum of 10% of all calculations and data sorting were reviewed for errors. Review counts were conducted on any apparent outliers.

For Sediment Cleanup Objective (SCO) and Cleanup Screening Level (CSL) suitability determinations, comparisons were made according to the Sediment Cleanup User's Manual (SCUM; WDOE 2019) and Fox et al. (1998), using BioStat software. All data were tested for normality using the Shapiro-Wilk test and equality of variance using Levene's test. Data reported as percent mortality or survival were transformed using an arcsine square root transformation prior to statistical analysis. Growth data with unequal variance were log10 transformed prior to statistical analysis. Determinations of statistical significance were based on one-tailed Student's t-tests with an alpha of 0.05. A comparison of the larval endpoint relative to the reference was made using an alpha level of 0.10. For samples failing to meet assumptions of normality, a Mann-Whitney test was conducted to determine significance. For those samples failing to meet the assumptions of normality and equality of variance, a t-test on rankits was used.

To evaluate the relative sensitivity of the organisms, reference toxicity tests were performed using standard reference toxicants (Lee 1980). A water-only reference-toxicant test was conducted concurrently with the sediment tests using ammonium chloride. The ammonium chloride reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to prior tests. This test also provided information on the sensitivity to ammonia concentrations that would possibly be present in the sediments.

Statistical analyses of all dose-response tests were performed using CETIS Comprehensive Toxicity Data Analysis and Database Software version 1.9.4.3. Comparisons between the lab control and each test concentration were performed following recommended USEPA decision matrices (USEPA 2002).

3. RESULTS

The results of the sediment testing, including a summary of test results and water quality observations are presented in this section. All data, laboratory bench sheets, and statistical analyses are provided in Appendix A while chain of custody forms and pre-test documents are supplied in Appendix B.

3.1 10-day Amphipod Bioassay

The bioassay test with *E. estuarius* was validated with 4% mortality in the native sediment control, which met the performance criterion of ≤10% mortality for SMS evaluations and indicated that the test conditions were suitable for adequate amphipod survival. Mean mortality in the reference treatment was 1%, which met the performance criteria (≤25% mortality) and indicated that the reference sediment was acceptable for suitability determination. Mean mortality in the project samples ranged from 4% to 5%. All endpoint results are summarized in Table 3-1. Summaries of water quality measurements, ammonia and sulfide concentrations, and test conditions are presented in Table 3-2 through Table 3-5.

Water quality parameters were within the acceptable limits throughout the duration of the test (Table 3-2).

A reference-toxicant test (positive control) was performed on the batch of test organisms utilized for this study. The reference-toxicant test control met the test acceptability criterion and the LC_{50} value was within control chart limits (±2 standard deviations from the laboratory historical mean). This indicates that the test organisms used in this study were of similar sensitivity to those previously tested.

Ammonia concentrations observed in the *E. estuarius* test were below the No Observed Effect Concentration (NOEC) value derived from the concurrent ammonia reference-toxicant test (Table 3-3; compare to NOEC of 106 mg/L total ammonia). Therefore, ammonia concentrations within the sediment samples should not have been a contributor to any adverse biological effects if observed in the test treatments. Initial and final sulfide concentrations within the overlying water and porewater were below the trigger value of 0.122 mg/L hydrogen sulfide for all treatments, suggesting that sulfides should not have contributed to mortality.

Table 3-1. Test Results for *Eohaustorius estuarius*

Treatment	Replicate	Number Initiated	Number Surviving	Number Missing or Dead	Percentage Mortality	Mean Percentage Mortality	SD
Control	1	20	18	2	10	4	4.2
	2	20	19	1	5		
	3	20	20	0	0		
	4	20	20	0	0		
	5	20	19	1	5		
CARR32-REF	1	20	20	0	0	1	2.2
	2	20	19	1	5		
	3	20	20	0	0		
	4	20	20	0	0		
	5	20	20	0	0		
IT682	1	20	20	0	0	5	8.7
	2	20	20	0	0		
	3	20	19	1	5		
	4	20	16	4	20		
	5	20	20	0	0		
SS682	1	20	18	2	10	4	4.2
	2	20	19	1	5		
	3	20	19	1	5		
	4	20	20	0	0		
	5	20	20	0	0		

Table 3-2. Water Quality Summary for *Eohaustorius estuarius*

Treatment	Dissolved Oxygen (mg/L) ≥5.1 mg/L			Temperature (°C) 15 ± 1°C			Salinity (ppt) 28 ± 1 ppt			pH 7 - 9 units		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	8.4	8.2	8.6	14.5	13.7	15.0	28	27	29	8.1	8.0	8.1
CARR32-REF	8.3	8.2	8.6	14.5	13.9	15.0	28	27	28	8.1	8.0	8.2
IT682	8.4	8.1	8.6	14.5	13.8	15.0	27	27	28	7.9	7.8	8.1
SS682	8.4	8.0	8.6	14.4	13.6	14.9	27	27	28	8.1	8.0	8.1

Table 3-3. Ammonia Summary for *Eohaustorius estuarius*

Treatment	Overlying				Interstitial			
	Total Ammonia (mg/L Total) NOEC = 106 mg/L[1]		Unionized Ammonia (mg/L) NOEC = 2.28[1]		Total Ammonia (mg/L Total) NOEC = 106 mg/L[1]		Unionized Ammonia (mg/L) NOEC = 2.28[1]	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control	0.000	0.000	0.000	0.000	0.234	0.136	NA	0.001
CARR32-REF	0.860	0.862	0.027	0.026	4.51	1.81	0.073	0.018
IT682	0.246	0.315	0.008	0.006	6.42	2.21	0.026	0.005
SS682	0.394	0.000	0.013	0.000	5.68	3.60	0.019	0.011

[1]NOEC derived from concurrent reference-toxicant test
NA = not enough porewater for analysis

Table 3-4. Sulfide Summary for *Eohaustorius estuarius*

Treatment	Overlying				Interstitial			
	Total Sulfides (mg/L)		Hydrogen Sulfide (mg/L) Trigger Value = 0.122 mg/L[1]		Total Sulfides (mg/L)		Hydrogen Sulfide (mg/L) Trigger Value = 0.122 mg/L[1]	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control	ND	ND	ND	ND	NA	ND	NM	ND
CARR32-REF	0.011	0.002	0.0006	0.0001	ND	ND	ND	ND
IT682	0.000	0.003	0.0000	0.0002	ND	0.000	ND	0.0000
SS682	0.006	ND	0.0003	ND	ND	ND	ND	ND

[1]Inouye et al. 2015:
ND = not detected; measurement below detection limit
NM = sulfides not measured due to insufficient porewater amount

Table 3-5. Test Condition Summary for *Eohaustorius estuarius*

Test Conditions: PSEP *E. estuarius*		
Date Sampled	July 13 – 14, 2021 (test samples) July 28, 2021 (reference sample)	
Date Received	August 30, 2021 (test samples) July 28, 2021 (reference sample)	
Test Dates	September 3 – 13, 2021	
Sample Storage Conditions	4°C, dark	
Days of Holding Recommended: ≤8 weeks (56 days)	52 Days	
Source of Control Sediment	Yaquina Bay, OR	
Test Species	*Eohaustorius estuarius*	
Supplier	Northwest Amphipod, Newport OR	
Date Acquired	September 2, 2021	
Age Class	Mature, 3-5 mm	
Test Procedures	PSEP 1995 with SMARM revisions, SCUM (2019)	
Test Location	EcoAnalysts Port Gamble Laboratory	
Test Type/Duration	10-Day static	
Control Water	North Hood Canal seawater, 0.45µm filtered	
Test Lighting	50 – 100 foot candles (ambient and constant)	
Test Chamber	1-Liter Glass Chamber	
Replicates per Treatment	5 + 2 surrogates (one used for WQ measurements throughout the test)	
Organisms per Replicate	20	
Exposure Volume	175 mL sediment/ 775 mL water	
Feeding	None	
Water Renewal	None	
Test Dissolved Oxygen	Recommended: > 5.1 mg/L	Observed: 8.0 – 8.6 mg/L
Test Temperature	Recommended: 15 ± 1 °C	Observed: 13.6 – 15.0°C
Test Salinity	Recommended: 28 ± 1 ppt	Observed: 27 – 29 ppt
Test pH	Recommended: 7 - 9	Observed: 7.8 – 8.2
Control Performance Standard SMS	Recommended: Control ≤ 10% mortality	Observed mortality: 4%
Reference Performance Standard SMS	Recommended: Reference ≤ 25% mortality	Observed mortality: 1%
Reference Toxicant LC_{50} (total ammonia)	LC_{50} = 189.2 mg/L	
Mean; Acceptable Range (total ammonia)	184.9; 115.5 – 295.9 mg/L	
NOEC (total ammonia)	106 mg/L	
NOEC (unionized ammonia)	2.28 mg /L	
Deviations from Test Protocol	None	

3.2 20-day Juvenile Polychaete Bioassay

The bioassay test with *N. arenaceodentata* was validated with 0% mortality in the control. Mean individual growth rate (MIG) in the control was 0.930 mg/ind/day (dry weight) and 0.684 mg/ind/day (AFDW). These values fall within the test acceptability criteria for SMS evaluations of <10% mean mortality and ≥0.38 mg/ind/day AFDW, indicating that the test conditions were suitable for adequate polychaete survival and growth. A summary of the test results for all samples is shown in Table 3-6. Summaries of water quality measurements, ammonia and sulfide concentrations, and test conditions are presented in Table 3-7 through Table 3-10.

Mean mortality in the reference treatment was 0% (CARR32-REF), meeting the reference performance standard of ≤10% (WDOE 2019). Mean individual growth rate for CARR32-REF was 1.057 mg/ind/day (dry weight) and 0.846 mg/ind/day (AFDW). When compared to the control, MIG expressed as dry weight for the CARR32-REF reference treatment was 1.14; it was 1.24 when expressed as AFDW. This ratio met the reference performance standard of ≥0.80 (WDOE 2019).

Mortality in the project sediments was 0% for all samples. Mean individual growth (as dry weight) in the test treatments was 0.789 (SS682) and 0.801 (IT682) mg/ind/day. Mean individual growth in the AFDW assessment, which removes variability caused by gut contents, was 0.654 (IT682) and 0.686 (SS682) mg/ind/day as AFDW.

All water quality parameters were within the acceptable limits throughout the duration of the test (Table 3-7). Initial mean individual biomass (pretest) of the test organisms met the recommended criterion of 0.25 – 1.0 mg/individual at 0.734 mg/ind dry weight and 0.419 mg/ind AFDW. Control Replicate 5 was inadvertently initiated with 6 organisms. Adjustments were made to the statistical analysis to compensate for the additional organism.

A reference-toxicant test (positive control) was performed on the batch of test organisms utilized for this study. The reference-toxicant test control met the test acceptability criterion and the LC_{50} value was within control chart limits (±2 standard deviations from the laboratory historical mean). This indicates that the test organisms used in this study were of similar sensitivity to those previously tested.

Ammonia concentrations observed in the *N. arenaceodentata* test were below the NOEC value derived from the concurrent ammonia reference-toxicant test (Table 3-8; compare to NOEC of 108 mg/L). Sulfide concentrations were below the trigger value of 3.4 mg/L hydrogen sulfide (Inouye et al. 2015) for all samples (Table 3-9).

Table 3-6. Test Results for *Neanthes arenaceodentata*

Treatment	Rep	Number Initiated	Survivors	Mean Mortality (%)	Individual Growth Rate (mg/ind/day)					
					Dry Weight	Mean	SD	AFDW	Mean	SD
Control	1	5	5	0	1.299	0.930	0.247	1.066	0.684	0.233
	2	5	5		0.813			0.571		
	3	5	5		0.819			0.634		
	4	5	5		1.050			0.701		
	5	6	6		0.672			0.447		
CARR32-REF	1	5	5	0	0.667	1.057	0.406	0.482	0.846	0.402
	2	5	5		0.620			0.452		
	3	5	5		1.294			1.057		
	4	5	5		1.143			0.830		
	5	5	5		1.560			1.408		
IT682	1	5	5	8	0.609	0.801	0.181	0.459	0.654	0.150
	2	5	5		0.963			0.783		
	3	5	5		1.003			0.814		
	4	5	5		0.636			0.555		
	5	5	3		0.792			0.660		
SS682	1	5	5	0	0.817	0.789	0.146	0.661	0.686	0.144
	2	5	5		1.009			0.924		
	3	5	5		0.623			0.556		
	4	5	5		0.698			0.594		
	5	5	5		0.801			0.696		

Table 3-7. Water Quality Summary for *Neanthes arenaceodentata*

Treatment	Dissolved Oxygen (mg/L) ≥4.6 mg/L			Temperature (°C) 20 ± 1°C			Salinity (ppt) 28 ± 2 ppt			pH 7 - 9 units		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.4	7.2	7.9	19.9	18.8	20.4	29	28	30	8.0	7.9	8.2
CARR32-REF	7.4	7.0	7.9	20.0	18.6	20.6	29	28	29	8.0	7.8	8.2
IT682	7.3	6.9	7.9	20.0	18.8	20.5	28	27	29	7.9	7.8	8.0
SS682	7.3	6.9	7.9	19.9	18.8	20.4	28	27	29	7.9	7.5	8.1

Table 3-8. Ammonia Summary for *Neanthes arenaceodentata*

Treatment	Overlying				Interstitial			
	Total Ammonia (mg/L Total) NOEC = 108 mg/L[1]		Unionized Ammonia (mg/L) NOEC = 2.053[1]		Total Ammonia (mg/L Total) NOEC = 108 mg/L[1]		Unionized Ammonia (mg/L) NOEC = 2.053[1]	
	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20
Control	0.00	2.94	0.000	0.109	0.00	3.49	0.000	0.021
CARR32-REF	0.0159	0.00	0.000	0.000	1.87	0.495	0.020	0.003
IT682	0.125	0.131	0.003	0.004	2.07	1.73	0.012	0.005
SS682	0.412	0.00	0.009	0.000	4.40	1.54	0.020	0.005

[1]NOEC (concurrent reference-toxicant test derived)

Table 3-9. Sulfide Summary for *Neanthes arenaceodentata*

Treatment	Overlying				Interstitial			
	Total Sulfides (mg/L Total)		Hydrogen Sulfide (mg/L) Trigger Value = 3.4 mg/L[1]		Total Sulfides (mg/L Total)		Hydrogen Sulfide (mg/L) Trigger Value = 3.4 mg/L[1]	
	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20
Control	ND	0.002	ND	0.000	ND	ND	ND	ND
CARR32-REF	ND	ND	ND	ND	0.000	ND	0.000	ND
IT682	ND	0.000	ND	0.000	0.171	0.019	0.0464	0.008
SS682	ND	ND	ND	ND	ND	0.030	ND	0.012

[1]Inouye et al. 2015
ND = not detected; measurement below detection limit

Table 3-10. Test Condition Summary for *Neanthes arenaceodentata*

Test Conditions: PSEP *N. arenaceodentata*		
Date Sampled	July 13 – 14, 2021 (test samples) July 28, 2021 (reference sample)	
Date Received	August 30, 2021 (test samples) July 28, 2021 (reference sample)	
Test Dates	September 3 – 23, 2021	
Sample Storage Conditions	4°C, dark	
Days of Holding Recommended: ≤8 weeks (56 days)	52 Days	
Source of Control Sediment	Yaquina Bay, OR	
Test Species	*Neanthes arenaceodentata*	
Supplier	Aquatic Toxicology Support	
Date Acquired	September 2, 2021	
Age Class	Juvenile; 16 days post-emergence	
Test Procedures	PSEP 1995 with SMARM revisions, SCUM (2019)	
Test Location	EcoAnalysts Port Gamble Laboratory	
Test Type/Duration	20-Day static renewal	
Control Water	North Hood Canal seawater, 0.45µm filtered	
Test Lighting	50 – 100 foot candles (ambient and constant)	
Test Chamber	1-Liter Glass Chamber	
Replicates per Treatment	5 + 2 surrogates (one used for WQ measurements throughout the test)	
Organisms per Replicate	5	
Exposure Volume	175 mL sediment/ 775 mL water	
Feeding	40 mg/jar every other day (8 mg/ind every other day)	
Water Renewal	Water renewed every third day (1/3 volume of exposure chamber)	
Test Dissolved Oxygen	Recommended: > 4.6 mg/L	Observed: 6.9 – 7.9 mg/L
Test Temperature	Recommended: 20 ± 1 °C	Observed: 18.6 – 20.6 °C
Test Salinity	Recommended: 28 ± 2 ppt	Observed: 27 – 30 ppt
Test pH	Recommended: 7 - 9	Observed: 7.5 – 8.2
Initial Biomass	Recommended: 0.5 - 1.0 mg Minimum: 0.25 mg	0.734 mg (dry weight) 0.419 mg (AFDW)
Control Performance Standard	Recommended: Control < 10% mortality	Observed: 0%
	Recommended: ≥ 0.38 mg/ind/day (as AFDW)	Observed: 0.684 mg/ind/day
Reference Performance Standard (SMS)	Recommended: Mortality ≤20% $MIG_{Reference}/MIG_{Control} \geq 0.80$	Observed: 0% 1.14 (dry weight) 1.24 (AFDW)
Reference Toxicant LC_{50} (total ammonia)	LC_{50} = 174.6 mg/L	
Mean; Acceptable Range (total ammonia)	207.9; 161.7 – 267.3 mg/L	
NOEC (total ammonia)	108 mg/L	
NOEC (unionized ammonia)	2.053 mg/L	
Deviations from Test Protocol	Additional animal in control replicate 5	

3.3 Larval Development Bioassay

The larval development test with *M. galloprovincialis* was validated by 0.70 proportion normal survivorship (defined as the mean number of normal larvae within the control divided by the stocking density) in the seawater control and 0.71 in the sand control. These values were within the SMS control acceptability criterion of ≥0.70. A summary of the test results for all samples is shown in Table 3-11. Summaries of water quality measurements, ammonia and sulfide concentrations, and test conditions are presented in Table 3-12 through Table 3-14.

Mean number normal of the CARR32-REF reference sediment was 0.84 of the seawater control response and 0.83 of the sand control. The reference sediment met the SMS reference acceptability criteria (N_R/N_C) of ≥0.65, which is defined as the number of normal larvae in the reference sample(s) divided by the number of normal larvae in the control. The test mean chamber stocking density (measured at test initiation) was 29.0 embryos/mL and was within the test objective of 20 – 40 embryos/mL.

Water quality parameters were within acceptable limits throughout the test (Table 3-12). Approximately 24hrs after test initiation, dissolved oxygen had dropped to 5.7 mg/L in SS682 (below the 6.0 mg/L trigger for initiation of aeration). Upon discovery, gentle aeration was added to all chambers. The dissolved oxygen remained above the 60% saturation limit (5.0 mg/L at 28 ppt and 16°C) throughout the test.

A reference-toxicant test (positive control) was performed on the batch of test organisms utilized for this study. The reference-toxicant test control met the test acceptability criterion and the EC_{50} value was within control chart limits (±2 standard deviations from the laboratory historical mean). This indicates that the test organisms used in this study were of similar sensitivity to those previously tested.

Ammonia concentrations observed in the *M. galloprovincialis* test were below the NOEC value derived from the concurrent ammonia reference-toxicant test (1.59 mg/L total ammonia and 0.03 mg/L unionized ammonia; Table 3-13), indicating that ammonia is unlikely to have contributed to biological effects within the samples. Sulfide concentrations were below the trigger value of 0.0025 mg/L hydrogen sulfide (Inouye et al. 2015), indicating that sulfides within the sediment samples are unlikely to have contributed to any adverse biological effects observed in the test treatments.

Table 3-11. Test Results for *Mytilus galloprovincialis*: Standard Exposure

Treatment	Rep	Number Normal	Number Abnormal	Mean # Normal (N)	SD	Control Normal Survival N_C/I	Reference Normal Survival Relative to Control N_R/N_C	Performance Standard
Seawater Control	1	198	57	202.8	12.5	0.70		≥0.70; Meets Criterion
	2	201	67					
	3	219	51					
	4	210	58					
	5	186	65					
Sand Control	1	208	31	204.8	11.5	0.71		≥0.70; Meets Criterion
	2	197	39					
	3	216	44					
	4	214	44					
	5	189	41					
CARR32-REF	1	173	39	170.4	9.0		vs Seawater Control: 0.84 vs Sand Control: 0.83	≥0.65; Meets Criterion
	2	170	29					
	3	164	22					
	4	184	26					
	5	161	29					
IT682	1	162	34	169.6	8.0	See Section 4.3 for Larval Test Suitability Determination		
	2	169	27					
	3	162	37					
	4	175	40					
	5	180	44					
SS682	1	120	26	132.6	9.3			
	2	140	33					
	3	143	34					
	4	132	21					
	5	128	26					

I = Mean Initial count (Stocking density); 290.4
N_C = Mean Control Normal
N_R = Mean Reference Normal

Table 3-12. Water Quality Summary for *Mytilus galloprovincialis*

Treatment	Dissolved Oxygen (mg/L) ≥5.0 mg/L			Temperature (°C) 16± 1°C			Salinity (ppt) 28 ± 1 ppt			pH 7.5 - 9 units		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Seawater Control	7.7	7.5	8.3	15.9	15.2	16.9	28	27	28	8.0	7.9	8.0
Sand Control	7.8	7.4	8.3	15.9	15.0	17.4	28	27	28	8.0	7.9	8.0
CARR32-REF	7.1	6.3	7.8	16.1	15.4	17.2	28	27	28	8.0	7.9	8.0
IT682	6.9	6.0	8.3	15.9	15.2	17.1	27	27	28	7.9	7.8	8.0
SS682	6.9	5.7	8.3	15.9	14.8	17.2	28	27	28	7.9	7.8	8.0

Table 3-13. Ammonia and Sulfide Summary for *Mytilus galloprovincialis*

Treatment	Total Ammonia (mg/L Total) NOEC = 1.59 mg/L[1]		Unionized Ammonia (mg/L) NOEC = 0.03 mg/L[1]		Total Sulfides (mg/L Total)		Hydrogen Sulfide (mg/L) Trigger Value = 0.0025 mg/L[2]	
	Day 0	Final (Day 2)	Day 0	Final (Day 2)	Day 0	Final (Day 2)	Day 0	Final (Day 2)
Seawater Control	0.109	0.000	0.003	0.000	ND	ND	ND	ND
Sand Control	0.000	0.000	0.000	0.000	ND	0.008	ND	0.0005
CARR32-REF	0.000	0.000	0.000	0.000	0.002	0.003	0.0001	0.0002
IT682	0.000	0.000	0.000	0.000	0.003	0.002	0.0002	0.0001
SS682	0.0849	0.000	0.002	0.000	0.000	ND	0.0000	ND

[1]NOEC (concurrent reference-toxicant test derived)
[2]Inouye et al. 2015
ND = Non-detect

Table 3-14. Test Condition Summary for *Mytilus galloprovincialis*

Test Conditions: PSEP *M. galloprovincialis*		
Date Sampled	July 13 – 14, 2021 (test samples) July 28, 2021 (reference sample)	
Date Received	August 30, 2021 (test samples) July 28, 2021 (reference sample)	
Test Dates	September 2 – 4, 2021	
Sample Storage Conditions	4°C, dark	
Holding Time Recommended: < 8 weeks (56 days)	51 Days	
Test Species	*Mytilus galloprovincialis*	
Supplier	Taylor Shellfish, Shelton, WA	
Date Acquired	September 1, 2021	
Age Class	<4-h old embryos	
Test Procedures	PSEP 1995 with SMARM revisions, SCUM (2019)	
Test Location	EcoAnalysts Port Gamble Laboratory	
Test Type/Duration	48-60 Hour static test (Actual: 48 hours)	
Control Water	North Hood Canal sea water, 0.45µm filtered	
Test Lighting	50 – 100 foot candles (14hr light: 10hr dark)	
Test Chamber	1-Liter Glass Chamber	
Replicates per Treatment	5 + 1 surrogate (used for WQ measurements throughout the test)	
Exposure Volume	18 g sediment/ 900 mL water	
Feeding	None	
Water Renewal	None	
Test Dissolved Oxygen	Recommended: >4.8 mg/L	Observed: 5.7 – 8.3 mg/L
Test Temperature	Recommended: 16 ± 1 °C	Observed: 14.8 – 17.4 °C
Test Salinity	Recommended: 28 ± 1 ppt	Observed: 27 – 28 ppt
Test pH	Recommended: 7.5 – 9	Observed: 7.8 – 8.0
Stocking Density	Recommended: 20 – 40 embryos/mL	Observed: 29.0 embryos/mL
Control Performance Standard (SMS)	Recommended: Control normal survival ≥ 0.70	Observed: Seawater Control 0.70 Sand Control 0.71
Reference Performance Standard (SMS)	Recommended: Reference normal survival relative to sediment control ≥ 0.65	Observed: CARR32-REF: 0.83 – 0.84
Reference Toxicant Endpoint	Total Ammonia	Unionized Ammonia
Reference Toxicant EC_{50}	EC_{50} = 6.23 mg/L	EC_{50} = 0.138 mg/L
Mean; Acceptable Range	6.50; 3.72 – 11.37 mg/L	0.136; 0.066 – 0.280 mg/L
NOEC Combined Proportion Normal	1.59 mg/L	0.03 mg /L
Deviations from Test Protocol	Test aerated due to decreasing dissolved oxygen (Day 1 in SS682)	

4. DISCUSSION

Sediments were evaluated based on SMS criteria. The biological criteria are based on both statistical significance (a statistical comparison) and the degree of biological response (a numerical comparison). The SMS criteria are derived from the Washington Department of Ecology's Sediment Cleanup User's Manual II (SCUM; WDOE 2019). Comparisons were made for each treatment against the reference sample using BioStat software. Two numerical comparisons were made under SMS: the Sediment Cleanup Objectives (SCO) and the Cleanup Screening Level (CSL).

4.1 Amphipod Test Suitability Determination

Under the SMS program, a treatment will fail SCO if mean mortality in the test sediment is >25% and the difference between mean mortality in the treatment compared to mean mortality in the reference is statistically significant ($p < 0.05$). Treatments fail the CSL if mean mortality in the test treatment ≥30% relative to the reference sediment and the difference is statistically significant.

None of the mortality observed in the project sediments was statistically different than that of the applicable reference treatment. None of the project sediments fail the SCO and CSL criteria for the amphipod test as shown in Table 4-1.

Table 4-1. SMS Comparison for *Eohaustorius estuarius*

Treatment	Mean Mortality (%)	Compared To:	Statistically Different than Reference? (P=0.05)	Mortality Comparison to Reference M_T-M_R (%)	Fails SCO?[1] > 25 % (Absolute)	Fails CSL?[2] ≥ 30 % (M_T-M_R)
Control	4					
CARR32-REF	1					
IT682	5	CARR32-REF	No	4	No	No
SS682	4	CARR32-REF	No	3	No	No

[1]SCO: Statistical Significance and M_T >25%
[2]CSL: Statistical Significance and M_T-M_R ≥30%
M_T = Treatment Mortality
M_R = Reference Mortality

4.2 Juvenile Polychaete Test Suitability Determination

Suitability determinations for the juvenile polychaete test were based on MIG as AFDW. A test treatment fails SCO criteria if MIG is statistically lower in the test treatment, relative to the reference, and the ratio of the MIG in the test treatment is <0.70 that of the reference. The treatments will fail CSL criteria if the MIG is significantly lower than the reference treatment and the ratio between the MIG of the treatment and the MIG of the reference is <0.50.

There was no significant difference in growth between any of the project sediments and the reference treatment (Table 4-2). Both project sediments pass the SCO and CSL criteria.

Table 4-2. SMS Comparison for *Neanthes arenaceodentata*

Treatment	MIG (mg/ind/day) AFDW	Comparison To:	Statistically Less than Reference? (p=0.05)	MIG Relative to Reference MIG_T/MIG_R	Fails SCO?[1] < 0.70	Fails CSL?[2] < 0.50
Control	0.684					
CARR32-REF	0.846					
IT682	0.654	CARR32-REF	No	0.77	No	No
SS682	0.686	CARR32-REF	No	0.81	No	No

[1]SCO: Statistical Significance and MIG_T/MIG_R <0.70
[2]CSL: Statistical Significance and MIG_T/MIG_R <0.50
MIG_T = Treatment Mean Individual Growth Rate
MIG_R = Reference Mean Individual Growth Rate

4.3 Larval Test Suitability Determination

Larval test treatments fail SCO criteria if the number of normal larvae in the test treatment is significantly lower ($p < 0.10$) than that of the reference and if the ratio between the normal larval development in the test treatment is less than 0.85 of the normal development in the reference. Treatments fail CSL criteria if the number of normal larvae in the test treatment is significantly lower ($p < 0.10$) than that of the reference and if the ratio between the normal larval development in the test treatment is less than 0.70 of the normal development in the reference.

When compared to CARR32-REF, sample SS682 contained a mean number of normal larvae that was statistically less than that of the reference whereas IT682 did not (Table 4-3). The ratio of normal larvae between sample SS682 and the reference was below 0.85, failing SCO criteria; however, it was not below 0.70, meeting CSL criteria. The ratio of normal larvae between sample IT682 and the reference was not below 0.85, which met SCO and CSL criteria.

Ammonia and sulfide levels in sample SS682 were below trigger values for the duration of the larval test and are not likely to have contributed to adverse biological results.

Table 4-3. SMS Comparison for *Mytilus galloprovincialis*

Treatment	Mean Number Normal	Compared To:	Statistically Less than Reference? (p=0.10)	Normal Survival to Reference N_T/N_R	Fails SCO?[1] <0.85	Fails CSL?[2] <0.70
Seawater Control	202.8					
Sand Control	204.8					
CARR32-REF	170.4					
IT682	169.6	CARR32-REF	No	1.00	No	No
SS682	132.6	CARR32-REF	Yes	0.78	Yes	No

[1] SCO: Statistical Significance and (N_T/N_R) <0.85
[2] CSL: Statistical Significance and (N_T/N_R) <0.70
N_T =Treatment Mean Number Normal
N_R =Reference Mean Number Normal

5. SUMMARY

A summary of the biological tests conducted on the sediments evaluated under the SMS sediment quality criteria (Table 5-1) are provided below.

Sample IT682 passes the SCO and CSL performance criteria for all bioassay tests. Sample SS682 fails to meet the SCO criteria for the sediment larval test but passes for the other two test species; it passes CSL criteria for all three test species.

Table 5-1. Summary of SMS Evaluation

Treatment	Sediment Cleanup Objectives			Cleanup Screening Levels		
	Amphipod	Polychaete	Larval	Amphipod	Polychaete	Larval
IT682	Pass	Pass	Pass	Pass	Pass	Pass
SS682	Pass	Pass	Fail	Pass	Pass	Pass

6. REFERENCES

CETIS. 2016. CETIS™ Comprehensive Environmental Toxicity Information System User's Guide. Tidepool Scientific Software. McKinleyville, CA.

Gardiner, W. 2010. Bioassay Testing Issues. Public Issue Paper presented by Mr. William Gardiner (Newfields, Inc.) at 2010 Sediment Management Annual Review Meeting, Federal Center South (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/2010_SMARM_Minutes_Final.pdf).

Inouye, L.; E. Hoffman; D. Fox. 2015. DMMP Clarification Paper: Modifications to Ammonia and Sulfide Triggers for Purging and Reference Toxicant Testing for Marine Bioassays. Final Paper August 14, 2015. Prepared by Laura Inouye (Ecology), Erika Hoffman (EPA) and David Fox (Corps) for the DMMP agencies.

Lee, D.R. 1980. Reference toxicants in quality control of aquatic bioassays: Aquatic invertebrate bioassays. In Buikema AL Jr, Cairns J Jr, eds, Proceedings, 2nd Annual Symposium on Aquatic Toxicology. STP 715. American Society for Testing and Materials, Philadelphia, PA, pp 188–199.

PSEP 1986. Recommended Protocols for measuring conventional sediment variables in Puget Sound. Prepared by Tetra Tech, Inc. for U.S. Environmental Protection Agency and Puget Sound Water Quality Authority. Tetra Tech Inc., Bellevue, WA.

PSEP 1995. Puget Sound Protocols and Guidelines. Puget Sound Estuary Program. Puget Sound Water Quality Action Team, Olympia, Washington.

Plumb, R.H. 1981. Procedures for handling and chemical analysis of sediment and water samples. Technical Report EPA/CE-81-1. U.S. Army Corps of Engineers, Vicksburg, MS.

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition. EPA-821-R-02-012

WDOE 2019. Sediment Cleanup User's Manual (SCUM). Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Toxics Cleanup Program. Washington State Department of Ecology. Olympia, Washington. Publication No. 12-09-057. Second Revision December 2019.

APPENDIX A. TEST DATA, STATISTICAL ANALYSES, AND REFERENCE TOXICANT TEST RESULTS

1. *EOHAUSTORIUS ESTUARIUS* 10-DAY TEST

1.1 *EOHAUSTORIUS ESTUARIUS* TEST DATA
1.2 *EOHAUSTORIUS ESTUARIUS* STATISTICAL RESULTS
1.3 *EOHAUSTORIUS ESTUARIUS* REFERENCE TOXICANT TEST RESULTS

2. *NEANTHES ARENACEODENTATA* SOLID-PHASE TEST

2.1 *NEANTHES ARENACEODENTATA* TEST DATA
2.2 *NEANTHES ARENACEODENTATA* STATISTICAL RESULTS
2.3 *NEANTHES ARENACEODENTATA* REFERENCE TOXICANT TEST RESULTS

3. *MYTILUS GALLOPROVINCIALIS* WATER-COLUMN TEST

3.1 *MYTILUS GALLOPROVINCIALIS* TEST DATA
3.2 *MYTILUS GALLOPROVINCIALIS* STATISTICAL RESULTS
3.3 *MYTILUS GALLOPROVINCIALIS* REFERENCE TOXICANT TEST RESULTS

APPENDIX B. CHAIN-OF-CUSTODY FORMS, LOGS, AND PRE-TEST DOCUMENTS

APPENDIX A. TEST DATA, STATISTICAL ANALYSES, AND REFERENCE TOXICANT TEST RESULTS

1. *Eohaustorius estuarius* 10-day Test

1.1 *Eohaustorius estuarius* Test Data

Version T.5

GENERAL

Client	Anchor/Windward
Project	Lower Duwamish / AOC4
Project Number	PG1541
Project Manager	M. Knowlen
Date Oldest Sample Collected	7/13/2021
Sample Holding Time	52
Test Start Date	09/03/21
Test Species	*Eohaustorius estuarius*
Organism Supplier	NW Amphipod
Organism Acquired	9/2/2021
Organism Acclimation	1
Organism Age	Mature, 3-5 mm
Test Type/Duration	10 day SP
Test Protocol	PSEP 1995
Regional Protocol	SCUM 2019
Laboratory Location	Port Gamble
Test Location	Bath 5
Sample Treatment	none
Control Sediment Source	Yaquina Bay, OR
Water Batch	FSW090121.02
Test Lighting	Continuous
Test Chamber	1 L mason jars
Replicates Per Treatment	5
Organisms per Replicate	20
Exposure Volume	2 cm sediment/ 775 mL water
Feeding Information	None
Test Dissolved Oxygen	> 5.1
Test Temperature	15 ± 1
Test Salinity	28 ± 1
Test pH	8 ± 1
Water Renewal Info	None

Note: input lowest and highest decimal for temp

Test Parameters		
	Min	**Max**
DO:	5.1	
Temp:	13.5	16.4
Sal:	27	29
pH:	7	9

TEST START TIME:	**1420**
TEST END TIME:	**845**

	CLIENT SAMPLE ID	LAB ID
1	**Control**	**P210902.03**
2	**Carr32-Ref**	**P210728.02**
3	**IT682**	**P210830.02**
4	**SS682**	**P210830.03**
5	.	.
6	.	.
7	.	.
8	.	.
9	.	.
10	.	.
11	.	.
12	.	.
13	.	.
14	.	.
15	.	.
16	.	.
17	.	.
18	.	.
19	.	.
20	.	.

EcoAnalysts, Inc.

10 DAY SP WQ DATA SHEET

CLIENT	PROJECT	SPECIES	LOCATION	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	*Eohaustorius estuarius*	Port Gamble / Bath 5	PSEP 1995 , SCUM 2019
PROJECT NUMBER	**TEST TYPE/DURATION**	**WATER DESCRIPTION**	**TEST START DATE**	**TEST END DATE**
PG1541	10 day SP	FSW090121.02	September 3, 2021	September 13, 2021

WATER QUALITY DATA

SAMPLE ID	DAY	REP	JAR #	TECHNICIAN	Date	Meter	DO (mg/L) > 5.1	TEMP (°C) 14 - 16	SALINITY (ppt) 27 - 29	pH 7 - 9	Notes
Control	0	Surr	22	MK	09/03/21	9	8.2	14.8	28	8.0	
Control	1	Surr	22	NL	09/04/21	9	8.3	14.8	28	8.1	
Control	2	Surr	22	IP	09/05/21	9	8.4	14.5	28	8.1	
Control	3	Surr	22	DM	09/06/21	9	8.2	15.0	29	8.1	
Control	4	Surr	22	DM	09/07/21	8	8.5	14.7	27	8.1	
Control	5	Surr	22	NL	09/08/21	8	8.4	14.6	28	8.1	
Control	6	Surr	22	IP	09/09/21	9	8.3	13.7	29	8.1	
Control	7	Surr	22	MS	09/10/21	8	8.5	14.3	28	8.1	
Control	8	Surr	22	NL	09/11/21	8	8.6	14.2	28	8.1	
Control	9	Surr	22	IP	09/12/21	8	8.5	14.4	28	8.1	
Control	10	Surr	22	MS	09/13/21	8	8.3	14.5	29	8.1	
Carr32-Ref	0	Surr	23	MK	09/03/21	9	8.2	14.7	28	8.1	
Carr32-Ref	1	Surr	23	NL	09/04/21	9	8.2	14.8	28	8.0	
Carr32-Ref	2	Surr	23	IP	09/05/21	9	8.2	14.6	28	8.0	
Carr32-Ref	3	Surr	23	DM	09/06/21	9	8.3	15.0	28	8.1	
Carr32-Ref	4	Surr	23	DM	09/07/21	8	8.3	14.8	28	8.0	
Carr32-Ref	5	Surr	23	NL	09/08/21	8	8.6	14.7	27	8.1	
Carr32-Ref	6	Surr	23	IP	09/09/21	9	8.2	13.9	28	8.1	
Carr32-Ref	7	Surr	23	MS	09/10/21	8	8.4	14.4	28	8.1	
Carr32-Ref	8	Surr	23	NL	09/11/21	8	8.5	14.3	28	8.1	
Carr32-Ref	9	Surr	23	IP	09/12/21	8	8.6	14.4	28	8.2	
Carr32-Ref	10	Surr	23	MS	09/13/21	8	8.3	14.2	28	8.1	
IT682	0	Surr	5	MK	09/03/21	9	8.1	14.6	28	8.1	
IT682	1	Surr	5	NL	09/04/21	9	8.2	14.8	28	7.9	
IT682	2	Surr	5	IP	09/05/21	9	8.3	14.5	27	8.0	
IT682	3	Surr	5	DM	09/06/21	9	8.3	15.0	28	7.9	

EcoAnalysts, Inc.

10 DAY SP WQ DATA SHEET

CLIENT	PROJECT	SPECIES	LOCATION	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	*Eohaustorius estuarius*	Port Gamble / Bath 5	PSEP 1995 , SCUM 2019
PROJECT NUMBER	**TEST TYPE/DURATION**	**WATER DESCRIPTION**	**TEST START DATE**	**TEST END DATE**
PG1541	10 day SP	FSW090121.02	September 3, 2021	September 13, 2021

WATER QUALITY DATA

SAMPLE ID	DAY	REP	JAR #	TECHNICIAN	Date	Meter	DO (mg/L) > 5.1	TEMP (°C) 14 - 16	SALINITY (ppt) 27 - 29	pH 7 - 9	Notes
IT682	4	Surr	5	DM	09/07/21	8	8.4	14.7	27	7.9	
IT682	5	Surr	5	NL	09/08/21	8	8.6	14.4	27	7.8	
IT682	6	Surr	5	IP	09/09/21	9	8.3	13.8	27	7.8	
IT682	7	Surr	5	MS	09/10/21	8	8.5	14.3	27	7.8	
IT682	8	Surr	5	NL	09/11/21	8	8.4	14.4	27	7.9	
IT682	9	Surr	5	IP	09/12/21	8	8.5	14.5	27	7.8	
IT682	10	Surr	5	MS	09/13/21	8	8.6	14.1	27	7.9	
SS682	0	Surr	17	MK	09/03/21	9	8.0	14.8	28	8.1	
SS682	1	Surr	17	NL	09/04/21	9	8.3	14.8	28	8.0	
SS682	2	Surr	17	IP	09/05/21	9	8.4	14.5	28	8.1	
SS682	3	Surr	17	DM	09/06/21	9	8.3	14.9	28	8.1	
SS682	4	Surr	17	DM	09/07/21	8	8.5	14.6	27	8.0	
SS682	5	Surr	17	NL	09/08/21	8	8.6	14.3	27	8.0	
SS682	6	Surr	17	IP	09/09/21	9	8.4	13.6	28	8.1	
SS682	7	Surr	17	MS	09/10/21	8	8.5	14.3	27	8.1	
SS682	8	Surr	17	NL	09/11/21	8	8.6	14.3	27	8.1	
SS682	9	Surr	17	IP	09/12/21	8	8.6	14.5	27	8.1	
SS682	10	Surr	17	MS	09/13/21	8	8.5	14.3	27	8.1	

10-DAY SP TEST OBSERVATION DATA SHEET

CLIENT	PROJECT	PROJECT NO.	PROJECT MANAGER	LOCATION	PROTOCOL	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	M. Knowlen	Port Gamble / Bath 5	PSEP 1995	*Eohaustorius estuarius*

Observation Key
#FOS = Num Floating on Water Surface
#E = Num Emerged from Sediment
#M = Number of Mortalities
L = Anoxic Surface
G = Growth
D = No Air Flow
N = Normal
TC = Too Cloudy to Observe

					ENDPOINT DATA & OBSERVATIONS										
				Technician	NL	IP	DM	DM	NL	IP	MS	NL	IP	MK	
				Date	09/04/21	09/05/21	09/06/21	09/07/21	09/08/21	09/09/21	09/10/21	09/11/21	09/12/21	09/13/21	
CLIENT ID	REP	Jar #	Initial #	Day	1	2	3	4	5	6	7	8	9	10	Comments
Control	1	9	20		N	N	N	N	N	N	N	N	N	1E	
Control	2	13	20		N	N	N	N	1M	N	N	N	1E	1E	
Control	3	15	20		N	N	N	N	N	N	N	N	N	N	
Control	4	8	20		N	N	N	N	N	N	N	N	N	N	
Control	5	19	20		N	N	N	N	1M	N	1E	1E	1E	1E	
Carr32-Ref	1	11	20		N	N	N	N	N	G	G	G	G	G	
Carr32-Ref	2	4	20		N	N	1M	N	1M	G	G	G	G	G	
Carr32-Ref	3	2	20		N	N	N	N	N	N	N	N	G	G	
Carr32-Ref	4	10	20		N	N	N	G	G	G	G	G	G	G	
Carr32-Ref	5	24	20		N	N	N	N	N	N	N	N	G	G	
IT682	1	20	20		2FOS	N	N	N	TC	N	N	N	N	N	
IT682	2	18	20		1FOS,TC	N	N	N	N	N	N	N	N	N	
IT682	3	12	20		TC	TC,1FOS	N	1FOS	N	N	N	N	N	N	
IT682	4	16	20		1FOS	1FOS	N	N	N	N	N	TC	1FOS	N	
IT682	5	1	20		TC	TC	TC	TC	TC	TC	N	N	N	N	
SS682	1	3	20		N	N	N	N	N	1E	N	N	N	N	

EcoAnalysts, Inc.

10-DAY SP TEST OBSERVATION DATA SHEET

CLIENT	PROJECT	PROJECT NO.	PROJECT MANAGER	LOCATION	PROTOCOL	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	M. Knowlen	Port Gamble / Bath 5	PSEP 1995	*Eohaustorius estuarius*

Observation Key
#FOS = Num Floating on Water Surface
#E = Num Emerged from Sediment
#M = Number of Mortalities
L = Anoxic Surface
G = Growth
D = No Air Flow
N = Normal
TC = Too Cloudy to Observe

					ENDPOINT DATA & OBSERVATIONS										
				Technician	NL	IP	DM	DM	NL	IP	MS	NL	IP	MK	
				Date	09/04/21	09/05/21	09/06/21	09/07/21	09/08/21	09/09/21	09/10/21	09/11/21	09/12/21	09/13/21	
CLIENT ID	**REP**	**Jar #**	**Initial #**	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Comments**
SS682	2	21	20		1FOS	N	N	N	N	N	N	1FOS	N	1FOS	
SS682	3	7	20		1FOS	1FOS	N	N	N	1FOS	N	N	N	N	
SS682	4	14	20		N	N	N	N	1FOS	N	N	N	N	N	
SS682	5	6	20		1FOS	1FOS	N	N	N	1FOS	1FOS	N	N	N	

EcoAnalysts, Inc.

10 Day SP Survival Summary

CLIENT	PROJECT	PROJECT NUMBER
Anchor/Windward	Lower Duwamish / AOC4	PG1541
PROJECT MANAGER	**SPECIES**	
M. Knowlen	*Eohaustorius estuarius*	

Sample ID	Rep	Jar #	# Initiated	Date Recovered 9/13/2021 # Alive	# Dead	Initials	# Missing or Dead	Comments
Control	1	9	20	18	2	MK	2	
Control	2	13	20	19	0	MK	1	
Control	3	15	20	20	0	MK	0	
Control	4	8	20	20	0	MK	0	
Control	5	19	20	19	0	MK	1	
Carr32-Ref	1	11	20	20	0	MK	0	
Carr32-Ref	2	4	20	19	0	MK	1	
Carr32-Ref	3	2	20	20	0	MK	0	
Carr32-Ref	4	10	20	20	0	MK	0	
Carr32-Ref	5	24	20	20	0	MK	0	
IT682	1	20	20	20	0	MK	0	
IT682	2	18	20	20	0	MK	0	
IT682	3	12	20	19	0	MK	1	
IT682	4	16	20	16	2	MK	4	
IT682	5	1	20	20	0	MK	0	
SS682	1	3	20	18	0	MK	2	
SS682	2	21	20	19	0	MK	1	
SS682	3	7	20	19	0	MK	1	

EcoAnalysts, Inc.

10 Day SP Survival Summary

CLIENT	PROJECT	PROJECT NUMBER
Anchor/Windward	Lower Duwamish / AOC4	PG1541
PROJECT MANAGER	**SPECIES**	
M. Knowlen	*Eohaustorius estuarius*	

Sample ID	Rep	Jar #	# Initiated	Date Recovered 9/13/2021 # Alive	# Dead	Initials	# Missing or Dead	Comments
SS682	4	14	20	20	0	MK	0	
SS682	5	6	20	20	0	MK	0	

CLIENT			PROJECT		PROJECT NUMBER		SPECIES		
Anchor/Windward			Lower Duwamish / AOC4		PG1541		*Eohaustorius estuarius*		
				Survival Statistics			Mortality Statistics		
Sample ID	**Rep**	**# Initiated**	**# Alive**	**% Survival**	**Mean Survival (%)**	**SD**	**% Mortality**	**Mean Mortality (%)**	**SD**
Control	1	20	18	90			10		
Control	2	20	19	95			5		
Control	3	20	20	100			0		
Control	4	20	20	100			0		
Control	5	20	19	95	96.0	4.2	5	4.0	4.2
Carr32-Ref	1	20	20	100			0		
Carr32-Ref	2	20	19	95			5		
Carr32-Ref	3	20	20	100			0		
Carr32-Ref	4	20	20	100			0		
Carr32-Ref	5	20	20	100	99.0	2.2	0	1.0	2.2
IT682	1	20	20	100			0		
IT682	2	20	20	100			0		
IT682	3	20	19	95			5		
IT682	4	20	16	80			20		
IT682	5	20	20	100	95.0	8.7	0	5.0	8.7
SS682	1	20	18	90			10		
SS682	2	20	19	95			5		
SS682	3	20	19	95			5		
SS682	4	20	20	100			0		
SS682	5	20	20	100	96.0	4.2	0	4.0	4.2

10 Day SP Test Day 0 Overlying Ammonia

CLIENT	PROJECT	PROJECT NUMBER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	*Eohaustorius estuarius*

Calibration Standards Temperature: 20.3 **Date:** 9/3/2021 **Tech:** MK (sulf) & IP (NH3)

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Test salinity (ppt)*	*Test pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa^s*	*Unionized NH_3 (mg/L)*	*H_2S pK_a **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Sourced	Sourced	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	0	Overlying	0	20.8	T17/10	ND	10	1	ND	28	8.0	14.8	287.95	9.26	0.000	6.68	ND	
Carr32-Ref	0	Overlying	0.86	21.0	T17/10	11	10	1	11	28	8.1	14.7	287.85	9.26	0.027	6.68	0.565	
IT682	0	Overlying	0.246	21.1	T17/10	0	10	1	0	28	8.1	14.6	287.75	9.26	0.008	6.69	0.000	
SS682	0	Overlying	0.394	21.0	T17/10	6	10	1	6	28	8.1	14.8	287.95	9.26	0.013	6.68	0.307	

10 Day SP Test Day 0 Porewater Ammonia

CLIENT	PROJECT	PROJECT NUMBER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	*Eohaustorius estuarius*

Calibration Standards Temperature: 20.3 **Date:** 9/3/2021 **Tech:** MK (sulf) & IP (NH3)

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Porewater salinity (ppt)*	*Porewater pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pK$_a$ **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Record	Record	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	0	Porewater	0.234	21.1	T17/10	NA	NA	NA	#VALUE!	NA	NA	14.8	287.95	#VALUE!	#VALUE!	#VALUE!	#VALUE!	Not enough PW for sulfide analysis. MK 9/3
Carr32-Ref	0	Porewater	4.51	20.9	T17/10	ND	5	2	ND	29	7.8	14.7	287.85	9.26	0.073	6.68	ND	
IT682	0	Porewater	6.42	20.9	T17/10	ND	10	1	ND	21	7.2	14.6	287.75	9.25	0.026	6.71	ND	
SS682	0	Porewater	5.68	21.2	T17/10	ND	10	1	ND	27	7.1	14.8	287.95	9.26	0.019	6.68	ND	

10 Day SP Test Day 10 Overlying Ammonia

CLIENT	PROJECT	PROJECT NUMBER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	*Eohaustorius estuarius*

Calibration Standards Temperature: 20.0 **Date:** 9/13/2021 **Tech:** IP/DM

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Test salinity (ppt)*	*Test pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa^5*	*Unionized NH_3 (mg/L)*	*H_2S pK_a **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Sourced	Sourced	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	10	Overlying	0	21.0	10/T17	ND	10	1	ND	29	8.1	14.5	287.65	9.26	0.000	6.69	ND	
Carr32-Ref	10	Overlying	0.862	20.8	10/T17	2	10	1	2	28	8.1	14.2	287.35	9.26	0.026	6.69	0.105	
IT682	10	Overlying	0.315	20.7	10/T17	3	10	1	3	27	7.9	14.1	287.25	9.26	0.006	6.70	0.244	
SS682	10	Overlying	0	20.7	10/T17	ND	10	1	ND	27	8.1	14.3	287.45	9.26	0.000	6.69	ND	

10 Day SP Test Day 10 Porewater Ammonia

CLIENT	PROJECT	PROJECT NUMBER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	*Eohaustorius estuarius*

Calibration Standards Temperature: 20.0 **Date:** 9/13/2021 **Tech:** IP/DM

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Porewater salinity (ppt)*	*Porewater pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pK_a **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Record	Record	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	10	Porewater	0.136	19.7	T17/8	ND	10	1	ND	29	7.5	14.5	287.65	9.26	0.001	6.69	ND	
Carr32-Ref	10	Porewater	1.81	19.7	T17/8	ND	10	1	ND	28	7.6	14.2	287.35	9.26	0.018	6.69	ND	
IT682	10	Porewater	2.21	19.8	T17/8	0	10	1	0	26	7.0	14.1	287.25	9.26	0.005	6.70	0.000	
SS682	10	Porewater	3.6	19.5	T17/8	ND	10	1	ND	27	7.1	14.3	287.45	9.26	0.011	6.69	ND	

1.2 *Eohaustorius estuarius* Statistical Results

Project Name: Lower Duwamish / AOC4: Amphipod Mortality

Sample:	x1
Samp ID:	IT682
Alias:	
Replicates:	5
Mean:	0.05
SD:	0.087
Tr Mean:	N/A
Trans SD:	N/A

Ref Samp:	x2
Ref ID:	CARR32-REF
Alias:	
Replicates:	5
Mean:	0.01
SD:	0.022
Tr Mean:	N/A
Trans SD:	N/A

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	0.041
SS:	0.032
K:	5
b:	0.155
Alpha Level:	0.05
Calculated Value:	0.7518
Critical Value:	<= 0.842
Normally Distributed:	No
Override Option:	Not Invoked

Levene's Results:

Test Residual Mean:	0.06
Test Residual SD:	0.055
Ref. Residual Mean:	0.016
Ref. Residual SD:	0.013
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	1.7447
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

Statistic:	Mann-Whitney
Balanced Design:	Yes
Transformation:	rank-order
Experimental Hypothesis	
Null:	x1 <= x2
Alternate:	x1 > x2
Mann-Whitney N1:	5
Mann-Whitney N2:	5
Degrees of Freedom:	
Experimental Alpha Level:	0.05
Calculated Value:	15.5
Critical Value:	>= 21.000
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0	4	0	4	0.05	0.01	4		-0.05
2	0	4	0.05	8.5	0.05	0.04	4		-0.05
3	0.05	8.5	0	4	0	0.01	4		-0.05
4	0.2	10	0	4	0.15	0.01	4		-0.01
5	0	4	0	4	0.05	0.01	4		-0.01
6							4		-0.01
7							4		-0.01
8							8.5		0
9							8.5		0.04
10							10		0.15

Project Name: Lower Duwamish / AOC4: Amphipod Mortality

Sample:	x1
Samp ID:	SS682
Alias:	
Replicates:	5
Mean:	0.04
SD:	0.042
Tr Mean:	0.875
Trans SD:	0.828

Ref Samp:	x2
Ref ID:	CARR32-REF
Alias:	
Replicates:	5
Mean:	0.01
SD:	0.022
Tr Mean:	0.256
Trans SD:	0.573

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	0.462
SS:	4.053
K:	5
b:	1.91
Alpha Level:	0.05
Calculated Value:	0.8999
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	0.7
Test Residual SD:	0.269
Ref. Residual Mean:	0.41
Ref. Residual SD:	0.344
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	1.4847
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	1.3744
Critical Value:	>= 1.860
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.1	1.812	0	0	0.937	0.256			-0.875
2	0.05	1.281	0.05	1.281	0.406	1.025			-0.875
3	0.05	1.281	0	0	0.406	0.256			-0.256
4	0	0	0	0	0.875	0.256			-0.256
5	0	0	0	0	0.875	0.256			-0.256
6									-0.256
7									0.406
8									0.406
9									0.937
10									1.025

1.3 *Eohaustorius estuarius* Reference Toxicant Test Results

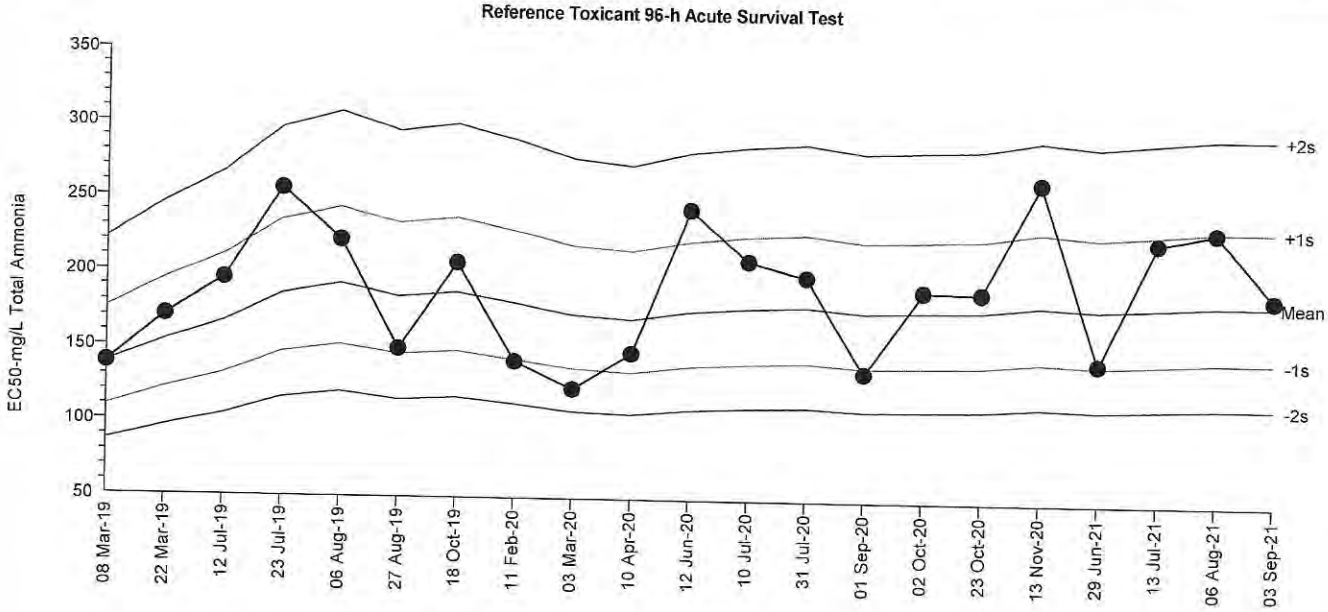
CETIS QC Plot

Report Date: 17 Sep-21 12:29 (1 of 1)

Reference Toxicant 96-h Acute Survival Test

All Matching Labs

Test Type: Survival
Protocol: All Protocols
Organism: Eohaustorius estuarius (Amphipod)
Endpoint: Proportion Survived
Material: Total Ammonia
Source: Reference Toxicant-REF



Mean: 184.9 **Count:** 20 **-1s Warning Limit:** 146.2 **-2s Action Limit:** 115.5
Sigma: n/a **CV:** 23.80% **+1s Warning Limit:** 233.9 **+2s Action Limit:** 295.9

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Mar	8	15:05	138.7	-46.27	-1.225	(-)		13-2397-9481	18-8307-3890	EcoAnalysts
2			22	14:35	170.7	-14.22	-0.3403			01-8305-5138	03-7924-8286	EcoAnalysts
3		Jul	12	15:00	195.3	10.33	0.2312			11-8021-4502	08-1650-3490	EcoAnalysts
4			23	15:15	256.2	71.22	1.386	(+)		17-6815-2027	16-9000-1675	EcoAnalysts
5		Aug	6	15:55	221.9	36.96	0.775			04-7165-8948	01-3458-4366	EcoAnalysts
6			27	14:25	149.5	-35.44	-0.9049			16-1141-7710	18-3800-2446	EcoAnalysts
7		Oct	18	14:40	206.9	22.01	0.4784			10-1139-9672	04-6029-5418	EcoAnalysts
8	2020	Feb	11	11:30	141.8	-43.15	-1.13	(-)		09-3507-3124	12-7490-3807	EcoAnalysts
9		Mar	3	10:50	123.7	-61.2	-1.709	(-)		01-7038-2185	20-8945-2710	EcoAnalysts
10		Apr	10	14:35	148.2	-36.7	-0.9409			15-3093-6458	02-4348-5257	EcoAnalysts
11		Jun	12	14:25	244.4	59.51	1.187	(+)		17-6535-4072	07-7299-7620	EcoAnalysts
12		Jul	10	14:19	210.4	25.44	0.5483			21-2712-7178	15-5267-1443	EcoAnalysts
13			31	13:31	200.1	15.18	0.3355			19-0166-9324	03-8578-2577	EcoAnalysts
14		Sep	1	11:50	136.2	-48.69	-1.3	(-)		02-9531-4833	11-6890-2134	EcoAnalysts
15		Oct	2	13:55	191.4	6.487	0.1466			10-8959-5787	01-2752-4170	EcoAnalysts
16			23	10:35	190.7	5.8	0.1313			09-8256-6636	12-6068-0049	EcoAnalysts
17		Nov	13	15:42	264.7	79.81	1.526	(+)		12-1804-8521	19-5275-8749	EcoAnalysts
18	2021	Jun	29	16:15	144.4	-40.53	-1.052	(-)		07-6082-1836	05-1033-0371	EcoAnalysts
19		Jul	13	13:45	225.7	40.73	0.8467			15-1767-0094	07-8834-3646	EcoAnalysts
20		Aug	6	15:40	233.3	48.4	0.9889			13-1244-3040	10-3339-7021	EcoAnalysts
21		Sep	3	14:25	189.2	4.242	0.09646			14-2430-8410	06-3875-1883	EcoAnalysts

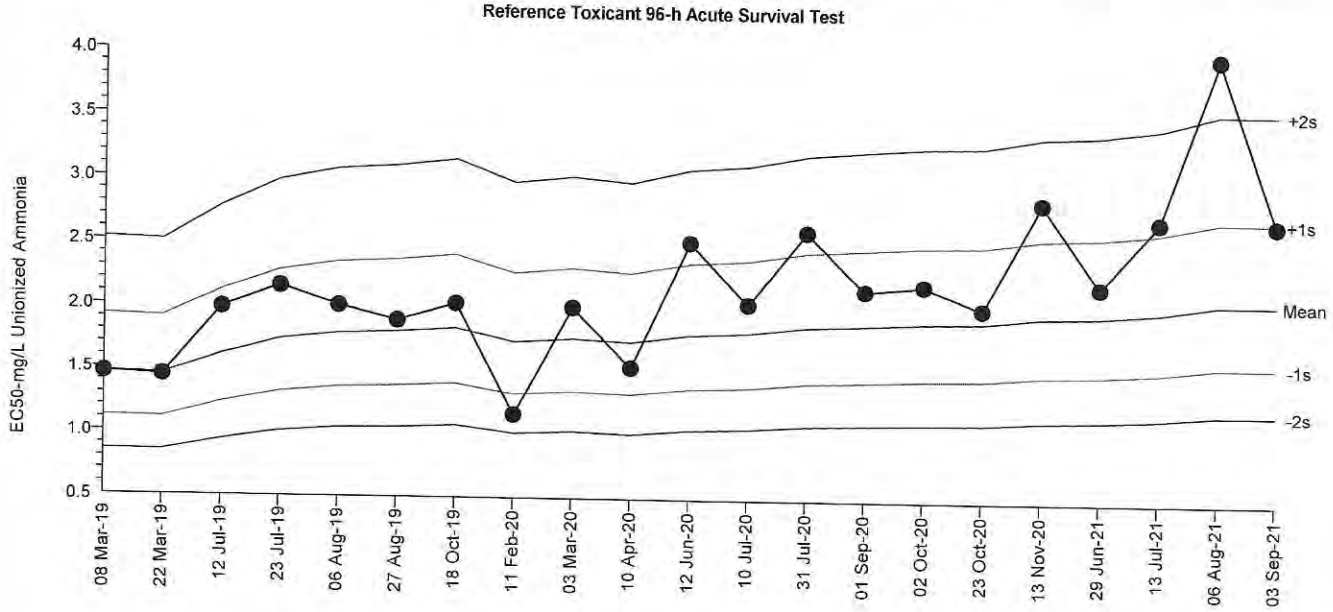
CETIS QC Plot

Report Date: 17 Sep-21 12:31 (1 of 1)

Reference Toxicant 96-h Acute Survival Test

All Matching Labs

Test Type: Survival
Protocol: All Protocols
Organism: Eohaustorius estuarius (Amphipod)
Endpoint: Proportion Survived
Material: Unionized Ammonia
Source: Reference Toxicant-REF



Mean: 2.069 **Count:** 20 **-1s Warning Limit:** 1.577 **-2s Action Limit:** 1.202
Sigma: n/a **CV:** 27.70% **+1s Warning Limit:** 2.716 **+2s Action Limit:** 3.564

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Mar	8	15:05	1.463	-0.6068	-1.277	(-)		06-0570-4350	17-2978-1796	EcoAnalysts
2			22	14:35	1.444	-0.6252	-1.324	(-)		08-8020-3971	15-7045-5745	EcoAnalysts
3		Jul	12	15:00	1.982	-0.08776	-0.1595			01-3966-5124	15-4747-7341	EcoAnalysts
4			23	15:15	2.151	0.08185	0.1428			08-1022-0183	07-0772-7892	EcoAnalysts
5		Aug	6	15:55	2.002	-0.06749	-0.122			10-1925-5694	08-4274-3725	EcoAnalysts
6			27	14:25	1.888	-0.1816	-0.338			18-5396-1387	02-7188-5010	EcoAnalysts
7		Oct	18	14:40	2.025	-0.04489	-0.08072			01-8678-8913	10-6861-7593	EcoAnalysts
8	2020	Feb	11	11:30	1.153	-0.9162	-2.152	(-)	(-)	20-1044-3853	15-7919-2486	EcoAnalysts
9		Mar	3	10:50	2	-0.0699	-0.1265			02-4224-7585	10-8613-3376	EcoAnalysts
10		Apr	10	14:35	1.532	-0.5375	-1.107	(-)		03-6100-0320	17-4770-7985	EcoAnalysts
11		Jun	12	14:25	2.515	0.4455	0.7176			12-0347-2631	12-6656-5651	EcoAnalysts
12		Jul	10	14:19	2.036	-0.0336	-0.06025			19-2747-2298	11-5216-9625	EcoAnalysts
13			31	13:31	2.604	0.5347	0.8459			00-3001-9040	12-3550-9219	EcoAnalysts
14		Sep	1	11:50	2.15	0.08011	0.1398			20-8197-8748	01-8924-2597	EcoAnalysts
15		Oct	2	13:55	2.192	0.1229	0.2124			11-7285-1322	05-0028-0196	EcoAnalysts
16			23	10:35	2.014	-0.05592	-0.1008			06-9998-7880	19-7260-2994	EcoAnalysts
17		Nov	13	15:42	2.846	0.7764	1.173	(+)		18-9101-0953	11-1982-6601	EcoAnalysts
18	2021	Jun	29	16:15	2.193	0.1232	0.2129			19-9925-7350	18-0084-5381	EcoAnalysts
19		Jul	13	13:45	2.706	0.6367	0.9873			19-3066-6785	16-4976-7245	EcoAnalysts
20		Aug	6	15:40	3.994	1.925	2.42	(+)	(+)	10-9355-9036	08-0099-3943	EcoAnalysts
21		Sep	3	14:25	2.695	0.6253	0.9717			12-5464-4660	16-4098-9472	EcoAnalysts

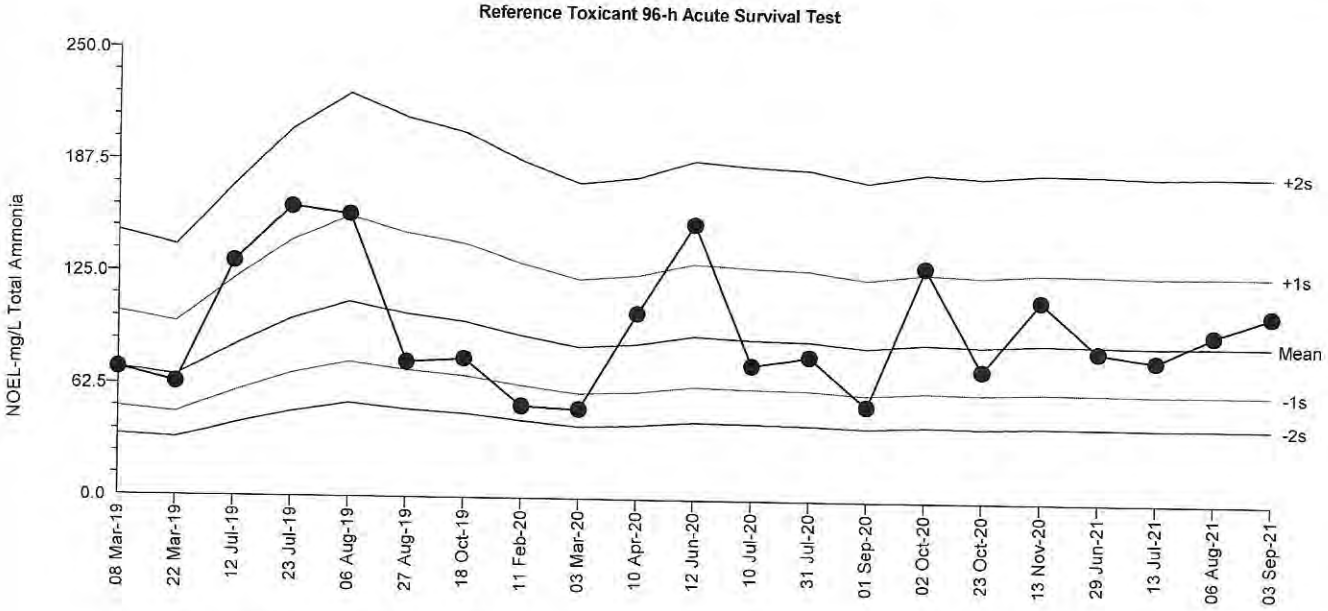
CETIS QC Plot

Report Date: 17 Sep-21 12:29 (1 of 1)

Reference Toxicant 96-h Acute Survival Test

All Matching Labs

Test Type: Survival
Protocol: All Protocols
Organism: Eohaustorius estuarius (Amphipod)
Endpoint: Proportion Survived
Material: Total Ammonia
Source: Reference Toxicant-REF



Mean: 88.59	**Count:** 20	**-1s Warning Limit:** 61.54	**-2s Action Limit:** 42.75
Sigma: n/a	**CV:** 37.70%	**+1s Warning Limit:** 127.5	**+2s Action Limit:** 183.6

Quality Control Data

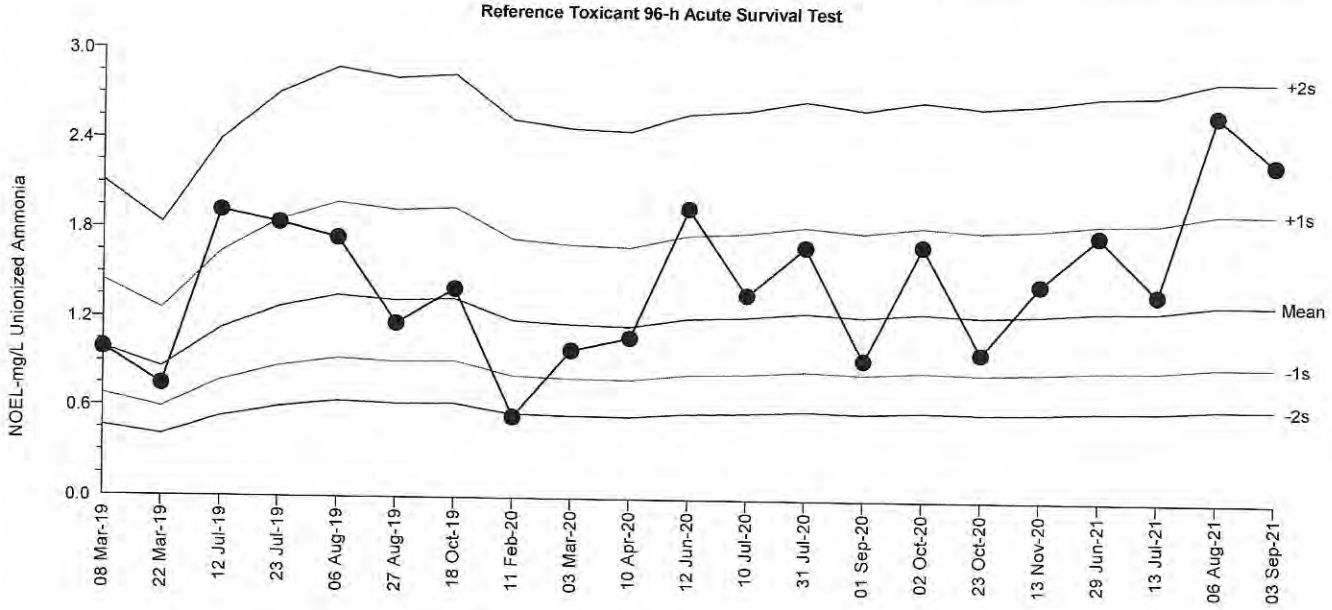
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Mar	8	15:05	71.3	-17.29	-0.5959			13-2397-9481	07-4616-8731	EcoAnalysts
2			22	14:35	63.6	-24.99	-0.9097			01-8305-5138	01-5094-6419	EcoAnalysts
3		Jul	12	15:00	131	42.41	1.074	(+)		11-8021-4502	11-6723-5493	EcoAnalysts
4			23	15:15	162	73.41	1.657	(+)		17-6815-2027	16-9478-2247	EcoAnalysts
5		Aug	6	15:55	158	69.41	1.588	(+)		04-7165-8948	03-2243-7067	EcoAnalysts
6			27	14:25	75.8	-12.79	-0.4279			16-1141-7710	12-2316-3444	EcoAnalysts
7		Oct	18	14:40	78	-10.59	-0.3494			10-1139-9672	05-2006-4501	EcoAnalysts
8	2020	Feb	11	11:30	52.1	-36.49	-1.457	(-)		09-3507-3124	13-5894-1723	EcoAnalysts
9		Mar	3	10:50	50.5	-38.09	-1.543	(-)		01-7038-2185	21-4048-9176	EcoAnalysts
10		Apr	10	14:35	104	15.41	0.4403			15-3093-6458	05-9305-5932	EcoAnalysts
11		Jun	12	14:25	154	65.41	1.518	(+)		17-6535-4072	07-6969-7095	EcoAnalysts
12		Jul	10	14:19	75.8	-12.79	-0.4279			21-2712-7178	13-0630-6125	EcoAnalysts
13			31	13:31	80.9	-7.688	-0.2492			19-0166-9324	03-5532-3283	EcoAnalysts
14		Sep	1	11:50	53.7	-34.89	-1.374	(-)		02-9531-4833	07-4441-0331	EcoAnalysts
15		Oct	2	13:55	131	42.41	1.074	(+)		10-8959-5787	16-6668-9815	EcoAnalysts
16			23	10:35	74.1	-14.49	-0.4902			09-8256-6636	18-1896-1590	EcoAnalysts
17		Nov	13	15:42	113	24.41	0.6681			12-1804-8521	08-0142-9966	EcoAnalysts
18	2021	Jun	29	16:15	85.1	-3.488	-0.1103			07-6082-1836	16-9941-2080	EcoAnalysts
19		Jul	13	13:45	80.3	-8.288	-0.2696			15-1767-0094	15-0390-7924	EcoAnalysts
20		Aug	6	15:40	94.8	6.212	0.186			13-1244-3040	01-5789-6440	EcoAnalysts
21		Sep	3	14:25	106	17.41	0.4926			14-2430-8410	12-7543-2792	EcoAnalysts

CETIS QC Plot

Report Date: 17 Sep-21 12:30 (1 of 1)

Reference Toxicant 96-h Acute Survival Test — **All Matching Labs**

Test Type: Survival
Protocol: All Protocols
Organism: Eohaustorius estuarius (Amphipod)
Endpoint: Proportion Survived
Material: Unionized Ammonia
Source: Reference Toxicant-REF



Mean: 1.33	**Count:** 20	**-1s Warning Limit:** 0.9117	**-2s Action Limit:** 0.6248
Sigma: n/a	**CV:** 39.20%	**+1s Warning Limit:** 1.941	**+2s Action Limit:** 2.832

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Mar	8	15:05	0.992	-0.3382	-0.7764			06-0570-4350	05-4558-3875	EcoAnalysts
2			22	14:35	0.748	-0.5822	-1.524	(-)		08-8020-3971	02-0863-1050	EcoAnalysts
3		Jul	12	15:00	1.919	0.5888	0.9701			01-3966-5124	09-4580-1187	EcoAnalysts
4			23	15:15	1.841	0.5108	0.8603			08-1022-0183	07-2627-9819	EcoAnalysts
5		Aug	6	15:55	1.74	0.4098	0.7109			10-1925-5694	11-7110-4221	EcoAnalysts
6			27	14:25	1.169	-0.1612	-0.3419			18-5396-1387	17-3719-5174	EcoAnalysts
7		Oct	18	14:40	1.403	0.07284	0.1411			01-8678-8913	18-9446-3335	EcoAnalysts
8	2020	Feb	11	11:30	0.542	-0.7882	-2.376	(-)	(-)	20-1044-3853	05-7199-7325	EcoAnalysts
9		Mar	3	10:50	0.993	-0.3372	-0.7738			02-4224-7585	21-0063-9299	EcoAnalysts
10		Apr	10	14:35	1.083	-0.2472	-0.5441			03-6100-0320	05-0989-9940	EcoAnalysts
11		Jun	12	14:25	1.954	0.6238	1.018	(+)		12-0347-2631	14-7232-3891	EcoAnalysts
12		Jul	10	14:19	1.377	0.04684	0.0916			19-2747-2298	01-8578-1404	EcoAnalysts
13			31	13:31	1.7	0.3698	0.6494			00-3001-9040	15-3409-7029	EcoAnalysts
14		Sep	1	11:50	0.941	-0.3892	-0.9161			20-8197-8748	17-0650-0152	EcoAnalysts
15		Oct	2	13:55	1.712	0.3818	0.668			11-7285-1322	15-2673-4105	EcoAnalysts
16			23	10:35	0.99	-0.3402	-0.7818			06-9998-7880	14-0668-5693	EcoAnalysts
17		Nov	13	15:42	1.455	0.1248	0.2374			18-9101-0953	07-0117-9007	EcoAnalysts
18	2021	Jun	29	16:15	1.788	0.4578	0.7829			19-9925-7350	08-0508-5283	EcoAnalysts
19		Jul	13	13:45	1.396	0.06584	0.1279			19-3066-6785	11-7333-5005	EcoAnalysts
20		Aug	6	15:40	2.604	1.274	1.778	(+)		10-9355-9036	10-6853-3642	EcoAnalysts
21		Sep	3	14:25	2.277	0.9468	1.423	(+)		12-5464-4660	09-4330-3760	EcoAnalysts

CETIS Summary Report

Report Date: 17 Sep-21 12:24 (p 1 of 1)
Test Code/ID: P190612.204 / 14-2430-8410

Reference Toxicant 96-h Acute Survival Test

EcoAnalysts

Batch ID:	04-5897-9839	Test Type:	Survival	Analyst:	
Start Date:	03 Sep-21 14:25	Protocol:	PSEP (1995)	Diluent:	Laboratory Seawater
Ending Date:	07 Sep-21 13:31	Species:	Eohaustorius estuarius	Brine:	Not Applicable
Test Length:	95h	Taxon:	Malacostraca	Source:	Northwestern Aquatic Scien Age:

Sample ID:	16-4191-8874	Code:	P190612.204	Project:	Reference Toxicant
Sample Date:	12 Jun-19	Material:	Total Ammonia	Source:	Reference Toxicant
Receipt Date:	12 Jun-19	CAS (PC):		Station:	P190612.204
Sample Age:	814d 14h	Client:	Internal Lab		

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓ NOEL	LOEL	TOEL	TU	PMSD	S
12-7543-2792	Proportion Survived	Dunnett Multiple Comparison Test	106	209	148.8		14.7%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	mg/L	95% LCL	95% UCL	TU	S
06-3875-1883	Proportion Survived	Linear Interpolation (ICPIN)	EC5	112.3	n/a	114.3		1
			EC10	119	99.17	123.2		
			EC15	126.1	104.5	132.8		
			EC20	133.7	109.9	143.1		
			EC25	141.6	115.6	154.2		
			EC40	168.5	136.5	194.3		
			EC50	189.2	151.2	230.8		

Proportion Survived Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
27.2		3	0.9333	0.6465	1.0000	0.8000	1.0000	0.0667	0.1155	12.37%	3.45%
54.7		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-3.45%
106		3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
209		3	0.4000	0.1516	0.6484	0.3000	0.5000	0.0577	0.1000	25.00%	58.62%
413		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Proportion Survived Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	0.9000	1.0000	1.0000
27.2		1.0000	0.8000	1.0000
54.7		1.0000	1.0000	1.0000
106		1.0000	1.0000	0.9000
209		0.5000	0.4000	0.3000
413		0.0000	0.0000	0.0000

Proportion Survived Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	9/10	10/10	10/10
27.2		10/10	8/10	10/10
54.7		10/10	10/10	10/10
106		10/10	10/10	9/10
209		5/10	4/10	3/10
413		0/10	0/10	0/10

CETIS Test Data Worksheet

Report Date: 17 Sep-21 12:24 (p 1 of 1)
Test Code/ID: P190612.204 / 14-2430-8410

Reference Toxicant 96-h Acute Survival Test — EcoAnalysts

Start Date:	03 Sep-21 14:25	**Species:**	Eohaustorius estuarius	**Sample Code:**	P190612.204
End Date:	07 Sep-21 13:31	**Protocol:**	PSEP (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Total Ammonia	**Sample Station:**	P190612.204

Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	Notes
0	D	1	13	10	9	
0	D	2	4	10	10	
0	D	3	11	10	10	
27.2		1	9	10	10	
27.2		2	1	10	8	
27.2		3	12	10	10	
54.7		1	8	10	10	
54.7		2	7	10	10	
54.7		3	3	10	10	
106		1	10	10	10	
106		2	16	10	10	
106		3	17	10	9	
209		1	6	10	5	
209		2	5	10	4	
209		3	15	10	3	
413		1	14	10	0	
413		2	18	10	0	
413		3	2	10	0	

/

CETIS Summary Report

Report Date: 17 Sep-21 12:28 (p 1 of 1)
Test Code/ID: P190612.204.UIA / 12-5464-4660

Reference Toxicant 96-h Acute Survival Test — EcoAnalysts

Batch ID:	04-5897-9839	**Test Type:**	Survival	**Analyst:**	
Start Date:	03 Sep-21 14:25	**Protocol:**	PSEP (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	07 Sep-21 13:31	**Species:**	Eohaustorius estuarius	**Brine:**	Not Applicable
Test Length:	95h	**Taxon:**	Malacostraca	**Source:**	Northwestern Aquatic Scien **Age:**

Sample ID:	07-3693-5572	**Code:**	P190612.204.UIA	**Project:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Unionized Ammonia	**Source:**	Reference Toxicant
Receipt Date:	12 Jun-19	**CAS (PC):**		**Station:**	P190612.204
Sample Age:	814d 14h	**Client:**	Internal Lab		

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
09-4330-3760	Proportion Survived	Dunnett Multiple Comparison Test		2.277	2.772	2.512		14.7%	1

Proportion Survived Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
0.742		3	0.9333	0.6465	1.0000	0.8000	1.0000	0.0667	0.1155	12.37%	3.45%
1.439		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-3.45%
2.277		3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
2.772		3	0.4000	0.1516	0.6484	0.3000	0.5000	0.0577	0.1000	25.00%	58.62%
3.602		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Proportion Survived Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	0.9000	1.0000	1.0000
0.742		1.0000	0.8000	1.0000
1.439		1.0000	1.0000	1.0000
2.277		1.0000	1.0000	0.9000
2.772		0.5000	0.4000	0.3000
3.602		0.0000	0.0000	0.0000

Proportion Survived Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	9/10	10/10	10/10
0.742		10/10	8/10	10/10
1.439		10/10	10/10	10/10
2.277		10/10	10/10	9/10
2.772		5/10	4/10	3/10
3.602		0/10	0/10	0/10

CETIS Test Data Worksheet

Report Date: 17 Sep-21 12:28 (p 1 of 1)
Test Code/ID: P190612.204.UIA / 12-5464-4660

Reference Toxicant 96-h Acute Survival Test — EcoAnalysts

Start Date:	03 Sep-21 14:25	**Species:**	Eohaustorius estuarius	**Sample Code:**	P190612.204.UIA
End Date:	07 Sep-21 13:31	**Protocol:**	PSEP (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Unionized Ammonia	**Sample Station:**	P190612.204

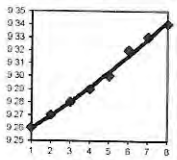
Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	Notes
0	D	1	8	10	9	
0	D	2	13	10	10	
0	D	3	16	10	10	
0.742		1	18	10	10	
0.742		2	11	10	8	
0.742		3	3	10	10	
1.439		1	4	10	10	
1.439		2	10	10	10	
1.439		3	15	10	10	
2.277		1	1	10	10	
2.277		2	17	10	10	
2.277		3	6	10	9	
2.772		1	5	10	5	
2.772		2	12	10	4	
2.772		3	2	10	3	
3.602		1	9	10	0	
3.602		2	14	10	0	
3.602		3	7	10	0	

Un-ionized Ammonia Calculator

CLIENT:	Anchor / Windward	Date of Test:	September 3, 2021
PROJECT:	Lower Duwamish	Test Type:	*E. estuarius*
COMMENTS:	RT		

To convert Total Ammonia (mg/L) to Free (un-ionized) Ammonia (mg/L) enter the corresponding total ammonia, salinity, temperature, and pH.

Ionic strength	pKa^s
1	9.26
2	9.27
3	9.28
4	9.29
5	9.30
6	9.32
7	9.33
8	9.34



$y = 0.0003x^2 + 0.0091x + 9.2502$

...

	Sample	Mod	*NH3T (mg/L)*	*salinity (ppt)*	*pH*	*temp (C)*	*temp (K)*	*pKa^s*		NH_3U (mg/L)
	Target / Sample Name		Actual	Actual	Actual	Actual	Calculated	Calculated		Calculated
	Example 3.5		2.000	10.0	7.5	5.0	278.15	9.2520		**0.008**
1										
2										
3	20		27.2	28	8.0	15.7	288.85	9.2555		**0.742**
4	40		54.7	28	8.0	15.2	288.35	9.2555		**1.439**
5	80		106	28	7.9	15.5	288.65	9.2555		**2.277**
6	160		209	28	7.7	15.1	288.25	9.2555		**2.772**
7	320		413	29	7.5	15.6	288.75	9.2557		**3.602**
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
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QA✓ MSMS

EcoAnalysts

Ammonia Reference Toxicant Test Water Quality Data Sheet

CLIENT	PROJECT	SPECIES		
		Eohaustorius estuarius		
Anchor/Windward	Lower Duwamish / AOc4	PROJECT MANAGER: M. Knowlen	LABORATORY: Port Gamble .	PROTOCOL: PSEP

SURVIVAL & BEHAVIOR DATA

OBSERVATION KEY
N = Normal
LOE = Loss of equilibium
Q = Quiescent
DC = Discoloration
NB = No body
F = Floating on surface

INITIAL # OF ORGANISMS: 10

SAMPLE ID	CONC. value	CONC. units	REP	INITIAL NUMBER	DAY 1 #ALIVE	DAY 1 #DEAD	DAY 1 OBS	DAY 2 #ALIVE	DAY 2 #DEAD	DAY 2 OBS	DAY 3 #ALIVE	DAY 3 #DEAD	DAY 3 OBS	DAY 4 #ALIVE	DAY 4 #DEAD	DAY 4 OBS
					DATE 9/04/21			DATE 9/5/21			DATE 9/6/21			DATE 9/7/21		
					TECHNICIAN JL			TECHNICIAN IP			TECHNICIAN DM			TECHNICIAN SH		
Ref.Tox.- Ammonia	0	mg/L	1	10	10	0	2F (1)	10	Ø	1F (1)	10	0	1F	9	1 (1)	N
			2	10	10	0	1F	10	Ø	2F	10	0	2F	10	0 (1)	N
			3	10	10	0	4F (1)	10	Ø	3F (1)	10	0	3F	10	0 (1)	1F
Ref.Tox.- Ammonia	20 ~~15~~	mg/L	1	10	10	0	2F	10	Ø	1F	10	0	1F	10	0 (1)	1F
			2	10	9	1	N	8	1	N	8	0	N	8	0 (1)	N
			3	10	10	0	2F	10	Ø	3F	10	0	4F	10	0 (1)	2F
Ref.Tox.- Ammonia	40 ~~30~~	mg/L	1	10	10	0	N	10	Ø	N	10	0	N	10	0 (4)	N
			2	10	10	0	1F (1)	10	Ø	2F (1)	10	0	N	10	0 (1)	1F
			3	10	10	0	2F (1)	10	Ø	2F	10	0	1F	10	0 (4)	N
Ref.Tox.- Ammonia	80 ~~60~~	mg/L	1	10	10	0	2F (2) 4F	10	Ø	1F	10	0	4F	10	0	1F
			2	10	10	0	2F	10	Ø	2F	10	0	3F	10	0	3F
			3	10	10	0	N (1)	10	Ø	1F (1)	10	0	1F	9	1 (1)	N
Ref.Tox.- Ammonia	160 ~~120~~	mg/L	1	10	10	0	Q (1)	10	Ø	2F,Q	5	5	5Q	5	0	5Q
			2	10	9	1	Q	9	Ø	Q	4	5	4Q	4	0	4Q
			3	10	10	0	1F,Q	9	1	Q	3	6	3Q	3	0	3Q
Ref.Tox.- Ammonia	320 ~~240~~	mg/L	1	10	3	7	Q (1)	Ø	Ø (3)	DC,Q (1)						
			2	10	7	3	1F,Q (1)	Ø	3	DC,Q (1)						
			3	10	4	6	1F,Q (1)	Ø	6	DC (1)						

(1) Babies present JL 9/04/21 - IP 9/5/21
(2) WC. JL 9/04/21
(3) WC - all dead - IP 9/5/21
(4) I.E. - SH 9/7/21

ECO ANALYSTS

Ammonia Reference Toxicant Test Water Quality Data Sheet

CLIENT	PROJECT		Laboratory	PROTOCOL
Anchor/Windward	Lower Duwamish AOc4	*Eohaustorius estuarius*	Port Gamble .	PSEP
TEST ID: P190612.204	LOT #: 1BH13567763	DILUTION PREP INITIALS: SH		
CHAMBER SIZE/TYPE: Pint Jar	EXPOSURE VOLUME: 250 ml	TEST START DATE: 03Sep21 — INITIALS: MW MS — TIME: 1425	TEST END DATE: 07Sep21	TIME: 1331 SH

WATER QUALITY DATA

TEST CONDITIONS					DO (mg/L) > 5.1		TEMP(C) 15 ± 1		SAL (ppt) 28 ± 2		pH 7-9		TECHNICIAN	AMMONIA					
SAMPLE ID	CONCENTRATION value	CONCENTRATION units	DAY	REP	D.O. meter	D.O. mg/L	TEMP. meter	TEMP. °C	SALINITY meter	SALINITY ppt	pH meter	pH unit	WQ TECH/ DATE	AMMONIA METER	AMMONIA mg/L	Tech			
Ref.Tox.-ammonia	0	mg/L	0	Stock	~~8~~ 9 ①	7.6	~~8~~ 9 ①	15.8	9	28	9	8.1	9/3/21 SH	10	0.00	IP/SH			
			4	1	9	7.5	9	15.3	9	28	9	7.8	9/7/21 DM						
Ref.Tox.-ammonia	20	mg/L	0	Stock	9	7.7	9	15.7	9	28	9	8.0	9/3/21 SH	10	27.2	IP/SH			
			4	1	9	7.8	9	14.8	9	28	9	7.9	DM 9/7/21						
Ref.Tox.-ammonia	40	mg/L	0	Stock	9	7.3	9	15.2	9	28	9	8.0	9/3/21 SH	10	54.7	SH/IP			
			4	1	9	7.8	9	15.5	9	28	9	7.9	DM 9/7/21						
Ref.Tox.-ammonia	80	mg/L	0	Stock	9	7.4	9	15.5	9	28	9	7.9	9/3/21 SH	10	106	IP/SH			
			4	1	9	7.8	9	15.1	9	28	9	8.0	DM 9/7/21						
Ref.Tox.-ammonia	160	mg/L	0	Stock	9	7.5	9	15.1	9	28	9	7.7	9/3/21 SH	10	209	SH/IP			
			4	1	9	7.9	9	14.7	9	29	9	7.9	DM 9/7/21						
Ref.Tox.-ammonia	320	mg/L	0	Stock	9	7.5	9	15.6	9	29	9	7.5	9/3/21 SH	10	413	SH/IP			
			4	1															

① wrong cart - SH 9/3/21

Ammonia Reference Toxicant
Spiking Worksheet

Reference Toxicant ID: P190612.2034 ①
Date Prepared: 9/3/21
Technician Initials: SH

Eoh NH_3 RT

Assumptions in Model
Stock ammonia concentration is 10,000 mg/L = 10 mg/mL

Date: 7/20/2021
Measurement: 9,323

Test Solutions			Volume of stock to reach desired concentration	
Measured Concentration	**Desired Concentration**	**Volume**		
mg/L	mg/L	mL	mL stock to increase	
0.00				SALT WATER
27.2	**20**	750		**2.413**
54.7	**40**	750		**4.827**
106	**80**	750		**9.653**
209	**160**	750		**19.306**
413	**320**	750		**38.613**

① Wrong # - SH 9/3/21

Rndm #s
P190612-204

Ø	1	17
	2	1
	3	4
	4	18
20	5	10
	6	6
	7	8
40	8	16
	9	14
	10	11
80	11	12
	12	9
	13	7
160	14	5
	15	2
320	16	15
	17	3
	18	13

2. *Neanthes arenaceodentata* Solid-Phase Test

2.1 *Neanthes arenaceodentata* Test Data

Version T.6

GENERAL

Client	Anchor/Windward
Project	Lower Duwamish / AOC4
Project Number	PG1541
Project Manager	M. Knowlen
Date Oldest Sample Collected	7/13/2021
Sample Holding Time	52
Test Start Date	09/03/21
Test Species	*Neanthes arenaceodentata*
Organism Supplier	Aquatic Toxicology Support
Organism Acquired	9/3/2021
Organism Acclimation	0
Organism Age	Juvenile (2-3 weeks post emergence)
Test Type/Duration	20-Day Solid Phase
Test Protocol	PSEP 1995
Regional Protocol	SCUM 2019
Laboratory Location	Port Gamble
Test Location	Bath 6
Sample Treatment	none
Control Sediment Source	Yaquina Bay, OR
Water Batch	FSW090121.02
Test Lighting	Continuous
Test Chamber	1 L glass jars
Replicates Per Treatment	5 replicates + 2 surrogates
Organisms per Replicate	5
Exposure Volume	2 cm sediment/ 775 mL water
Feeding Information	40 mg Tetramin/Replicate every other day
Test Dissolved Oxygen	> 4.6
Test Temperature	20 ± 1
Test Salinity	28 ± 2
Test pH	8 ± 1
Water Renewal Info	Renewed every third day

Food Batch ID
D04843

Note: input lowest and highest decimal for temp

Test Parameters		
	Min	**Max**
DO:	4.6	
Temp:	18.5	21.4
Sal:	26	30
pH:	7	9

TEST START TIME:	15:48
TEST END TIME:	1045

	CLIENT SAMPLE ID	LAB ID
1	Control	P210902.03
2	Carr32 Ref	P210728.02
3	IT682	P210830.02
4	SS682	P210830.03
5	.	.
6	.	.
7	.	.
8	.	.
9	.	.
10	.	.
11	.	.
12	.	.
13	.	.
14	.	.
15	.	.
16	.	.
17	.	.
18	.	.
19	.	.
20	.	.

20 Day SP Test Pretest

CLIENT	PROJECT	PROJECT MANAGER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	M. Knowlen	*Neanthes arenaceodentata*

	Oven Event 1	Oven Event 2	Muffle Furnace
Oven ID:	**Persephone**	**Beelzebub**	**Persephone**
Date/Time/Initals In Oven:	N/A (used prev ashed boats)	9/3/21 16:23 SH	9/9/21 0905 MS
Oven Temp °C:	N/A (used prev ashed boats)	60	550
Date/Time/Initials Out Oven into Dessicator:	N/A (used prev ashed boats)	9/4/2021 1651 NL	9/9/21 1225 MS
Date/Time/Initials Weighed:	9/3/21 1535 MK	9/9/21 0900 MS	9/23/2021 1504 SH
Balance ID:	#3	#3	#3

Rep/Boat #	Number Animals Weighed	Tare Wt. (mg)	Total Dry Wt. (mg)	Total Ashed Wt. (mg)	Calculated Dry Weights: Dry Weight per Replicate (mg)	Dry Weight per Individual (mg)	Mean Individual Dry Weight (mg)	SD	Calculated Ash Free Dry Weights: Ash-Free Dry Weight per Replicate (mg)	AFDW per Individual (mg)	Mean Individual AFDW (mg)	SD
99	5	262.39	264.83	262.79	2.44	0.488			2.04	0.408		
X1	5	371.66	377.1	374.64	5.44	1.088			2.46	0.492		
X2	5	358.01	361.14	359.36	3.13	0.626	0.734	0.31	1.78	0.356	0.419	0.07

20 Day SP Test WQ Data Sheet

CLIENT	PROJECT	SPECIES	LOCATION	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	*Neanthes arenaceodentata*	Port Gamble / Bath 6	PSEP 1995 , SCUM 2019
PROJECT MANAGER	**TEST TYPE/DURATION**	**PROJECT NUMBER**	**TEST START DATE**	**TEST END DATE**
M. Knowlen	20-Day Solid Phase	PG1541	September 3, 2021	September 23, 2021

WATER QUALITY DATA

SAMPLE ID	DAY	REP	JAR #	TECHNICIAN	Date	Meter	DO (mg/L) > 4.6	TEMP (°C) 19 - 21	SALINITY (ppt) 26 - 30	pH 7 - 9	Water Renewal	Feed 40 mg Tetramin/Rep	Notes
Control	0	Surr	5	MS	09/03/21	8	7.9	18.8	28	7.9		MK	
Control	1	Surr	5	NL	09/04/21	9	7.2	19.9	28	7.9			
Control	2	Surr	5	IP	09/05/21	9	7.4	20.1	28	8.0		IP	
Control	3	Surr	5	DM	09/06/21	9	7.2	20.2	29	7.9	DM		
Control	4	Surr	5	DM	09/07/21	8	7.5	20.2	28	8.0		SH	
Control	5	Surr	5	NL	09/08/21	8	7.3	20.4	28	7.9			
Control	6	Surr	5	IP	09/09/21	9	7.2	20.0	29	8.1	NL	IP	
Control	7	Surr	5	MS	09/10/21	8	7.3	20.1	28	7.9			
Control	8	Surr	5	NL	09/11/21	8	7.4	20.4	28	8.2		NL	
Control	9	Surr	5	IP	09/12/21	8	7.2	20.2	28	7.9	IP		
Control	10	Surr	5	MS	09/13/21	8	7.5	19.8	29	8.0		MS	
Control	11	Surr	5	IP	09/14/21	8	7.3	19.8	29	7.9			
Control	12	Surr	5	MS	09/15/21	8	7.6	20.1	29	8.1	MS	MS	
Control	13	Surr	5	NL	09/16/21	8	7.5	19.7	29	7.9			
Control	14	Surr	5	NL	09/17/21	9	7.3	19.7	29	8.0		NL	
Control	15	Surr	5	NL	09/18/21	9	7.2	19.8	29	8.0	NL		
Control	16	Surr	5	IP	09/19/21	9	7.3	19.5	29	8.0		IP	
Control	17	Surr	5	IP	09/20/21	8	7.5	19.9	30	7.9			
Control	18	Surr	5	DM	09/21/21	8	7.5	19.9	29	8.0	DM	DM	
Control	19	Surr	5	MS	09/22/21	9	7.4	19.5	28	7.9			
Control	20	Surr	5	MS	09/23/21	8	7.6	19.9	29	8.0			
Carr32 Ref	0	Surr	21	MS	09/03/21	8	7.9	18.6	28	7.9		MK	
Carr32 Ref	1	Surr	21	NL	09/04/21	9	7.1	20.3	28	7.9			
Carr32 Ref	2	Surr	21	IP	09/05/21	9	7.2	20.3	28	7.9		IP	
Carr32 Ref	3	Surr	21	DM	09/06/21	9	7.1	20.5	29	7.9	DM		
Carr32 Ref	4	Surr	21	DM	09/07/21	8	7.4	20.4	28	8.0		SH	
Carr32 Ref	5	Surr	21	NL	09/08/21	8	7.2	20.6	28	7.8			
Carr32 Ref	6	Surr	21	IP	09/09/21	9	7.0	20.3	29	8.1	NL	IP	
Carr32 Ref	7	Surr	21	MS	09/10/21	8	7.1	20.3	28	7.9			

20 Day SP Test WQ Data Sheet

CLIENT	PROJECT	SPECIES	LOCATION	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	*Neanthes arenaceodentata*	Port Gamble / Bath 6	PSEP 1995 , SCUM 2019
PROJECT MANAGER	**TEST TYPE/DURATION**	**PROJECT NUMBER**	**TEST START DATE**	**TEST END DATE**
M. Knowlen	20-Day Solid Phase	PG1541	September 3, 2021	September 23, 2021

WATER QUALITY DATA

SAMPLE ID	DAY	REP	JAR #	TECHNICIAN	Date	Meter	DO (mg/L) > 4.6	TEMP (°C) 19 - 21	SALINITY (ppt) 26 - 30	pH 7 - 9	Water Renewal	Feed 40 mg Tetramin/Rep	Notes
Carr32 Ref	**8**	Surr	21	NL	09/11/21	8	7.5	20.5	28	8.2		NL	
Carr32 Ref	**9**	Surr	21	IP	09/12/21	8	7.4	19.9	29	8.1	IP		
Carr32 Ref	**10**	Surr	21	MS	09/13/21	8	7.5	19.9	29	8.1		MS	
Carr32 Ref	**11**	Surr	21	IP	09/14/21	8	7.4	19.9	29	8.0			
Carr32 Ref	**12**	Surr	21	MS	09/15/21	8	7.6	19.6	29	8.2	MS	MS	
Carr32 Ref	**13**	Surr	21	NL	09/16/21	8	7.5	19.5	29	8.1			
Carr32 Ref	**14**	Surr	21	NL	09/17/21	9	7.3	19.4	29	8.2		NL	
Carr32 Ref	**15**	Surr	21	NL	09/18/21	9	7.2	19.8	29	8.1	NL		
Carr32 Ref	**16**	Surr	21	IP	09/19/21	9	7.4	19.6	29	8.1		IP	
Carr32 Ref	**17**	Surr	21	IP	09/20/21	8	7.4	20.0	29	8.0			
Carr32 Ref	**18**	Surr	21	DM	09/21/21	8	7.5	19.9	29	8.1	DM	DM	
Carr32 Ref	**19**	Surr	21	MS	09/22/21	9	7.5	19.7	28	8.1			
Carr32 Ref	**20**	Surr	21	MS	09/23/21	8	7.6	20.0	29	8.1			
IT682	**0**	Surr	7	MS	09/03/21	8	7.9	18.8	27	7.8		MK	
IT682	**1**	Surr	7	NL	09/04/21	9	7.1	20.0	28	7.8			
IT682	**2**	Surr	7	IP	09/05/21	9	7.4	20.2	27	7.9		IP	
IT682	**3**	Surr	7	DM	09/06/21	9	7.2	20.3	28	7.9	DM		
IT682	**4**	Surr	7	DM	09/07/21	8	7.5	20.2	27	7.9		SH	
IT682	**5**	Surr	7	NL	09/08/21	8	7.3	20.5	27	7.9			
IT682	**6**	Surr	7	IP	09/09/21	9	7.2	20.1	28	8.0	NL	IP	
IT682	**7**	Surr	7	MS	09/10/21	8	7.4	20.2	28	7.9			
IT682	**8**	Surr	7	NL	09/11/21	8	7.4	20.5	28	8.0		NL	
IT682	**9**	Surr	7	IP	09/12/21	8	7.2	20.2	28	7.8	IP		
IT682	**10**	Surr	7	MS	09/13/21	8	7.5	20.0	28	7.9		MS	
IT682	**11**	Surr	7	IP	09/14/21	8	7.3	19.9	28	7.8			
IT682	**12**	Surr	7	MS	09/15/21	8	7.4	20.2	28	7.9	MS	MS	
IT682	**13**	Surr	7	NL	09/16/21	8	7.4	19.9	29	7.8			
IT682	**14**	Surr	7	NL	09/17/21	9	7.3	19.8	29	7.9		NL	
IT682	**15**	Surr	7	NL	09/18/21	9	7.0	19.9	29	7.8	NL		

20 Day SP Test WQ Data Sheet

CLIENT	PROJECT	SPECIES	LOCATION	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	*Neanthes arenaceodentata*	Port Gamble / Bath 6	PSEP 1995 , SCUM 2019
PROJECT MANAGER	**TEST TYPE/DURATION**	**PROJECT NUMBER**	**TEST START DATE**	**TEST END DATE**
M. Knowlen	20-Day Solid Phase	PG1541	September 3, 2021	September 23, 2021

WATER QUALITY DATA

SAMPLE ID	DAY	REP	JAR #	TECHNICIAN	Date	Meter	DO (mg/L) > 4.6	TEMP (°C) 19 - 21	SALINITY (ppt) 26 - 30	pH 7 - 9	Water Renewal	Feed 40 mg Tetramin/Rep	Notes
IT682	**16**	Surr	7	IP	09/19/21	9	6.9	19.7	28	7.8		IP	
IT682	**17**	Surr	7	IP	09/20/21	8	7.4	20.0	29	7.8			
IT682	**18**	Surr	7	DM	09/21/21	8	7.4	20.0	29	7.9	DM	DM	
IT682	**19**	Surr	7	MS	09/22/21	9	7.4	19.7	28	7.8			
IT682	**20**	Surr	7	MS	09/23/21	8	7.6	20.0	29	7.9			
SS682	**0**	Surr	3	MS	09/03/21	8	7.9	18.8	27	7.8		MK	
SS682	**1**	Surr	3	NL	09/04/21	9	6.9	20.2	28	7.8			
SS682	**2**	Surr	3	IP	09/05/21	9	7.2	20.0	28	7.8		IP	
SS682	**3**	Surr	3	DM	09/06/21	9	7.2	20.2	28	8.0	DM		
SS682	**4**	Surr	3	DM	09/07/21	8	7.1	20.3	28	7.9		SH	
SS682	**5**	Surr	3	NL	09/08/21	8	7.0	20.4	28	7.8			
SS682	**6**	Surr	3	IP	09/09/21	9	7.0	20.0	28	7.9	NL	IP	
SS682	**7**	Surr	3	MS	09/10/21	8	7.3	20.0	28	7.9			
SS682	**8**	Surr	3	NL	09/11/21	8	7.5	20.2	28	8.0		NL	
SS682	**9**	Surr	3	IP	09/12/21	8	7.3	20.1	28	7.9	IP		
SS682	**10**	Surr	3	MS	09/13/21	8	7.4	19.6	29	7.9		MS	
SS682	**11**	Surr	3	IP	09/14/21	8	7.4	19.8	29	8.0			
SS682	**12**	Surr	3	MS	09/15/21	8	7.5	20.1	29	8.1	MS	MS	
SS682	**13**	Surr	3	NL	09/16/21	8	7.5	19.7	29	8.0			
SS682	**14**	Surr	3	NL	09/17/21	9	7.3	19.6	29	8.1		NL	
SS682	**15**	Surr	3	NL	09/18/21	9	7.2	19.8	29	8.0	NL		
SS682	**16**	Surr	3	IP	09/19/21	9	7.4	19.5	29	8.1		IP	
SS682	**17**	Surr	3	IP	09/20/21	8	7.5	19.9	29	8.0			
SS682	**18**	Surr	3	DM	09/21/21	8	7.5	19.9	29	7.5	DM	DM	
SS682	**19**	Surr	3	MS	09/22/21	9	7.5	19.5	28	8.0			
SS682	**20**	Surr	3	MS	09/23/21	8	7.6	19.9	29	8.0			

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20 Day SP Test Obs Sheet

CLIENT	PROJECT	PROJECT NO.	PROJECT MANAGER	LOCATION	PROTOCOL	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	M. Knowlen	Port Gamble / Bath 6	PSEP 1995 , SCUM 2019	*Neanthes arenaceodentata*

Observation Key
#FOS = Num Floating on Water Surface
#E = Num Emerged from Sediment
#M = Number of Mortalities
L =Anoxic Surface
G = Growth
D = No Air Flow
N = Normal
TC = Too Cloudy to Observe
U = Excess Food

ENDPOINT DATA & OBSERVATIONS

CLIENT ID	REP	Jar #	Initial #	Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Comments
				Technician	NL	IP	DM	DM	NL	IP	MS	NL	IP	MS	IP	MS	NL	NL	NL	IP	IP	DM	MS	MS	
				Date	09/04/21	09/05/21	09/06/21	09/07/21	09/08/21	09/09/21	09/10/21	09/11/21	09/12/21	09/13/21	09/14/21	09/15/21	09/16/21	09/17/21	09/18/21	09/19/21	09/20/21	09/21/21	09/22/21	09/23/21	
Control	1	22	5		U	U	U	L	U,L	L	N	N	N	U,L,1E	L,U	L	G	G	G,1E	G,1E	G,U,1E	G	G	G	
Control	2	2	5		U	N	N	N	N	N	U	N	U	U	U	N	1E	N	G	G	G	N	N	N	
Control	3	8	5		U	N	U	N	U	N	U	N	N	U	U	1E	U	N	N	N	U	N	N	N	
Control	4	10	5		U	U	U	N	U	U	U	N	U	U	U	1E	N	1E	N	N	U	G	N	N	
Control	5	11	5		U	U	U	N	U	N	U	U	U	U	U	N	U	N	N	N	U	G	N	N	
Carr32 Ref	1	17	5		U	U	U	N	U	G,U	U	G	U,G	U	U,G	G	U,G	G	G	G	G	G	N	N	
Carr32 Ref	2	24	5		U	U	U	U	U	G,U	U	N	U,G	U,G	G,U	G	G	G	G	G	G,U	G	G	G	
Carr32 Ref	3	18	5		U	U	U	U	U	G,U	U,G	G	U,G	U	U,G	G	U,G	G	G	G	G,U	G	N	N	
Carr32 Ref	4	19	5		U	N	U	N	U	G,U	U	G	G,U	U	U,G	N	N	G	G	G	G	G	G	G	
Carr32 Ref	5	13	5		U	U	U	U,G	U,G,L	U,G	U	G	G,U,L	G,L	G,U,L	G	G	G	G	G	G,U	G	G	N	
IT682	1	23	5		U	U	U	U	U	U	U	N	U	N	G,U	G	G	G	G	G	G,U	G	G	G	
IT682	2	15	5		U	U	U	U	U	U,1E	U	N	U	U	U,G	G	U,G	G	G	G	G,U	G	G	G	
IT682	3	1	5		U	U	N	N	U	G,U	U,L	L	L,U	L,1E	1E,U,L	G	G	G	G	N	N	G	N	N	
IT682	4	16	5		U	U	U	N	U	L	U,L	L	G,U,L	N	U,G	TC	N	G	G	G	G	G	N	N	
IT682	5	20	5		U	U	U	U	U	U	U	G,L	L,U,G	G,L	L,U,G	TC	G	G	G	G	G,U,L	G, 1E	G	G	
SS682	1	14	5		U	U	U	U	U	U,G	U	G	U,G	U,G	G,U	U,G	U,G	G,L	G,L	G	G,U	G	G	G	
SS682	2	4	5		U	U	U	U	U	U	U	U	U,G	U,G	G,U	U,G	U	G	G	G	G	G	N	G	
SS682	3	6	5		U	N	U,L	U,L	U,L,G	G,U,L	U,G,L	G,L	L,U,G	U,G,L	G,U	U,G,L	G,L	G,L	G,L,1E	G,L	G,U,L	G	G	G	
SS682	4	12	5		U	U	U,L	U,L	U,G,L	G,U,L	U	U	U	U	G,U	U,G,L	U,G,L	G,L	G,L	G,L	G,U,L,1E	G	G	G	
SS682	5	9	5		U	U	U	U	U,G,L	G,U,L	U	N	U,L,G	U,G	G,U	U,G,L,1E	G,L	G,L	G,L	G,L	G,U,L	G	G	G	

20 Day SP Test Survival Summary

CLIENT				PROJECT			PROJECT NUMBER
Anchor/Windward				Lower Duwamish / AOC4			PG1541
PROJECT MANAGER				**SPECIES**			
M. Knowlen				*Neanthes arenaceodentata*			
				Date Recovered/ Initials: 9/23/21 MK DM			
Sample ID	**Rep**	**Jar #**	**Boat #**	**# Initiated**	**# Alive**	**# Dead**	**Comments**
Control	1	22	1	5	5	0	
Control	2	2	2	5	5	0	
Control	3	8	3	5	5	0	
Control	4	10	4	5	5	0	
Control	5	11	5	5	6	0	
Carr32 Ref	1	17	6	5	5	0	
Carr32 Ref	2	24	7	5	5	0	
Carr32 Ref	3	18	8	5	5	0	
Carr32 Ref	4	19	9	5	5	0	
Carr32 Ref	5	13	10	5	5	0	
IT682	1	23	11	5	5	0	
IT682	2	15	12	5	5	0	
IT682	3	1	13	5	5	0	
IT682	4	16	14	5	5	0	One small worm
IT682	5	20	15	5	5	0	
SS682	1	14	16	5	5	0	
SS682	2	4	17	5	5	0	
SS682	3	6	18	5	5	0	
SS682	4	12	19	5	5	0	One small worm
SS682	5	9	20	5	5	0	

20 Day SP Test Weights Summary

CLIENT	PROJECT
Anchor/Windward	Lower Duwamish / AOC4

PROJECT NUMBER	PROJECT MANAGER	SPECIES
PG1541	M. Knowlen	*Neanthes arenaceodentata*

	Oven Event 1	Oven Event 2	Muffle Furnace
Oven ID:	Persephone	Beelzebub	Persephone
Date/Time/Initials In Oven:	9/22/21 0903 MS	9/23/21 1120 DM	9/27/21 0936 MS
Oven Temp °C:	550	60	550.00
Date/Time/Initials Out Oven into Dessicator:	9/22/21 1308 MS	9/24/21 1210 MS	9/27/21 1453 DM
Date/Time/Initials Weighed:	9/22/21 1605 MS	9/27/21 0921 MS	9/27/21 1533 MS
Balance ID:	#3	#3	#3

Sample ID	Rep	Boat #	Tare Wt. (mg)	Total Dry Wt. (mg)	Total Ashed Wt. (mg)	Comments
Control	1	1	322.4	455.97	347.3	
Control	2	2	337.68	422.64	363.41	
Control	3	3	378.56	464.08	398.58	
Control	4	4	396.84	505.47	433.26	
Control	5	5	287.78	372.82	316.65	
Carr32 Ref	1	6	362.49	432.82	382.48	
Carr32 Ref	2	7	333.09	398.76	351.49	
Carr32 Ref	3	8	327.09	460.16	352.39	
Carr32 Ref	4	9	380.29	498.21	413.15	
Carr32 Ref	5	10	331.96	491.64	348.76	
IT682	1	11	384.67	449.21	401.22	
IT682	2	12	392.07	492.03	411.66	
IT682	3	13	326.96	430.95	347.49	
IT682	4	14	353.21	420.48	362.89	
IT682	5	15	331.52	414.41	346.27	
SS682	1	16	349.1	434.44	366.26	
SS682	2	17	373.75	478.3	383.82	
SS682	3	18	410.6	476.58	418.92	
SS682	4	19	352.08	425.5	364.03	
SS682	5	20	343.41	427.14	355.41	

EcoAnalysts, Inc.

20 Day SP Test Survival Summary

CLIENT	PROJECT	PROJECT NUMBER	PROJECT MANAGER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	M. Knowlen	*Neanthes arenaceodentata*

				Survival Statistics			Mortality Statistics			Calculated Dry Weights					Calculated Ash Free Dry Weights				
Sample ID	Rep	# Initiated	# Alive	% Survival	Mean Survival (%)	SD	% Mortality	Mean Mortality (%)	SD	Dry Weight per Replicate - Biomass (mg)	Dry Weight per Individual - Growth (mg)	Individual Growth Rate (mg/ind/d)	Mean Individual Growth Rate (mg/ind/d)	SD	AFDW per Replicate - Biomass (mg)	AFDW per Individual - Growth (mg)	Individual Growth Rate (mg/ind/d)	Mean Individual Growth Rate (mg/ind/d)	SD
Control	1	5	5	100			0			133.57	26.714	1.299			108.67	21.734	1.066		
Control	2	5	5	100			0			84.96	16.992	0.813			59.23	11.846	0.571		
Control	3	5	5	100			0			85.52	17.104	0.819			65.50	13.1	0.634		
Control	4	5	5	100			0			108.63	21.726	1.050			72.21	14.442	0.701		
Control	5	6	6	100	100.0	0.0	0	0.0	0.0	85.04	14.173	0.672	0.930	0.247	56.17	9.361666667	0.447	0.684	0.233
Carr32 Ref	1	5	5	100			0			70.33	14.066	0.667			50.34	10.068	0.482		
Carr32 Ref	2	5	5	100			0			65.67	13.134	0.620			47.27	9.454	0.452		
Carr32 Ref	3	5	5	100			0			133.07	26.614	1.294			107.77	21.554	1.057		
Carr32 Ref	4	5	5	100			0			117.92	23.584	1.143			85.06	17.012	0.830		
Carr32 Ref	5	5	5	100	100.0	0.0	0	0.0	0.0	159.68	31.936	1.560	1.057	0.406	142.88	28.576	1.408	0.846	0.402
IT682	1	5	5	100			0			64.54	12.908	0.609			47.99	9.598	0.459		
IT682	2	5	5	100			0			99.96	19.992	0.963			80.37	16.074	0.783		
IT682	3	5	5	100			0			103.99	20.798	1.003			83.46	16.692	0.814		
IT682	4	5	5	100			0			67.27	13.454	0.636			57.59	11.518	0.555		
IT682	5	5	5	100	100.0	0.0	0	0.0	0.0	82.89	16.578	0.792	0.801	0.181	68.14	13.628	0.660	0.654	0.150
SS682	1	5	5	100			0			85.34	17.068	0.817			68.18	13.636	0.661		
SS682	2	5	5	100			0			104.55	20.910	1.009			94.48	18.896	0.924		
SS682	3	5	5	100			0			65.98	13.196	0.623			57.66	11.532	0.556		
SS682	4	5	5	100			0			73.42	14.684	0.698			61.47	12.294	0.594		
SS682	5	5	5	100	100.0	0.0	0	0.0	0.0	83.73	16.746	0.801	0.789	0.146	71.73	14.346	0.696	0.686	0.144

20 Day SP Test Day 0 Overlying Ammonia

CLIENT	PROJECT				SPECIES
Anchor/Windward	Lower Duwamish / AOC4				*Neanthes arenaceodentata*
Calibration Standards Temperature: 20.3	Date: 9/3/2021	Tech: NL			

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Test salinity (ppt)*	*Test pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Sourced	Sourced	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	0	Overlying	0	19.7	T17/10	ND	10	1	ND	28	7.9	18.8	291.95	9.26	0.000	6.62	ND	
Carr32 Ref	0	Overlying	0.0159	20.0	T17/10	ND	10	1	ND	28	7.9	18.6	291.75	9.26	0.000	6.62	ND	
IT682	0	Overlying	0.125	19.7	T17/10	ND	10	1	ND	27	7.8	18.8	291.95	9.26	0.003	6.62	ND	
SS682	0	Overlying	0.412	19.7	T17/10	ND	10	1	ND	27	7.8	18.8	291.95	9.26	0.009	6.62	ND	

20 Day SP Test Day 0 Porewater Ammonia

CLIENT	PROJECT	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	*Neanthes arenaceodentata*
Calibration Standards Temperature: 20.3	Date: 9/3/2021 Tech: NL	

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Porewater salinity (ppt)*	*Porewater pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa**	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Record	Record	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	0	Porewater	0	21.3	T17/M8	ND	10	1.0	ND	29	7.4	18.8	291.95	9.26	0.000	6.61	ND	
Carr32 Ref	0	Porewater	1.87	21.2	T17/M8	0	10	1.0	0	28	7.5	18.6	291.75	9.26	0.020	6.62	0.000	
IT682	0	Porewater	2.07	20.7	T17/M8	171	10	1.0	171	26	7.2	18.8	291.95	9.26	0.012	6.62	46.360	
SS682	0	Porewater	4.4	21.0	T17/M8	ND	10	1.0	ND	26	7.1	18.8	291.95	9.26	0.020	6.62	ND	

20 Day SP Test Day 20 Overlying Ammonia

CLIENT	PROJECT	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	*Neanthes arenaceodentata*
Calibration Standards Temperature: 20.3	Date: 9/23/2021 Tech: MS	

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Test salinity (ppt)*	*Test pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa**	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Sourced	Sourced	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Control	20	Overlying	2.94	20.1	T17	2	10	1	2	29	8.0	19.9	293.05	9.26	0.109	6.60	0.106	
Carr32 Ref	20	Overlying	0	20.0	T17	ND	10	1	ND	29	8.1	20.0	293.15	9.26	0.000	6.59	ND	
IT682	20	Overlying	0.131	20.0	T17	0	10	1	0	29	7.9	20.0	293.15	9.26	0.004	6.59	0.000	
SS682	20	Overlying	0	20.0	T17	ND	10	1	ND	29	8.0	19.9	293.05	9.26	0.000	6.60	ND	

20 Day SP Test Day 20 Porewater Ammonia

CLIENT	PROJECT				SPECIES
Anchor/Windward	Lower Duwamish / AOC4				*Neanthes arenaceodentata*
Calibration Standards Temperature: 20.3	**Date:** 9/23/2021	**Tech:** MS			

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Porewater salinity (ppt)*	*Porewater pH*	*Test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa**	*Undissociated Sulfide (µg/L as H_2S)*	
Sourced	**Sourced**		**Record**	**Record**	**Record**	**Record**	**Record**	**Record**	**Calculated**	**Record**	**Record**	**Sourced**	**Calculated**	**Calculated**	**Calculated**	**Calculated**	**Calculated**	**Notes**
Control	20	Porewater	3.49	20.7	8/T17	ND	10	1	ND	29	7.2	19.9	293.05	9.26	0.021	6.60	ND	
Carr32 Ref	20	Porewater	0.495	21.0	8/T17	ND	10	1	ND	29	7.2	20.0	293.15	9.26	0.003	6.59	ND	
IT682	20	Porewater	1.73	20.9	8/T17	19	10	1	19	29	6.9	20.0	293.15	9.26	0.005	6.59	7.814	
SS682	20	Porewater	1.54	20.9	8/T17	30	10	1	30	29	6.9	19.9	293.05	9.26	0.005	6.60	12.364	

2.2 *Neanthes arenaceodentata* Statistical Results

Project Name: Lower Duwamish / AOC4: Neanthes Growth

Sample:	x1
Samp ID:	IT682
Alias:	
Replicates:	5
Mean:	0.654
SD:	0.15
Tr Mean:	0.217
Trans SD:	0.04

Ref Samp:	x2
Ref ID:	CARR32-REF
Alias:	
Replicates:	5
Mean:	0.846
SD:	0.403
Tr Mean:	0.258
Trans SD:	0.094

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	0.047
SS:	0.042
K:	5
b:	0.201
Alpha Level:	0.05
Calculated Value:	0.9682
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	0.031
Test Residual SD:	0.019
Ref. Residual Mean:	0.073
Ref. Residual SD:	0.046
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	1.899
Critical Value:	>= 1.860
Variances Homogeneous:	No

Test Results:

Statistic:	Approximate t
Balanced Design:	Yes
Transformation:	Log10 (x + 1.0)

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	5
Experimental Alpha Level:	0.05
Calculated Value:	0.8974
Critical Value:	>= 2.015
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.459	0.164	0.482	0.171	0.053	0.087			-0.096
2	0.783	0.251	0.452	0.162	0.034	0.096			-0.087
3	0.814	0.259	1.057	0.313	0.042	0.055			-0.053
4	0.555	0.192	0.83	0.262	0.025	0.004			-0.025
5	0.66	0.22	1.408	0.382	0.003	0.124			0.003
6									0.004
7									0.034
8									0.042
9									0.055
10									0.124

Project Name: Lower Duwamish / AOC4: Neanthes Growth

Sample:	x1
Samp ID:	SS682
Alias:	
Replicates:	5
Mean:	0.686
SD:	0.144
Tr Mean:	0.226
Trans SD:	0.036

Ref Samp:	x2
Ref ID:	CARR32-REF
Alias:	
Replicates:	5
Mean:	0.846
SD:	0.403
Tr Mean:	0.258
Trans SD:	0.094

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	0.046
SS:	0.04
K:	5
b:	0.197
Alpha Level:	0.05
Calculated Value:	0.9606
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	0.025
Test Residual SD:	0.023
Ref. Residual Mean:	0.073
Ref. Residual SD:	0.046
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	2.1272
Critical Value:	>= 1.860
Variances Homogeneous:	No

Test Results:

Statistic:	Approximate t
Balanced Design:	Yes
Transformation:	Log10 (x + 1.0)

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	5
Experimental Alpha Level:	0.05
Calculated Value:	0.7201
Critical Value:	>= 2.015
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.661	0.22	0.482	0.171	0.005	0.087			-0.096
2	0.924	0.284	0.452	0.162	0.059	0.096			-0.087
3	0.556	0.192	1.057	0.313	0.034	0.055			-0.034
4	0.594	0.202	0.83	0.262	0.023	0.004			-0.023
5	0.696	0.229	1.408	0.382	0.004	0.124			-0.005
6									0.004
7									0.004
8									0.055
9									0.059
10									0.124

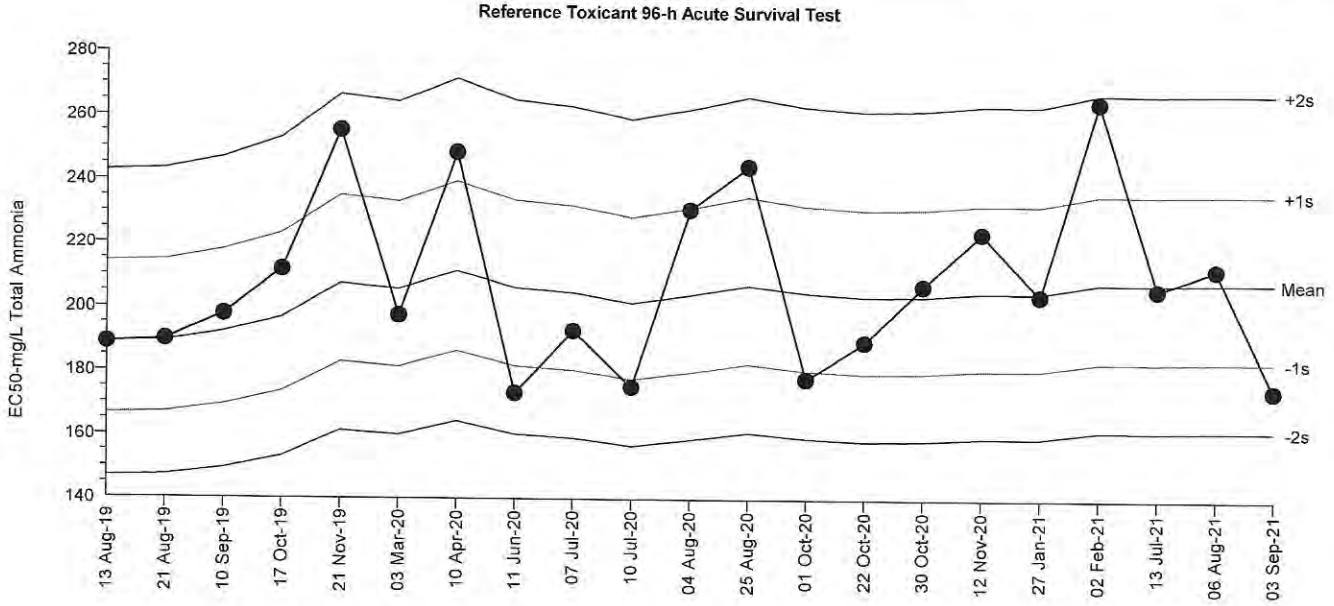
2.3 *Neanthes arenaceodentata* Reference Toxicant Test Results

CETIS QC Plot

Report Date: 17 Sep-21 12:17 (1 of 1)

Reference Toxicant 96-h Acute Survival Test — **All Matching Labs**

Test Type: Survival **Organism:** Neanthes arenaceodentata (Polycha **Material:** Total Ammonia
Protocol: PSEP (1995) **Endpoint:** Proportion Survived **Source:** Reference Toxicant-REF



Mean:	207.9	**Count:**	20	**-1s Warning Limit:**	183.4	**-2s Action Limit:**	161.7
Sigma:	n/a	**CV:**	12.60%	**+1s Warning Limit:**	235.8	**+2s Action Limit:**	267.3

Quality Control Data

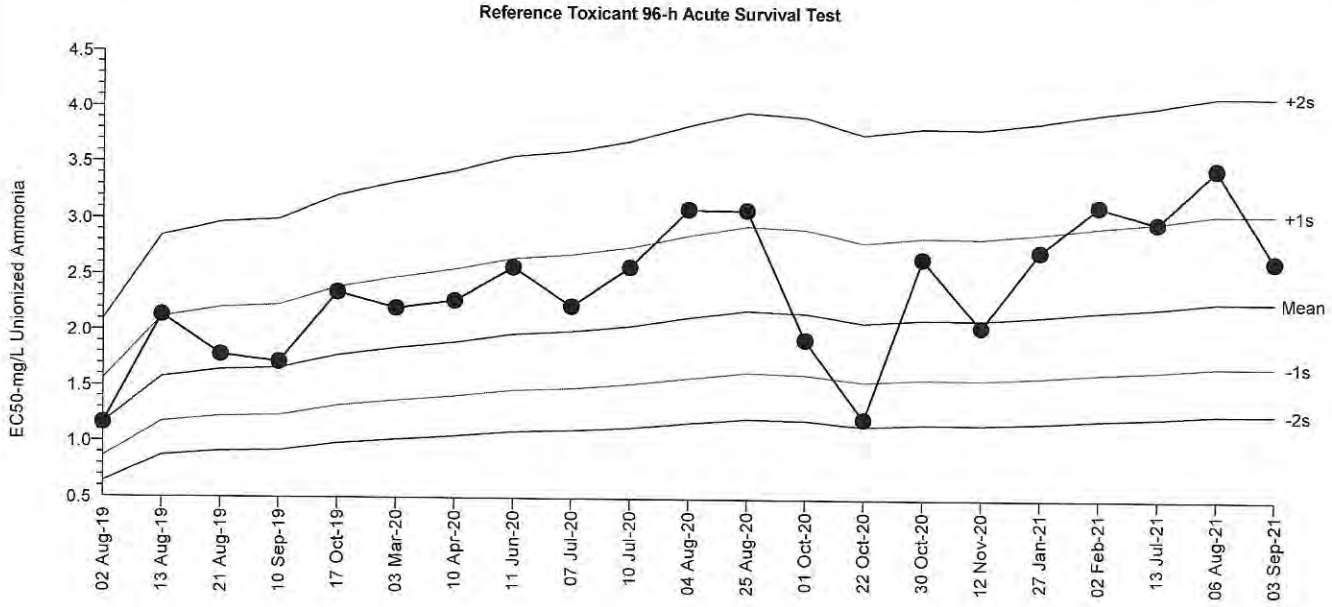
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Aug	13	15:55	188.8	-19.09	-0.767			08-6399-0477	04-6509-2576	EcoAnalysts
2			21	13:30	189.7	-18.15	-0.7272			21-2736-4211	02-0545-5733	EcoAnalysts
3		Sep	10	14:45	197.8	-10.1	-0.3965			15-3198-9821	13-4571-7808	EcoAnalysts
4		Oct	17	15:45	211.7	3.771	0.1431			00-3306-4323	18-7634-5789	EcoAnalysts
5		Nov	21	13:15	255.4	47.47	1.637	(+)		08-1679-8006	07-2089-5036	EcoAnalysts
6	2020	Mar	3	12:15	197.4	-10.44	-0.4102			02-7065-4747	20-0669-2254	EcoAnalysts
7		Apr	10	13:50	248.5	40.62	1.421	(+)		09-2249-5175	02-1750-8038	EcoAnalysts
8		Jun	11	14:20	173.3	-34.63	-1.451	(-)		10-7038-3789	15-7766-7010	EcoAnalysts
9		Jul	7	14:00	192.8	-15.09	-0.6001			04-7853-7168	03-6064-3133	EcoAnalysts
10			10	13:45	175.2	-32.68	-1.361	(-)		10-0532-1506	02-3392-3332	EcoAnalysts
11		Aug	4	14:00	230.8	22.91	0.8323			07-0264-3028	04-2417-7144	EcoAnalysts
12			25	15:25	244.5	36.57	1.29	(+)		01-2445-0323	09-2790-4163	EcoAnalysts
13		Oct	1	15:24	177.8	-30.05	-1.243	(-)		06-8958-2434	09-3027-2985	EcoAnalysts
14			22	12:45	189.4	-18.48	-0.7411			18-2772-3076	15-3659-2902	EcoAnalysts
15			30	14:30	206.9	-0.971	-0.03727			15-8988-3985	05-6115-8684	EcoAnalysts
16		Nov	12	13:15	223.5	15.65	0.5779			12-5983-6597	04-1875-7385	EcoAnalysts
17	2021	Jan	27	15:00	204	-3.913	-0.1513			07-1796-2534	20-2560-6364	EcoAnalysts
18		Feb	2	15:30	264.5	56.63	1.918	(+)		12-6803-5751	16-7187-7247	EcoAnalysts
19		Jul	13	12:50	206	-1.888	-0.07264			09-4145-4780	15-2595-5928	EcoAnalysts
20		Aug	6	14:30	212.3	4.413	0.1672			11-8491-1883	13-1741-3410	EcoAnalysts
21		Sep	3	14:56	174.6	-33.3	-1.39	(-)		12-1099-5516	08-9597-1962	EcoAnalysts

CETIS QC Plot

Report Date: 17 Sep-21 12:18 (1 of 1)

Reference Toxicant 96-h Acute Survival Test — **All Matching Labs**

Test Type: Survival
Protocol: PSEP (1995)
Organism: Neanthes arenaceodentata (Polycha
Endpoint: Proportion Survived
Material: Unionized Ammonia
Source: Reference Toxicant-REF



Mean:	2.279	**Count:**	20	**-1s Warning Limit:**	1.696	**-2s Action Limit:**	1.263
Sigma:	n/a	**CV:**	30.20%	**+1s Warning Limit:**	3.062	**+2s Action Limit:**	4.114

Quality Control Data

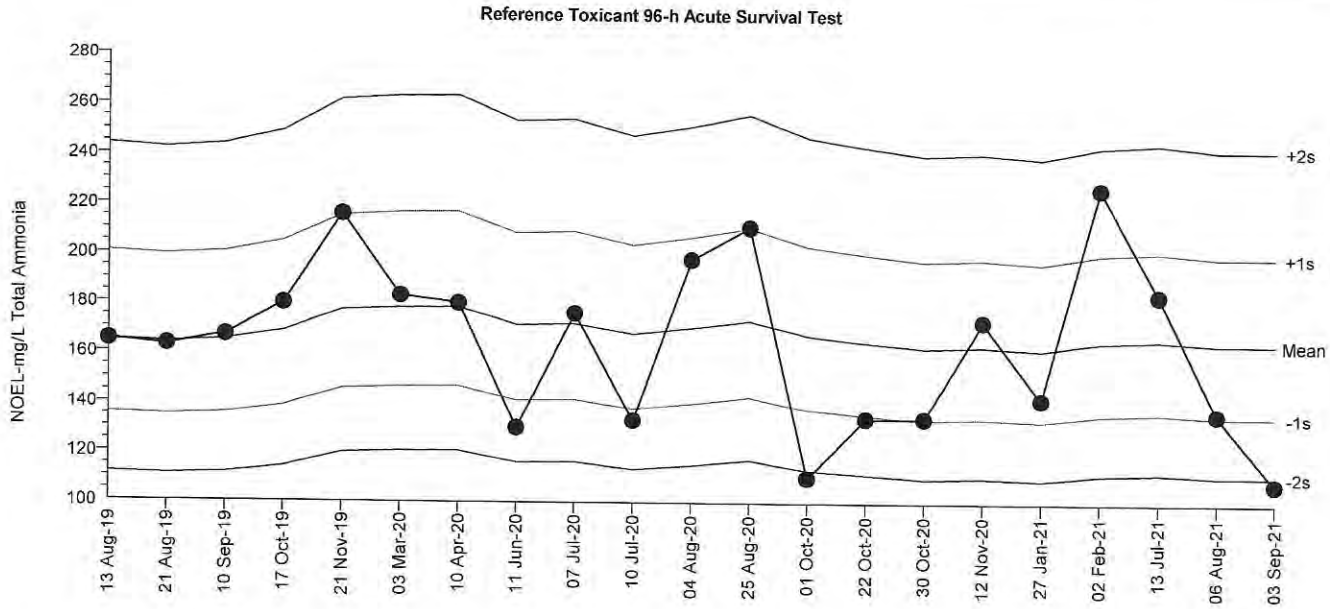
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Aug	2	15:20	1.163	-1.116	-2.279	(-)	(-)	10-1976-9391	00-8421-1808	EcoAnalysts
2			13	15:55	2.137	-0.1424	-0.2184			00-5853-2505	10-3089-9902	EcoAnalysts
3			21	13:30	1.779	-0.5005	-0.8396			14-7963-5363	12-5100-5995	EcoAnalysts
4		Sep	10	14:45	1.715	-0.5646	-0.9638			08-0609-5167	04-3709-1344	EcoAnalysts
5		Oct	17	15:45	2.345	0.06555	0.09601			10-0475-9886	14-9451-4606	EcoAnalysts
6	2020	Mar	3	12:15	2.203	-0.0762	-0.1151			19-4100-6388	19-4072-0594	EcoAnalysts
7		Apr	10	13:50	2.272	-0.007068	-0.01052			08-8618-3055	09-6455-0943	EcoAnalysts
8		Jun	11	14:20	2.573	0.294	0.4108			19-5183-7417	12-7291-4257	EcoAnalysts
9		Jul	7	14:00	2.229	-0.05007	-0.07521			04-3243-8508	19-7306-7310	EcoAnalysts
10			10	13:45	2.578	0.2983	0.4164			17-0317-7911	12-0227-7891	EcoAnalysts
11		Aug	4	14:00	3.098	0.8188	1.039	(+)		17-2104-8850	15-6640-3919	EcoAnalysts
12			25	15:25	3.091	0.8115	1.031	(+)		19-8320-1596	05-6772-0397	EcoAnalysts
13		Oct	1	15:24	1.934	-0.3457	-0.557			10-7496-8147	02-8737-4922	EcoAnalysts
14			22	12:45	1.218	-1.062	-2.123	(-)	(-)	05-5100-7142	10-2404-8829	EcoAnalysts
15			30	14:30	2.658	0.3791	0.521			01-3731-2040	11-2351-8876	EcoAnalysts
16		Nov	12	13:15	2.049	-0.2303	-0.3607			12-9901-3703	05-8140-5916	EcoAnalysts
17	2021	Jan	27	15:00	2.728	0.4485	0.6083			12-9966-3998	00-2755-1557	EcoAnalysts
18		Feb	2	15:30	3.136	0.8566	1.08	(+)		12-0475-2746	18-0917-0562	EcoAnalysts
19		Jul	13	12:50	2.985	0.7056	0.9133			07-4298-1789	21-1474-3341	EcoAnalysts
20		Aug	6	14:30	3.47	1.19	1.423	(+)		17-3928-7243	16-3530-0376	EcoAnalysts
21		Sep	3	14:56	2.643	0.364	0.5017			00-9699-3848	20-5821-4212	EcoAnalysts

CETIS QC Plot

Report Date: 17 Sep-21 12:18 (1 of 1)

Reference Toxicant 96-h Acute Survival Test — **All Matching Labs**

Test Type: Survival **Organism:** Neanthes arenaceodentata (Polycha **Material:** Total Ammonia
Protocol: PSEP (1995) **Endpoint:** Proportion Survived **Source:** Reference Toxicant-REF



Mean:	164.2	**Count:**	20	**-1s Warning Limit:**	135	**-2s Action Limit:**	111
Sigma:	n/a	**CV:**	19.70%	**+1s Warning Limit:**	199.6	**+2s Action Limit:**	242.7

Quality Control Data

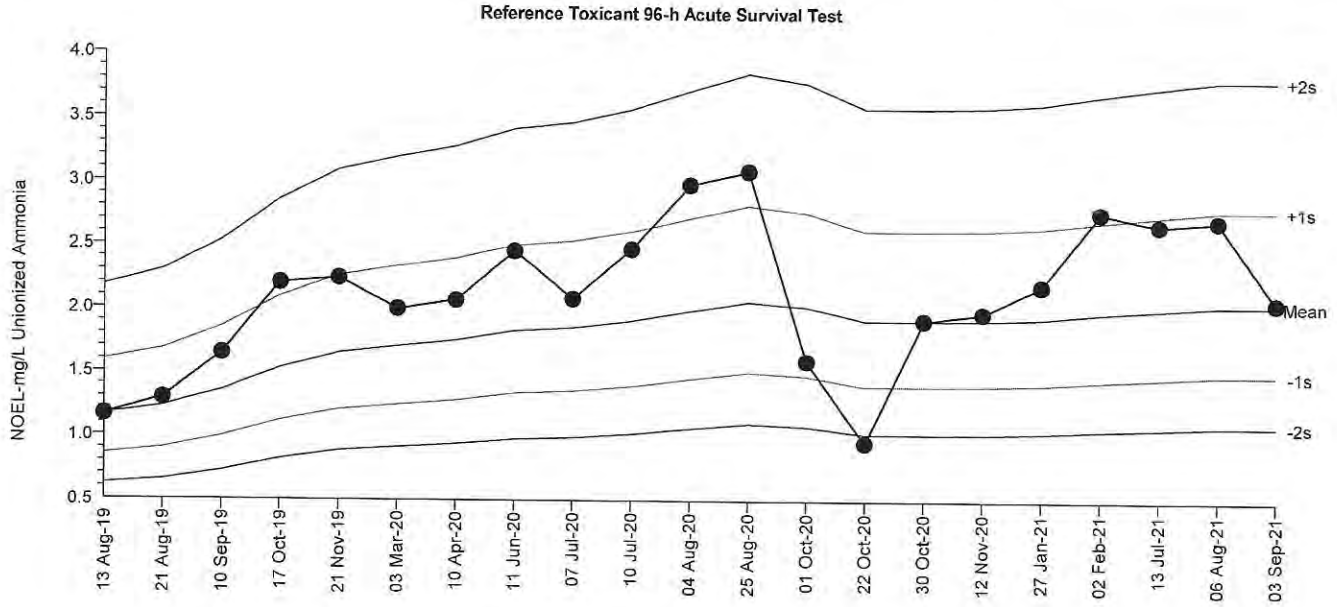
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Aug	13	15:55	165	0.814	0.0253			08-6399-0477	02-9565-0844	EcoAnalysts
2			21	13:30	163	-1.186	-0.03708			21-2736-4211	17-5434-7893	EcoAnalysts
3		Sep	10	14:45	167	2.814	0.08692			15-3198-9821	19-4980-7373	EcoAnalysts
4		Oct	17	15:45	180	15.81	0.4704			00-3306-4323	14-6485-5861	EcoAnalysts
5		Nov	21	13:15	216	51.81	1.403	(+)		08-1679-8006	16-1846-4388	EcoAnalysts
6	2020	Mar	3	12:15	183	18.81	0.5549			02-7065-4747	03-2467-0304	EcoAnalysts
7		Apr	10	13:50	180	15.81	0.4704			09-2249-5175	16-9643-7292	EcoAnalysts
8		Jun	11	14:20	130	-34.19	-1.194	(-)		10-7038-3789	00-6560-5727	EcoAnalysts
9		Jul	7	14:00	176	11.81	0.3554			04-7853-7168	10-9179-6173	EcoAnalysts
10			10	13:45	133	-31.19	-1.077	(-)		10-0532-1506	10-3843-7493	EcoAnalysts
11		Aug	4	14:00	198	33.81	0.9579			07-0264-3028	02-0234-7421	EcoAnalysts
12			25	15:25	211	46.81	1.283	(+)		01-2445-0323	11-1245-2780	EcoAnalysts
13		Oct	1	15:24	110	-54.19	-2.049	(-)	(-)	06-8958-2434	05-1165-3582	EcoAnalysts
14			22	12:45	134	-30.19	-1.039	(-)		18-2772-3076	03-0905-9354	EcoAnalysts
15			30	14:30	134	-30.19	-1.039	(-)		15-8988-3985	10-8137-0576	EcoAnalysts
16		Nov	12	13:15	173	8.814	0.2675			12-5983-6597	07-1593-8015	EcoAnalysts
17	2021	Jan	27	15:00	142	-22.19	-0.7426			07-1796-2534	02-2911-2660	EcoAnalysts
18		Feb	2	15:30	227	62.81	1.657	(+)		12-6803-5751	14-4852-5615	EcoAnalysts
19		Jul	13	12:50	184	19.81	0.5828			09-4145-4780	08-9052-1051	EcoAnalysts
20		Aug	6	14:30	136	-28.19	-0.9634			11-8491-1883	12-8065-7089	EcoAnalysts
21		Sep	3	14:56	108	-56.19	-2.143	(-)	(-)	12-1099-5516	04-9838-2957	EcoAnalysts

CETIS QC Plot

Report Date: 17 Sep-21 12:18 (1 of 1)

Reference Toxicant 96-h Acute Survival Test — **All Matching Labs**

Test Type: Survival
Protocol: PSEP (1995)
Organism: Neanthes arenaceodentata (Polycha
Endpoint: Proportion Survived
Material: Unionized Ammonia
Source: Reference Toxicant-REF



Mean: 2.032	**Count:** 20	**-1s Warning Limit:** 1.486	**-2s Action Limit:** 1.087
Sigma: n/a	**CV:** 32.10%	**+1s Warning Limit:** 2.779	**+2s Action Limit:** 3.8

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2019	Aug	13	15:55	1.165	-0.8674	-1.778	(-)		00-5853-2505	06-3471-0420	EcoAnalysts
2			21	13:30	1.292	-0.7404	-1.448	(-)		14-7963-5363	20-8907-8030	EcoAnalysts
3		Sep	10	14:45	1.648	-0.3844	-0.67			08-0609-5167	00-6589-3953	EcoAnalysts
4		Oct	17	15:45	2.2	0.1676	0.2533			10-0475-9886	00-3718-6473	EcoAnalysts
5		Nov	21	13:15	2.237	0.2046	0.3066			17-3983-7570	18-0011-8937	EcoAnalysts
6	2020	Mar	3	12:15	1.995	-0.03736	-0.0593			19-4100-6388	02-6955-3876	EcoAnalysts
7		Apr	10	13:50	2.064	0.03164	0.04936			08-8618-3055	17-3212-9760	EcoAnalysts
8		Jun	11	14:20	2.453	0.4206	0.6012			19-5183-7417	13-9382-6189	EcoAnalysts
9		Jul	7	14:00	2.078	0.04564	0.07097			04-3243-8508	08-7308-6971	EcoAnalysts
10			10	13:45	2.47	0.4376	0.6233			17-0317-7911	13-9340-7163	EcoAnalysts
11		Aug	4	14:00	2.977	0.9446	1.22	(+)		17-2104-8850	18-3454-0594	EcoAnalysts
12			25	15:25	3.082	1.05	1.331	(+)		19-8320-1596	14-9540-7760	EcoAnalysts
13		Oct	1	15:24	1.595	-0.4374	-0.7745			10-7496-8147	09-2299-9045	EcoAnalysts
14			22	12:45	0.952	-1.08	-2.424	(-)	(-)	05-5100-7142	08-2410-5818	EcoAnalysts
15			30	14:30	1.915	-0.1174	-0.1901			01-3731-2040	16-2281-9663	EcoAnalysts
16		Nov	12	13:15	1.969	-0.06336	-0.1012			12-9901-3703	01-2547-4284	EcoAnalysts
17	2021	Jan	27	15:00	2.184	0.1516	0.23			12-9966-3998	18-0563-5166	EcoAnalysts
18		Feb	2	15:30	2.764	0.7316	0.9827			12-0475-2746	00-8469-6997	EcoAnalysts
19		Jul	13	12:50	2.667	0.6346	0.8685			07-4298-1789	06-7493-7869	EcoAnalysts
20		Aug	6	14:30	2.701	0.6686	0.909			17-3928-7243	03-0077-1589	EcoAnalysts
21		Sep	3	14:56	2.053	0.02064	0.03229			00-9699-3848	03-1187-8495	EcoAnalysts

CETIS Summary Report

Report Date: 05 Oct-21 14:57 (p 1 of 1)
Test Code/ID: P190612.203 / 12-1099-5516

Reference Toxicant 96-h Acute Survival Test

EcoAnalysts

Batch ID:	03-1991-9811	**Test Type:**	Survival	**Analyst:**	
Start Date:	03 Sep-21 14:56	**Protocol:**	PSEP (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	07 Sep-21 13:55	**Species:**	Neanthes arenaceodentata	**Brine:**	Not Applicable
Test Length:	95h	**Taxon:**	Polychaeta	**Source:**	Aquatic Toxicology Support **Age:**

Sample ID:	02-2122-9611	**Code:**	P190612.203	**Project:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Total Ammonia	**Source:**	Reference Toxicant
Receipt Date:	12 Jun-19	**CAS (PC):**		**Station:**	P190612.203
Sample Age:	814d 15h	**Client:**	Internal Lab		

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
04-9838-2957	Proportion Survived	Fisher Exact Test		108	273	171.7		n/a	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
08-9597-1962	Proportion Survived	Linear Interpolation (ICPIN)		EC5	113.3	112.9	114.2		1
				EC10	118.9	118.1	120.7		
				EC15	124.8	123.5	127.6		
				EC20	130.9	129.1	134.8		
				EC25	137.3	135	142.5		
				EC40	158.6	154.4	168.2		
				EC50	174.6	168.8	187.8		

Proportion Survived Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
68.7		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
108		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
273		3	0.0333	0.0000	0.1768	0.0000	0.1000	0.0333	0.0577	173.21%	96.67%
533		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%
1050		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Proportion Survived Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	1.0000	1.0000	1.0000
68.7		1.0000	1.0000	1.0000
108		1.0000	1.0000	1.0000
273		0.0000	0.0000	0.1000
533		0.0000	0.0000	0.0000
1050		0.0000	0.0000	0.0000

Proportion Survived Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	10/10	10/10	10/10
68.7		10/10	10/10	10/10
108		10/10	10/10	10/10
273		0/10	0/10	1/10
533		0/10	0/10	0/10
1050		0/10	0/10	0/10

CETIS Test Data Worksheet

Report Date: 17 Sep-21 12:13 (p 1 of 1)
Test Code/ID: P190612.203 / 12-1099-5516

Reference Toxicant 96-h Acute Survival Test — EcoAnalysts

Start Date:	03 Sep-21 14:56	**Species:**	Neanthes arenaceodentata	**Sample Code:**	P190612.203
End Date:	07 Sep-21 13:55	**Protocol:**	PSEP (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Total Ammonia	**Sample Station:**	P190612.203

Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	Notes
0	D	1	9	10	10	
0	D	2	5	10	10	
0	D	3	15	10	10	
68.7		1	3	10	10	
68.7		2	18	10	10	
68.7		3	7	10	10	
108		1	12	10	10	
108		2	8	10	10	
108		3	17	10	10	
273		1	10	10	0	
273		2	4	10	0	
273		3	1	10	1	
533		1	16	10	0	
533		2	13	10	0	
533		3	2	10	0	
1050		1	6	10	0	
1050		2	14	10	0	
1050		3	11	10	0	

CETIS Summary Report

Report Date: 17 Sep-21 12:17 (p 1 of 1)
Test Code/ID: P190612.203.UIA / 00-9699-3848

Reference Toxicant 96-h Acute Survival Test — EcoAnalysts

Batch ID:	03-1991-9811	**Test Type:**	Survival	**Analyst:**	
Start Date:	03 Sep-21 14:56	**Protocol:**	PSEP (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	07 Sep-21 13:55	**Species:**	Neanthes arenaceodentata	**Brine:**	Not Applicable
Test Length:	95h	**Taxon:**	Polychaeta	**Source:**	Aquatic Toxicology Support **Age:**

Sample ID:	04-9465-2193	**Code:**	P190612.203.UIA	**Project:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Unionized Ammonia	**Source:**	Reference Toxicant
Receipt Date:	12 Jun-19	**CAS (PC):**		**Station:**	P190612.203
Sample Age:	814d 15h	**Client:**	Internal Lab		

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
03-1187-8495	Proportion Survived	Fisher Exact Test		2.053	3.297	2.602		n/a	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
20-5821-4212	Proportion Survived	Linear Interpolation (ICPIN)		EC5	2.107	2.104	2.116		1
				EC10	2.163	2.155	2.18		
				EC15	2.219	2.207	2.246		
				EC20	2.277	2.261	2.313		
				EC25	2.335	2.315	2.381		
				EC40	2.517	2.482	2.595		
				EC50	2.643	2.598	2.744		

Proportion Survived Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
1.648		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
2.053		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
3.297		3	0.0333	0.0000	0.1768	0.0000	0.1000	0.0333	0.0577	173.21%	96.67%
4.138		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%
5.118		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Proportion Survived Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	1.0000	1.0000	1.0000
1.648		1.0000	1.0000	1.0000
2.053		1.0000	1.0000	1.0000
3.297		0.0000	0.0000	0.1000
4.138		0.0000	0.0000	0.0000
5.118		0.0000	0.0000	0.0000

Proportion Survived Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	10/10	10/10	10/10
1.648		10/10	10/10	10/10
2.053		10/10	10/10	10/10
3.297		0/10	0/10	1/10
4.138		0/10	0/10	0/10
5.118		0/10	0/10	0/10

CETIS Test Data Worksheet

Report Date: 17 Sep-21 12:16 (p 1 of 1)
Test Code/ID: P190612.203.UIA / 00-9699-3848

Reference Toxicant 96-h Acute Survival Test — EcoAnalysts

Start Date:	03 Sep-21 14:56	**Species:**	Neanthes arenaceodentata	**Sample Code:**	P190612.203.UIA
End Date:	07 Sep-21 13:55	**Protocol:**	PSEP (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Unionized Ammonia	**Sample Station:**	P190612.203

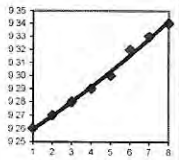
Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	Notes
0	D	1	13	10	10	
0	D	2	8	10	10	
0	D	3	10	10	10	
1.648		1	18	10	10	
1.648		2	17	10	10	
1.648		3	3	10	10	
2.053		1	6	10	10	
2.053		2	7	10	10	
2.053		3	15	10	10	
3.297		1	14	10	0	
3.297		2	4	10	0	
3.297		3	16	10	1	
4.138		1	2	10	0	
4.138		2	9	10	0	
4.138		3	5	10	0	
5.118		1	12	10	0	
5.118		2	11	10	0	
5.118		3	1	10	0	

Un-ionized Ammonia Calculator

CLIENT:	Anchor / Windward	Date of Test:	September 3, 2021
PROJECT:	Lower Duwamish	Test Type:	*N. arenaceodentata*
COMMENTS:	RT		

To convert Total Ammonia (mg/L) to Free (un-ionized) Ammonia (mg/L) enter the corresponding total ammonia, salinity, temperature, and pH.

Ionic strength	pKa^s
1	9.26
2	9.27
3	9.28
4	9.29
5	9.30
6	9.32
7	9.33
8	9.34



$y = 0.0003x^2 + 0.0091x + 9.2502$

...

	Sample	Mod	*NH3T (mg/L)*	*salinity (ppt)*	*pH*	*temp (C)*	*temp (K)*	*pKa^s*		NH_3U (mg/L)
	Target / Sample Name		Actual	Actual	Actual	Actual	Calculated	Calculated		**Calculated**
	Example 3.5		2.000	10.0	7.5	5.0	278.15	9.2520		**0.008**
1										
2										
3	50		68.7	28	7.8	20.1	293.25	9.2555		**1.648**
4	100		108	28	7.7	20.0	293.15	9.2555		**2.053**
5	200		273	28	7.5	20.0	293.15	9.2555		**3.297**
6	400		533	29	7.3	20.2	293.35	9.2557		**4.138**
7	800		1050	30	7.1	20.1	293.25	9.2559		**5.118**
8										
9										
10										
11										
12										
13										
14										
15										
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45										

Ammonia Reference Toxicant Test Survival Data Sheet

CLIENT	PROJECT	SPECIES	LABORATORY	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	*Neanthes arenaceodentata*	Port Gamble .	PSEP 1995

TEST ID	LOT #:	TEST START DATE	TIME	4-DAY END DATE	TIME
P190612.203	18H1356763	03Sep21	SH 1456	07Sep21	1355 DM

CHAMBER SIZE/TYPE	EXPOSURE VOLUME
Glass pint jar	250 mL

WATER QUALITY DATA

TEST CONDITIONS					DO (mg/L) > 4.6		TEMP(C) 20 ± 1		SAL (ppt) 28 ± 2		pH 7 - 9		TECHNICIAN	AMMONIA			SULFIDES		
CLIENT/ENVIRON ID	CONCENTRATION value	CONCENTRATION units	DAY	REP	D.O. meter	D.O. mg/L	TEMP. meter	TEMP. °C	SALINITY meter	SALINITY ppt	pH meter	pH unit	WQ TECH/ DATE	AMMONIA METER	AMMONIA mg/L	Tech	SULFIDES meter	SULFIDES mg/L	Tech
Ref.Tox.-ammonia	0	mg/L	0	Stock	8	7.8	8	20.2	8	28	8	8.0	9/3/21 SH	10	0.00				SH/FP
			4	1	9	7.8	9	19.5	9	29	9	8.3	DM 9/7/21						
Ref.Tox.-ammonia	50	mg/L	0	Stock	8	7.8	8	20.1	8	28	8	7.8	9/3/21 SH	10	68.7				SH/FP
			4	1	9	7.5	9	19.8	9	29	9	8.5	DM 9/7/21						
Ref.Tox.-ammonia	100	mg/L	0	Stock	8	7.8	8	20.0	8	28	8	7.7	9/3/21 SH	10	108				SH/FP
			4	1	9	7.4	9	19.9	9	29	9	8.6	DM 9/7/21						
Ref.Tox.-ammonia	200	mg/L	0	Stock	8	7.8	8	20.0	8	28	8	7.5	9/3/21 SH	10	273				SH/FP
			4	1	9	7.5	9	19.8	9	29	9	8.4	DM 9/7/21						
Ref.Tox.-ammonia	400	mg/L	0	Stock	8	7.7	8	20.2	8	29	8	7.3	9/3/21 SH	10	533				SH/FP
			4	1	—	—	—	—	—	—	—	—	—						
Ref.Tox.-ammonia	800	mg/L	0	Stock	8	7.7	8	20.1	8	30	8	7.1	9/3/21 SH	10	1050				SH/FP
			4	1	—	—	—	—	—	—	—	—	—						

Ammonia Reference Toxicant Test Survival Data Sheet

CLIENT	PROJECT	TEST ID	SPECIES		
			Neanthes arenaceodentata		
Anchor/Windward	Lower Duwamish / AOC4	P190612.203	PROJECT MANAGER: M. Knowlen	LABORATORY: Port Gamble .	PROTOCOL: PSEP 1995

SURVIVAL & BEHAVIOR DATA

OBSERVATION KEY
N = Normal
LOE = Loss of equilibium
Q = Quiescent
DC = Discoloration
NB = No body
F = Floating on surface

INITIAL # OF ORGANISMS: 10

				DAY 1			DAY 2			DAY 3			DAY 4		
				DATE 9/04/21			DATE 9/5/21			DATE 9/6/21			DATE 9/7/21		
				TECHNICIAN JL			TECHNICIAN IP			TECHNICIAN DM			TECHNICIAN DM		
CLIENT/ENVIRON ID	CONC. value units	REP	INITIAL NUMBER	#ALIVE	#DEAD	OBS	#ALIVE	#DEAD	OBS	#ALIVE	#DEAD	OBS	#ALIVE	#DEAD	OBS
Ref.Tox.- Ammonia	0 mg/L	1	10	10	0	N	10	Ø	N	10	0	N	10	0	N
		2	10	10	0	N	10	Ø	N	10	0	N	10	0	N
		3	10	10	0	N	10	Ø	N	10	0	N	10	0	N
Ref.Tox.- Ammonia	50 mg/L	1	10	10	0	N	10	Ø	N	10	0	N	10	0	N
		2	10	10	0	N	10	Ø	N	10	0	N	10	0	N
		3	10	10	0	N	10	Ø	N	10	0	N	10	0	N
Ref.Tox.- Ammonia	100 mg/L	1	10	10	0	Q	10	Ø	Q	10	0	10Q	10	0	10Q
		2	10	10	0	Q	10	Ø	Q	10	0	10Q	10	0	10Q
		3	10	10	0	Q	10	Ø	Q	10	0	10Q	10	0	10Q
Ref.Tox.- Ammonia	200 mg/L	1	10	10	0	Q	10	Ø	Q	3	7	3Q	0	3	—
		2	10	10	0	Q	10	Ø	Q	0	10	—	—	—	—
		3	10	10	0	Q	10	Ø	Q,DC	10 ① 3	0 ① 7	10Q ① 3Q	1	9	1Q
Ref.Tox.- Ammonia	400 mg/L	1	10	10	0	Q,DC	Ø	10	Q,DC	—	—	—	—	—	—
		2	10	10	0	Q,DC	Ø	10	Q,DC	—	—	—	—	—	—
		3	10	10	0	Q,DC	Ø	10	DC	—	—	—	—	—	—
Ref.Tox.- Ammonia	800 mg/L	1	10	10	0	Q,DC	Ø	10	DC	—	—	—	—	—	—
		2	10	10	0	Q,DC	1	9	DC,Q	0	1	—	—	—	—
		3	10	10	0	Q,DC	Ø	10	DC	—	—	—	—	—	—

① IE - DM - 9/7/21

Rndm #s
P190612.203

	1	17
Ø	2	1
	3	4
	4	18
50	5	10
	6	6
	7	8
100	8	16
	9	14
	10	11
200	11	12
	12	9
	13	7
400	14	5
	15	2
	16	15
800	17	3
	18	13

Ammonia Reference Toxicant
Spiking Worksheet

Reference Toxicant ID: P190612.203
Date Prepared: 9/3/21
Technician Initials: SH

Neanthes NH_3 RT

Assumptions in Model
Stock ammonia concentration is 10,000 mg/L = 10 mg/mL

Date: 7/20/2021
Measurement: 9323.33

Test Solutions			Volume of stock to reach desired concentration	
Measured Concentration	**Desired Concentration**	**Volume**		
mg/L	mg/L	mL	mL stock to increase	
0.00			FRESH WATER (mL)	SALT WATER (mL)
68.7	**50**	750	[redacted]	6.03
108	**100**	750		12.07
273	**200**	750		24.13
533	**400**	750		48.27
1050	**800**	750		96.53

3. *Mytilus galloprovincialis* Water-Column Test

3.1 *Mytilus galloprovincialis* Test Data

Version T.4

GENERAL

Client	Anchor/Windward
Project	Lower Duwamish / AOC4
Project Number	PG1541
Project Manager	M. Knowlen
Date Sample Collected (Oldest Sample)	7/13/2021
Sample Holding Time	51
Test Start Date	09/02/21
Test End Date	09/04/21
Test Species	*Mytilus galloprovincialis*
Organism Supplier	Taylor Shellfish
Date Organism Acquired	9/1/2021
Organism Acclimation Time (Days)	1
Organism Batch	TS090121
Test Type	Larval Development
Test Protocol	PSEP 1995
Regional Protocol	SCUM 2019
Laboratory Location	Port Gamble
Test Location	Bath 4
Sample Treatment	None
UV Light Treatment	No
Resuspension	Yes
Aeration from test initiation	No
Control Sediment Source (if applicable)	Eoh sand
Water Batch	FSW090121.01
Test Lighting	14:10 L:D
Test Chamber	26 mL shell vials
Replicates Per Treatment	5
Exposure Volume	18g sediment/900 mL seawater
Test Dissolved Oxygen	> 6
Test Temperature	16 ± 1
Test Salinity	28 ± 1
Test pH	8.25 ± 0.75

Note: input lowest and highest decimal for temp

Test Parameters		
	Min	**Max**
DO:	6	
Temp:	14.5	17.4
Sal:	27	29
pH:	7.5	9

TEST START TIME:	17:13
TEST END TIME:	15:48

	CLIENT SAMPLE ID	LAB ID
Control 1	Seawater Control	FSW090121.02
Control 2 (if used)	Sand Control	P210803.02
3	Carr32 Ref	P210728.02
4	IT682	P210830.02
5	SS682	P210830.03
6	.	.
7	.	.
8	.	.
9	.	.
10	.	.
11	.	.
12	.	.
13	.	.
14	.	.
15	.	.
16	.	.
17	.	.
18	.	.
19	.	.
20	.	.
21	.	.

EcoAnalysts, Inc.

96 Hour Larval Test

CLIENT	PROJECT	JOB NUMBER	PROJECT MANAGER	LABORATORY	PROTOCOL
Anchor/Windward	Lower Duwamish / AOC4	PG1541	M. Knowlen	Port Gamble , Bath 4	PSEP 1995 , SCUM 2019

TEST ORGANISM SPAWNING DATA

SPECIES			**TEST START DATE**
Mytilus galloprovincialis			2-Sep-21
SUPPLIER			**ORGANISM BATCH**
Taylor Shellfish			TS090121
SPAWNING METHOD		**INITIAL SPAWNING TIME**	**FINAL SPAWNING TIME**
Heat Shock		1330	1545
MALES	**FEMALES**	**SPERM VIABILITY**	**EGG CONDITION**
5	5	Good	Good
BEGIN FERTILIZATION	**END FERTILIZATION**		**CONDITION OF EMBRYOS**
1600	1713		Good

SEDIMENT TREATMENT	
None	
TEST CHAMBERS	
26 mL shell vials	
EXPOSURE VOLUME	
18g sediment/900 mL seawater	
TIME OF SHAKE	**INITIALS**
1121	NL/SH
TIME OF INITIATION	**INITIALS**
17:13	JL/MS
ROSE BENGAL LOT #	**FORMALIN LOT #**
5135	200924-20

SPECIAL CONDITIONS

UV LIGHT EXPOSURE (YES/NO)	**AERATION FROM TEST INITIATION (YES/NO)**
No	No
RESUSPENSION (YES/NO)	**OTHER (EXPLAIN)**
Yes	

EMBRYO DENSITY CALCULATIONS

No. of embryos in 1 mL of 100x diluted stock

62

mL of original embryo stock added to each test chamber

4.35

96 Hour Larval Test WQ Data Sheet

CLIENT	PROJECT	SPECIES	LOCATION		PROTOCOL		
Anchor/Windward	Lower Duwamish / AOC4	*Mytilus galloprovincialis*	Port Gamble / Bath 4		PSEP 1995 , SCUM 2019		
PROJECT MANAGER	**TEST TYPE**	**Project Number**	**TEST START DATE**	**TIME**	**TEST END DATE**	**TIME**	**INITIALS**
M. Knowlen	Larval Development	PG1541	September 2, 2021	17:13	September 4, 2021	15:48	NL

WATER QUALITY DATA

SAMPLE ID	DAY	REP	JAR #	TECHNICIAN	Date	Meter	DO (mg/L) > 6	TEMP (°C) 15 - 17	SALINITY (ppt) 27 - 29	pH 7.5 - 9	Notes
Seawater Control	0	Surr	29	MS/IP	09/02/21	8	7.7	16.9	28	7.9	
Seawater Control	1	Surr	29	MS	09/03/21	8	7.5	15.5	27	8.0	Aerated test due to low DO. MS 9/3
Seawater Control	2	Surr	29	NL	09/04/21	9	8.0	15.2	28	8.0	
Seawater Control	3	Surr	29								
Seawater Control	4	Surr	29								
Sand Control	0	Surr	16	MS/IP	09/02/21	8	7.4	17.4	28	8.0	
Sand Control	1	Surr	16	MS	09/03/21	8	7.6	15.4	27	7.9	Aerated test due to low DO. MS 9/3
Sand Control	2	Surr	16	NL	09/04/21	9	8.3	15.0	28	8.0	
Sand Control	3	Surr	16								
Sand Control	4	Surr	16								
Carr32 Ref	0	Surr	25	MS/IP	09/02/21	8	7.1	17.2	28	8.0	
Carr32 Ref	1	Surr	25	MS	09/03/21	8	6.3	15.7	27	7.9	Aerated test due to low DO. MS 9/3
Carr32 Ref	2	Surr	25	NL	09/04/21	9	7.8	15.4	28	8.0	
Carr32 Ref	3	Surr	25								
Carr32 Ref	4	Surr	25								
IT682	0	Surr	19	MS/IP	09/02/21	8	6.6	17.1	27	7.9	
IT682	1	Surr	19	MS	09/03/21	8	6.0	15.3	27	7.8	Aerated test due to low DO. MS 9/3
IT682	2	Surr	19	NL	09/04/21	9	8.3	14.8	28	8.0	
IT682	3	Surr	19								
IT682	4	Surr	19								
SS682	0	Surr	30	MS/IP	09/02/21	8	6.6	17.2	28	7.8	
SS682	1	Surr	30	MS	09/03/21	8	5.7	15.8	27	7.8	Aerated test due to low DO. MS 9/3
SS682	2	Surr	30	NL	09/04/21	9	8.3	14.8	28	8.0	
SS682	3	Surr	30								
SS682	4	Surr	30								

96 Hour Larval Test Summary

CLIENT	PROJECT	PROJECT NUMBER
Anchor/Windward	Lower Duwamish / AOC4	PG1541
PROJECT MANAGER	**TEST TYPE**	**SPECIES**
M. Knowlen	Larval Development	*Mytilus galloprovincialis*

LARVAL ENDPOINT DATA

Sample ID	Rep	# Normal	# Abnormal	Total	Date	Tech	Comments / QA Counts
Stocking Density	1			286	09/08/21	MK	
Stocking Density	2			292	09/08/21	MK	
Stocking Density	3			294	09/08/21	MK	
Stocking Density	4			297	09/08/21	MK	
Stocking Density	5			283	09/08/21	MK	
Seawater Control	1	198	57	255	09/08/21	MK	
Seawater Control	2	201	67	268	09/08/21	MK	
Seawater Control	3	219	51	270	09/08/21	MK	
Seawater Control	4	210	58	268	09/08/21	MK	
Seawater Control	5	186	65	251	09/08/21	MK	
Sand Control	1	208	31	239	09/08/21	MK	
Sand Control	2	197	39	236	09/08/21	MK	
Sand Control	3	216	44	260	09/08/21	MK	
Sand Control	4	214	44	258	09/08/21	MK	
Sand Control	5	189	41	230	09/08/21	MK	
Carr32 Ref	1	173	39	212	09/08/21	MK	
Carr32 Ref	2	170	29	199	09/08/21	MK	
Carr32 Ref	3	164	22	186	09/08/21	MK	
Carr32 Ref	4	184	26	210	09/08/21	MK	
Carr32 Ref	5	161	29	190	09/08/21	MK	
IT682	1	162	34	196	09/10/21	MK	
IT682	2	169	27	196	09/10/21	MK	
IT682	3	162	37	199	09/10/21	MK	
IT682	4	175	40	215	09/10/21	MK	
IT682	5	180	44	224	09/10/21	MK	
SS682	1	120	26	146	09/10/21	MK	
SS682	2	140	33	173	09/10/21	MK	
SS682	3	143	34	177	09/10/21	MK	
SS682	4	132	21	153	09/10/21	MK	
SS682	5	128	26	154	09/10/21	MK	

96 Hour Larval Test Summary

CLIENT	PROJECT
Anchor/Windward	Lower Duwamish / AOC4
PROJECT MANAGER	**TEST TYPE**
M. Knowlen	Larval Development

LARVAL ENDPOINT DATA

Sample ID	Rep	Normal	Abnormal	Total	Mean # Normal	SD	Average Control Normal Survival (Nc/I)
Stocking Density	1			286			
Stocking Density	2			292			
Stocking Density	3			294			
Stocking Density	4			297			
Stocking Density	5			283	290.4	5.8	
Seawater Control	1	198	57	255			
Seawater Control	2	201	67	268			
Seawater Control	3	219	51	270			
Seawater Control	4	210	58	268			
Seawater Control	5	186	65	251	202.8	12.5	0.70
Sand Control	1	208	31	239			
Sand Control	2	197	39	236			
Sand Control	3	216	44	260			
Sand Control	4	214	44	258			
Sand Control	5	189	41	230	204.8	11.5	0.71
Carr32 Ref	1	173	39	212			
Carr32 Ref	2	170	29	199			
Carr32 Ref	3	164	22	186			
Carr32 Ref	4	184	26	210			
Carr32 Ref	5	161	29	190	170.4	9.0	
IT682	1	162	34	196			
IT682	2	169	27	196			
IT682	3	162	37	199			
IT682	4	175	40	215			
IT682	5	180	44	224	169.6	8.0	
SS682	1	120	26	146			
SS682	2	140	33	173			

96 Hour Larval Test Summary

CLIENT	PROJECT
Anchor/Windward	Lower Duwamish / AOC4
PROJECT MANAGER	**TEST TYPE**
M. Knowlen	Larval Development

LARVAL ENDPOINT DATA

Sample ID	Rep	Normal	Abnormal	Total	Mean # Normal	SD	Average Control Normal Survival (Nc/I)
SS682	3	143	34	177			
SS682	4	132	21	153			
SS682	5	128	26	154	132.6	9.3	

96 Hour Larval Test Day 0 Ammonia

CLIENT	PROJECT	PROJECT NUMBER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	*Mytilus galloprovincialis*

Calibration Standards Temperature: 20.4 **Date:** 9/2/2021 **Tech:** NL

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Test salinity (ppt)*	*Test pH*	*Test temp (C)*	*Temp (K)*	*pKa^s*	*Unionized NH_3 (mg/L)*	*H_2S pKa**	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Sourced	Sourced	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Seawater Control	0	Overlying	0.109	19.4	T17/10	ND	10	1	ND	28	7.9	16.9	290.05	9.26	0.003	6.65	ND	
Sand Control	0	Overlying	0	19.4	T17/10	ND	10	1	ND	28	8.0	17.4	290.55	9.26	0.000	6.64	ND	
Carr32 Ref	0	Overlying	0	19.5	T17/10	2	10	1	2	28	8.0	17.2	290.35	9.26	0.000	6.64	0.117	
IT682	0	Overlying	0	19.7	T17/10	3	10	1	3	27	7.9	17.1	290.25	9.26	0.000	6.65	0.219	
SS682	0	Overlying	0.0849	19.7	T17/10	0	10	1	0	28	7.8	17.2	290.35	9.26	0.002	6.64	0.000	

96 Hour Larval Test Day 2 Ammonia

CLIENT	PROJECT	PROJECT NUMBER	SPECIES
Anchor/Windward	Lower Duwamish / AOC4	PG1541	*Mytilus galloprovincialis*
Calibration Standards Temperature: 20.4	Date: 9/4/2021	Tech: JL	

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Day	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Test salinity (ppt)*	*Test pH*	*Test temp (C)*	*Temp (K)*	*pKa [5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Sourced	Sourced		Record	Record	Record	Record	Record	Record	Calculated	Sourced	Sourced	Sourced	Calculated	Calculated	Calculated	Calculated	Calculated	
Seawater Control	2	Overlying	0.00	19.4	T17	ND	10	1	ND	28	8.0	15.2	288.35	9.26	0.000	6.68	ND	
Sand Control	2	Overlying	0.00	19.4	T17	8	10	1	8	28	8.0	15.0	288.15	9.26	0.000	6.68	0.505	
Carr32 Ref	2	Overlying	0.00	19.4	T17	3	10	1	3	28	8.0	15.4	288.55	9.26	0.000	6.67	0.187	
IT682	2	Overlying	0.00	19.4	T17	2	10	1	2	28	8.0	14.8	287.95	9.26	0.000	6.68	0.127	
SS682	2	Overlying	0.00	19.4	T17	ND	10	1	ND	28	8.0	14.8	287.95	9.26	0.000	6.68	ND	

3.2 *Mytilus galloprovincialis* Statistical Results

Project Name: Duwamish AOC4: Sediment Larval

Sample:	x1
Samp ID:	IT682
Alias:	
Replicates:	5
Mean:	169.6
SD:	7.956
Tr Mean:	169.6
Trans SD:	7.956

Ref Samp:	x2
Ref ID:	CARR32-REF
Alias:	
Replicates:	5
Mean:	170.4
SD:	8.961
Tr Mean:	170.4
Trans SD:	8.961

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	5.498
SS:	574.4
K:	5
b:	23.016
Alpha Level:	0.05
Calculated Value:	0.9223
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	6.32
Test Residual SD:	3.657
Ref. Residual Mean:	6.48
Ref. Residual SD:	5.274
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	0.0557
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	0.1493
Critical Value:	>= 1.397
Accept Null Hypothesis:	Yes
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	162	162	173	173	7.6	2.6			-9.4
2	169	169	170	170	0.6	0.4			-7.6
3	162	162	164	164	7.6	6.4			-7.6
4	175	175	184	184	5.4	13.6			-6.4
5	180	180	161	161	10.4	9.4			-0.6
6									-0.4
7									2.6
8									5.4
9									10.4
10									13.6

Project Name: Duwamish AOC4: Sediment Larval

Sample:	x1
Samp ID:	SS682
Alias:	
Replicates:	5
Mean:	132.6
SD:	9.263
Tr Mean:	132.6
Trans SD:	9.263

Ref Samp:	x2
Ref ID:	CARR32-REF
Alias:	
Replicates:	5
Mean:	170.4
SD:	8.961
Tr Mean:	170.4
Trans SD:	8.961

Shapiro-Wilk Results:

Residual Mean:	0
Residual SD:	5.913
SS:	664.4
K:	5
b:	25.396
Alpha Level:	0.05
Calculated Value:	0.9708
Critical Value:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

Test Residual Mean:	7.12
Test Residual SD:	4.736
Ref. Residual Mean:	6.48
Ref. Residual SD:	5.274
Deg. of Freedom:	8
Alpha Level:	0.1
Calculated Value:	0.2019
Critical Value:	>= 1.860
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	6.5583
Critical Value:	>= 1.397
Accept Null Hypothesis:	No
Power:	
Min. Difference for Power:	

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	120	120	173	173	12.6	2.6			-12.6
2	140	140	170	170	7.4	0.4			-9.4
3	143	143	164	164	10.4	6.4			-6.4
4	132	132	184	184	0.6	13.6			-4.6
5	128	128	161	161	4.6	9.4			-0.6
6									-0.4
7									2.6
8									7.4
9									10.4
10									13.6

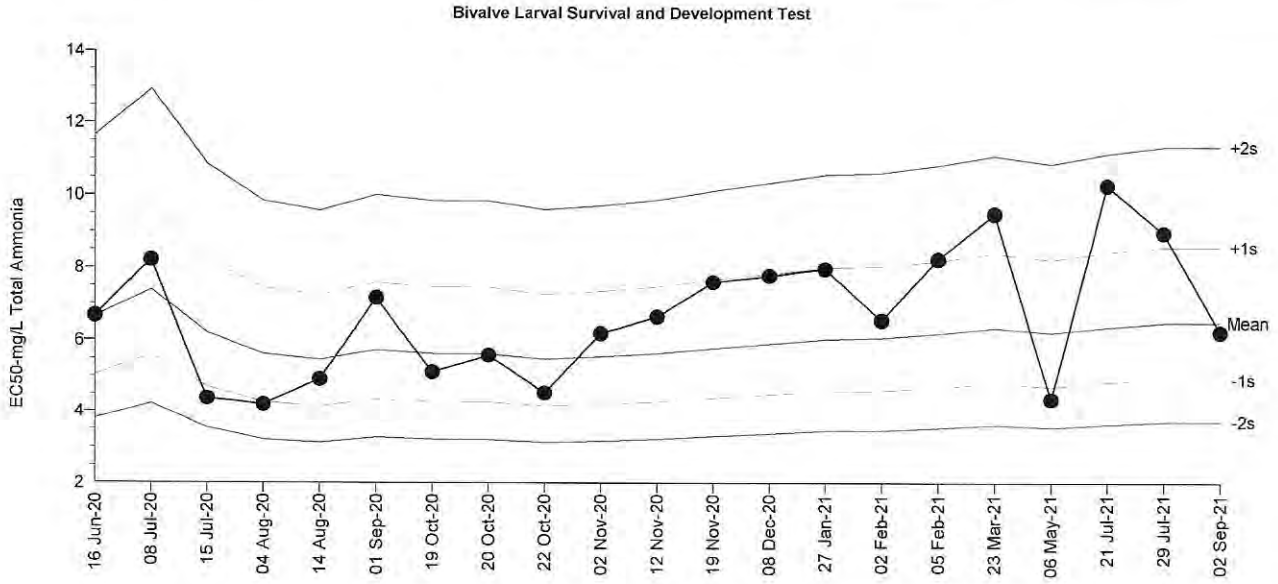
3.3 *Mytilus galloprovincialis* Reference Toxicant Test Results

CETIS QC Plot

Report Date: 24 Sep-21 08:44 (1 of 1)

Bivalve Larval Survival and Development Test — **All Matching Labs**

Test Type:	Development-Survival	**Organism:**	Mytilus galloprovincialis (Bay Mussel)	**Material:**	Total Ammonia
Protocol:	EPA/600/R-95/136 (1995)	**Endpoint:**	Combined Proportion Normal	**Source:**	Reference Toxicant-REF



Mean:	6.501	**Count:**	20	**-1s Warning Limit:**	4.915	**-2s Action Limit:**	3.716
Sigma:	n/a	**CV:**	28.50%	**+1s Warning Limit:**	8.599	**+2s Action Limit:**	11.37

Quality Control Data

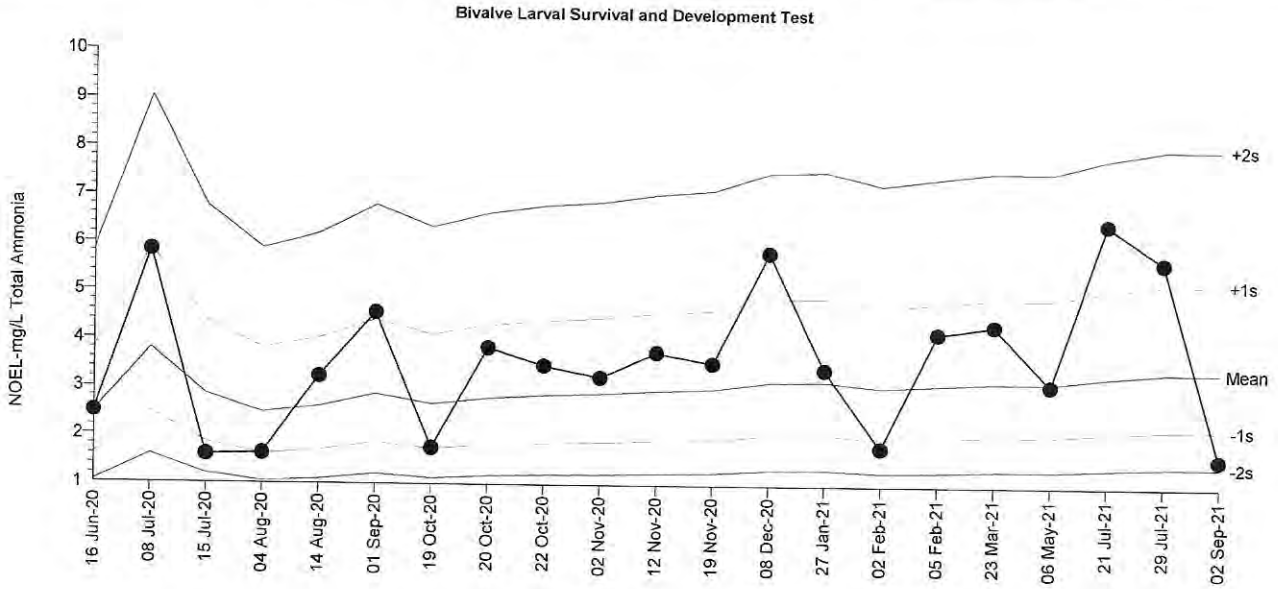
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2020	Jun	16	16:30	6.663	0.1619	0.08793			20-4167-7835	14-5400-1116	EcoAnalysts
2		Jul	8	16:11	8.209	1.708	0.8339			08-5035-5256	19-5704-9307	EcoAnalysts
3			15	16:23	4.365	-2.136	-1.424	(-)		15-9646-8760	06-4147-1899	EcoAnalysts
4		Aug	4	16:24	4.198	-2.303	-1.564	(-)		01-0670-7137	06-0301-5820	EcoAnalysts
5			14	16:55	4.909	-1.592	-1.004	(-)		04-3842-3020	15-6544-2892	EcoAnalysts
6		Sep	1	16:40	7.155	0.6541	0.3427			10-2380-5741	16-5117-8107	EcoAnalysts
7		Oct	19	16:12	5.11	-1.391	-0.8606			03-4887-8037	01-7158-1986	EcoAnalysts
8			20	16:45	5.584	-0.9171	-0.5437			02-8066-5792	09-4690-6741	EcoAnalysts
9			22	16:13	4.519	-1.982	-1.3	(-)		16-2361-2059	13-0949-7421	EcoAnalysts
10		Nov	2	16:25	6.19	-0.3116	-0.1756			09-9915-4860	16-6439-8802	EcoAnalysts
11			12	15:48	6.644	0.1424	0.07745			00-9253-4746	12-7689-2111	EcoAnalysts
12			19	14:25	7.603	1.102	0.5598			09-9158-3877	15-7726-4358	EcoAnalysts
13		Dec	8	17:10	7.778	1.277	0.6411			11-2786-8014	19-2146-7113	EcoAnalysts
14	2021	Jan	27	16:55	7.973	1.472	0.7295			08-6647-1109	09-0625-7215	EcoAnalysts
15		Feb	2	16:06	6.555	0.05345	0.02927			13-7329-9148	11-0719-6419	EcoAnalysts
16			5	15:30	8.244	1.742	0.8489			16-8922-0204	14-2787-9134	EcoAnalysts
17		Mar	23	16:28	9.504	3.003	1.358	(+)		18-0846-5810	13-9867-0503	EcoAnalysts
18		May	6	16:56	4.347	-2.155	-1.439	(-)		20-0688-2194	11-0705-0295	EcoAnalysts
19		Jul	21	15:45	10.3	3.798	1.645	(+)		15-0733-0020	12-3161-3844	EcoAnalysts
20			29	17:30	8.989	2.488	1.158	(+)		04-3086-3856	16-8778-8360	EcoAnalysts
21		Sep	2	17:22	6.232	-0.2694	-0.1513			12-7721-7392	18-5171-8342	EcoAnalysts

CETIS QC Plot

Report Date: 24 Sep-21 08:44 (1 of 1)

Bivalve Larval Survival and Development Test — **All Matching Labs**

Test Type: Development-Survival **Organism:** Mytilus galloprovincialis (Bay Mussel) **Material:** Total Ammonia
Protocol: EPA/600/R-95/136 (1995) **Endpoint:** Combined Proportion Normal **Source:** Reference Toxicant-REF



Mean: 3.397	**Count:** 20	**-1s Warning Limit:** 2.202	**-2s Action Limit:** 1.427
Sigma: n/a	**CV:** 45.50%	**+1s Warning Limit:** 5.24	**+2s Action Limit:** 8.084

Quality Control Data

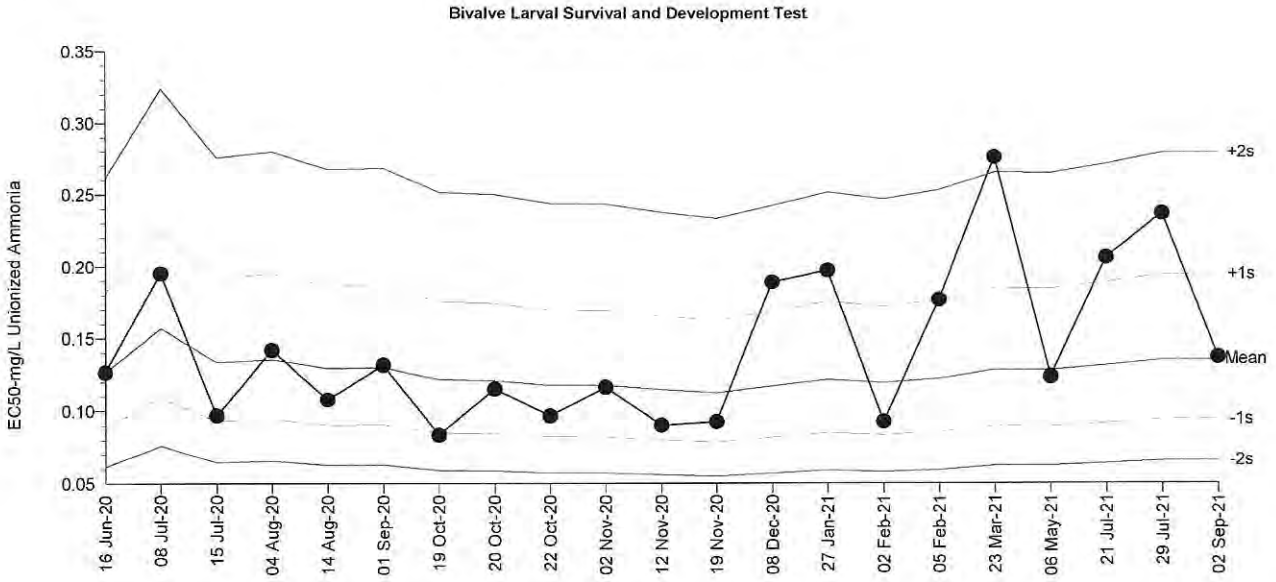
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2020	Jun	16	16:30	2.48	-0.9174	-0.726			20-4167-7835	09-8607-1747	EcoAnalysts
2		Jul	8	16:11	5.84	2.443	1.25	(+)		08-5035-5256	15-3252-7371	EcoAnalysts
3			15	16:23	1.59	-1.807	-1.751	(-)		15-9646-8760	10-4026-1588	EcoAnalysts
4		Aug	4	16:24	1.62	-1.777	-1.708	(-)		01-0670-7137	02-0847-6284	EcoAnalysts
5			14	16:55	3.23	-0.1674	-0.1165			04-3842-3020	20-5656-0671	EcoAnalysts
6		Sep	1	16:40	4.56	1.163	0.6789			10-2380-5741	13-6274-7985	EcoAnalysts
7		Oct	19	16:12	1.75	-1.647	-1.53	(-)		03-4887-8037	01-3719-7130	EcoAnalysts
8			20	16:45	3.84	0.4426	0.2825			02-8066-5792	02-5619-4726	EcoAnalysts
9			22	16:13	3.47	0.07264	0.0488			16-2361-2059	19-7842-4361	EcoAnalysts
10		Nov	2	16:25	3.24	-0.1574	-0.1094			09-9915-4860	18-9549-9885	EcoAnalysts
11			12	15:48	3.76	0.3626	0.234			00-9253-4746	08-5537-8252	EcoAnalysts
12			19	14:25	3.54	0.1426	0.09487			09-9158-3877	18-8616-2197	EcoAnalysts
13		Dec	8	17:10	5.84	2.443	1.25	(+)		11-2786-8014	13-9253-6845	EcoAnalysts
14	2021	Jan	27	16:55	3.43	0.03264	0.02205			08-6647-1109	08-3677-1779	EcoAnalysts
15		Feb	2	16:06	1.8	-1.597	-1.465	(-)		13-7329-9148	11-0410-6276	EcoAnalysts
16			5	15:30	4.19	0.7926	0.4837			16-8922-0204	02-5482-4547	EcoAnalysts
17		Mar	23	16:28	4.36	0.9626	0.5755			18-0846-5810	18-0485-1123	EcoAnalysts
18		May	6	16:56	3.12	-0.2774	-0.1965			20-0688-2194	07-1124-5995	EcoAnalysts
19		Jul	21	15:45	6.49	3.093	1.493	(+)		15-0733-0020	09-2905-9213	EcoAnalysts
20			29	17:30	5.68	2.283	1.186	(+)		04-3086-3856	15-9638-3535	EcoAnalysts
21		Sep	2	17:22	1.59	-1.807	-1.751	(-)		12-7721-7392	07-7736-1199	EcoAnalysts

CETIS QC Plot

Report Date: 24 Sep-21 08:50 (1 of 1)

Bivalve Larval Survival and Development Test — **All Matching Labs**

Test Type: Development-Survival **Organism:** Mytilus galloprovincialis (Bay Mussel) **Material:** Unionized Ammonia
Protocol: EPA/600/R-95/136 (1995) **Endpoint:** Combined Proportion Normal **Source:** Reference Toxicant-REF



Mean:	0.1359	**Count:**	20	**-1s Warning Limit:**	0.09453	**-2s Action Limit:**	0.06579
Sigma:	n/a	**CV:**	37.50%	**+1s Warning Limit:**	0.1951	**+2s Action Limit:**	0.2804

Quality Control Data

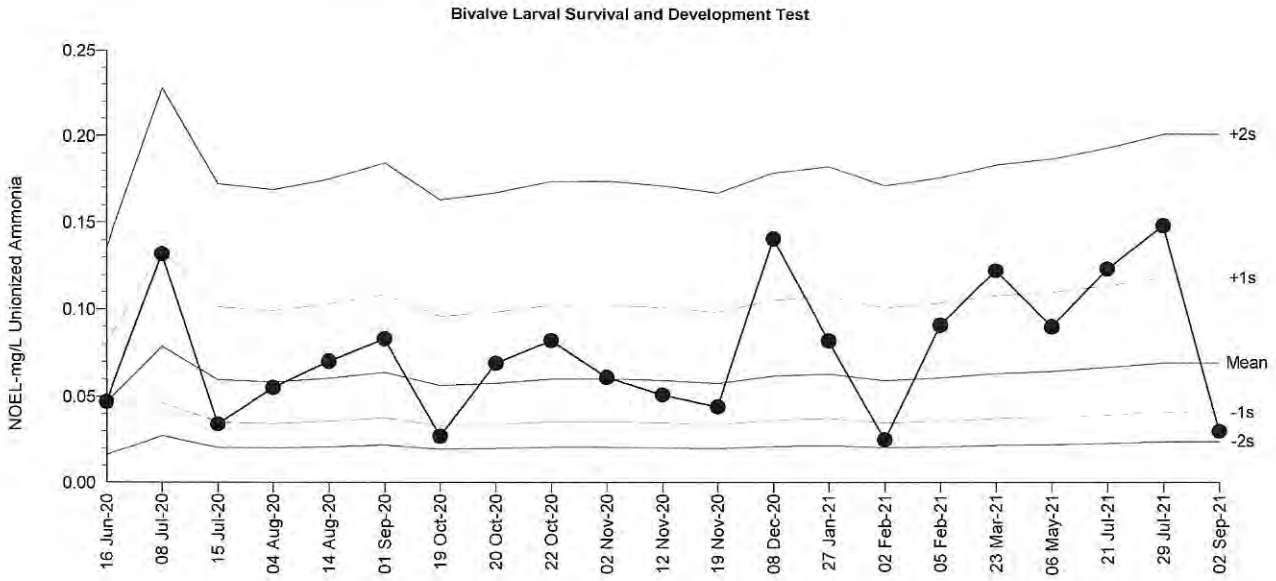
Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2020	Jun	16	16:30	0.1265	-0.009362	-0.197			10-1828-9125	13-8582-5794	EcoAnalysts
2		Jul	8	16:11	0.1951	0.05923	0.9984			05-5591-4841	03-7223-6999	EcoAnalysts
3			15	16:23	0.09681	-0.03907	-0.9354			21-0814-1988	04-9160-0553	EcoAnalysts
4		Aug	4	16:24	0.1422	0.006273	0.1245			04-1857-7084	12-7117-0261	EcoAnalysts
5			14	16:55	0.108	-0.02783	-0.6324			02-8126-2404	03-5088-5888	EcoAnalysts
6		Sep	1	16:40	0.1321	-0.003822	-0.07873			07-4415-5918	17-3359-5006	EcoAnalysts
7		Oct	19	16:12	0.08347	-0.05241	-1.345	(-)		05-2251-3827	15-9220-2980	EcoAnalysts
8			20	16:45	0.1153	-0.02055	-0.4524			11-2723-7877	20-9460-4276	EcoAnalysts
9			22	16:13	0.09669	-0.03919	-0.9389			14-1466-2942	09-4024-1285	EcoAnalysts
10		Nov	2	16:25	0.1166	-0.01928	-0.4222			03-2935-4227	19-7057-4430	EcoAnalysts
11			12	15:48	0.09021	-0.04567	-1.13	(-)		16-0999-2197	02-9356-3690	EcoAnalysts
12			19	14:25	0.09254	-0.04334	-1.06	(-)		04-4903-3862	00-9736-2696	EcoAnalysts
13		Dec	8	17:10	0.1894	0.05349	0.916			10-9003-3134	12-8741-9662	EcoAnalysts
14	2021	Jan	27	16:55	0.1977	0.0618	1.034	(+)		04-1822-1173	11-6185-9712	EcoAnalysts
15		Feb	2	16:06	0.09276	-0.04311	-1.053	(-)		03-3410-8803	20-5669-0584	EcoAnalysts
16			5	15:30	0.1773	0.04139	0.7338			03-0062-6771	15-1784-5646	EcoAnalysts
17		Mar	23	16:28	0.2767	0.1409	1.963	(+)		17-8758-4170	13-9507-5330	EcoAnalysts
18		May	6	16:56	0.124	-0.01184	-0.2515			18-3396-1658	10-8311-0494	EcoAnalysts
19		Jul	21	15:45	0.2068	0.07097	1.16	(+)		17-9855-0345	08-5046-8808	EcoAnalysts
20			29	17:30	0.2375	0.1017	1.541	(+)		06-8695-1424	04-5385-2324	EcoAnalysts
21		Sep	2	17:22	0.1375	0.001633	0.03297			03-1930-9595	16-9972-6626	EcoAnalysts

CETIS QC Plot

Report Date: 24 Sep-21 08:51 (1 of 1)

Bivalve Larval Survival and Development Test — **All Matching Labs**

Test Type: Development-Survival **Organism:** Mytilus galloprovincialis (Bay Mussel) **Material:** Unionized Ammonia
Protocol: EPA/600/R-95/136 (1995) **Endpoint:** Combined Proportion Normal **Source:** Reference Toxicant-REF



Mean:	0.06981	**Count:**	20	**-1s Warning Limit:**	0.04105	**-2s Action Limit:**	0.02414
Sigma:	n/a	**CV:**	57.10%	**+1s Warning Limit:**	0.1188	**+2s Action Limit:**	0.202

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2020	Jun	16	16:30	0.047	-0.02281	-0.7449			10-1828-9125	07-2633-5476	EcoAnalysts
2		Jul	8	16:11	0.132	0.06219	1.199	(+)		05-5591-4841	00-4319-6663	EcoAnalysts
3			15	16:23	0.034	-0.03581	-1.355	(-)		21-0814-1988	05-7587-8424	EcoAnalysts
4		Aug	4	16:24	0.055	-0.01481	-0.4489			04-1857-7084	11-1462-8874	EcoAnalysts
5			14	16:55	0.07	0.0001915	0.005159			02-8126-2404	18-7556-0897	EcoAnalysts
6		Sep	1	16:40	0.083	0.01319	0.3259			07-4415-5918	20-4554-8417	EcoAnalysts
7		Oct	19	16:12	0.027	-0.04281	-1.789	(-)		05-2251-3827	07-5665-8609	EcoAnalysts
8			20	16:45	0.069	-0.000809	-0.02193			11-2723-7877	04-9902-9704	EcoAnalysts
9			22	16:13	0.082	0.01219	0.3031			14-1466-2942	04-7728-0995	EcoAnalysts
10		Nov	2	16:25	0.061	-0.008808	-0.254			03-2935-4227	20-0276-1184	EcoAnalysts
11			12	15:48	0.051	-0.01881	-0.5911			16-0999-2197	12-7809-1417	EcoAnalysts
12			19	14:25	0.044	-0.02581	-0.8691			04-4903-3862	18-1208-6535	EcoAnalysts
13		Dec	8	17:10	0.141	0.07119	1.324	(+)		10-9003-3134	17-9450-1535	EcoAnalysts
14	2021	Jan	27	16:55	0.082	0.01219	0.3031			04-1822-1173	06-3060-1369	EcoAnalysts
15		Feb	2	16:06	0.025	-0.04481	-1.933	(-)		03-3410-8803	06-7183-2803	EcoAnalysts
16			5	15:30	0.091	0.02119	0.4992			03-0062-6771	13-9399-7616	EcoAnalysts
17		Mar	23	16:28	0.123	0.05319	1.067	(+)		17-8758-4170	10-5996-6199	EcoAnalysts
18		May	6	16:56	0.09	0.02019	0.4784			18-3396-1658	08-0223-1186	EcoAnalysts
19		Jul	21	15:45	0.124	0.05419	1.082	(+)		17-9855-0345	02-3257-0605	EcoAnalysts
20			29	17:30	0.149	0.07919	1.428	(+)		06-8695-1424	03-4375-8593	EcoAnalysts
21		Sep	2	17:22	0.03	-0.03981	-1.59	(-)		03-1930-9595	06-1524-4540	EcoAnalysts

CETIS Summary Report

Report Date:	24 Sep-21 08:43 (p 1 of 1)
Test Code/ID:	P190612.202 / 12-7721-7392

Bivalve Larval Survival and Development Test — **EcoAnalysts**

Batch ID:	00-6207-4527	**Test Type:**	Development-Survival	**Analyst:**	Julia Levengood		
Start Date:	02 Sep-21 17:22	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater		
Ending Date:	04 Sep-21 15:32	**Species:**	Mytilus galloprovincialis	**Brine:**	Not Applicable		
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish	**Age:**	

Sample ID:	17-1387-9244	**Code:**	P190612.202	**Project:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Total Ammonia	**Source:**	Reference Toxicant
Receipt Date:	12 Jun-19	**CAS (PC):**		**Station:**	P190612.202
Sample Age:	813d 17h	**Client:**	Internal Lab		

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
07-7736-1199	Combined Proportion Norma	Dunnett Multiple Comparison Test		1.59	3.27	2.28		5.72%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
18-5171-8342	Combined Proportion Norma	Trimmed Spearman-Kärber		EC50	6.232	6.072	6.396		1

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits Lower	TAC Limits Upper	Overlap	Decision
07-7736-1199	Combined Proportion Norma	PMSD	0.05724	<<	0.25	No	Passes Criteria

Combined Proportion Normal Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	4	0.6955	0.6661	0.7250	0.6786	0.7179	0.0093	0.0185	2.66%	0.00%
1.59		4	0.6795	0.6619	0.6971	0.6643	0.6893	0.0055	0.0111	1.63%	2.31%
3.27		4	0.6268	0.5913	0.6623	0.6036	0.6571	0.0112	0.0223	3.56%	9.88%
6.78		4	0.3446	0.2830	0.4063	0.2893	0.3786	0.0194	0.0387	11.24%	50.45%
13.2		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%
22.1		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Combined Proportion Normal Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.7036	0.7179	0.6786	0.6821
1.59		0.6893	0.6857	0.6643	0.6786
3.27		0.6250	0.6214	0.6036	0.6571
6.78		0.2893	0.3500	0.3607	0.3786
13.2		0.0000	0.0000	0.0000	0.0000
22.1		0.0000	0.0000	0.0000	0.0000

Combined Proportion Normal Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	197/280	201/280	190/280	191/280
1.59		193/280	192/280	186/280	190/280
3.27		175/280	174/280	169/280	184/280
6.78		81/280	98/280	101/280	106/280
13.2		0/280	0/280	0/280	0/280
22.1		0/280	0/280	0/280	0/280

CETIS Summary Report

Report Date: 24 Sep-21 08:49 (p 1 of 1)
Test Code/ID: P190612.202.uia / 03-1930-9595

Bivalve Larval Survival and Development Test

EcoAnalysts

Batch ID:	19-7946-4888	**Test Type:**	Development-Survival	**Analyst:**	Julia Levengood
Start Date:	02 Sep-21 17:22	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	04 Sep-21 15:32	**Species:**	Mytilus galloprovincialis	**Brine:**	Not Applicable
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish
					Age:

Sample ID:	14-5898-8490	**Code:**	P190612.202	**Project:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Unionized Ammonia	**Source:**	Reference Toxicant
Receipt Date:	12 Jun-19	**CAS (PC):**		**Station:**	P190612.202
Sample Age:	813d 17h	**Client:**	Internal Lab		

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
06-1524-4540	Combined Proportion Norma	Dunnett Multiple Comparison Test		0.03	0.077	0.04806		5.72%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
16-9972-6626	Combined Proportion Norma	Trimmed Spearman-Kärber		EC50	0.1375	0.1342	0.1409		1

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits Lower	TAC Limits Upper	Overlap	Decision
06-1524-4540	Combined Proportion Norma	PMSD	0.05724	<<	0.25	No	Passes Criteria

Combined Proportion Normal Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	4	0.6955	0.6661	0.7250	0.6786	0.7179	0.0093	0.0185	2.66%	0.00%
0.03		4	0.6795	0.6619	0.6971	0.6643	0.6893	0.0055	0.0111	1.63%	2.31%
0.077		4	0.6268	0.5913	0.6623	0.6036	0.6571	0.0112	0.0223	3.56%	9.88%
0.159		4	0.3446	0.2830	0.4063	0.2893	0.3786	0.0194	0.0387	11.24%	50.45%
0.247		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%
0.413		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Combined Proportion Normal Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.7036	0.7179	0.6786	0.6821
0.03		0.6893	0.6857	0.6643	0.6786
0.077		0.6250	0.6214	0.6036	0.6571
0.159		0.2893	0.3500	0.3607	0.3786
0.247		0.0000	0.0000	0.0000	0.0000
0.413		0.0000	0.0000	0.0000	0.0000

Combined Proportion Normal Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	197/280	201/280	190/280	191/280
0.03		193/280	192/280	186/280	190/280
0.077		175/280	174/280	169/280	184/280
0.159		81/280	98/280	101/280	106/280
0.247		0/280	0/280	0/280	0/280
0.413		0/280	0/280	0/280	0/280

CETIS Test Data Worksheet

Report Date: 24 Sep-21 08:43 (p 1 of 1)
Test Code/ID: P190612.202 / 12-7721-7392

Bivalve Larval Survival and Development Test — EcoAnalysts

Start Date:	02 Sep-21 17:22	**Species:**	Mytilus galloprovincialis	**Sample Code:**	P190612.202
End Date:	04 Sep-21 15:32	**Protocol:**	EPA/600/R-95/136 (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	12 Jun-19	**Material:**	Total Ammonia	**Sample Station:**	P190612.202

Conc-mg/L	Code	Rep	Pos	Initial Density	Final Density	# Counted	# Normal	Notes
0	D	1	24	280	272	272	197	
0	D	2	11	280	257	257	201	
0	D	3	16	280	257	257	190	
0	D	4	19	280	248	248	191	
1.59		1	14	280	244	244	193	
1.59		2	9	280	269	269	192	
1.59		3	5	280	259	259	186	
1.59		4	23	280	261	261	190	
3.27		1	8	280	260	260	175	
3.27		2	20	280	266	266	174	
3.27		3	13	280	247	247	169	
3.27		4	7	280	272	272	184	
6.78		1	15	280	230	230	81	
6.78		2	10	280	259	259	98	
6.78		3	4	280	261	261	101	
6.78		4	18	280	284	284	106	
13.2		1	22	280	277	277	0	
13.2		2	3	280	295	295	0	
13.2		3	6	280	218	218	0	
13.2		4	21	280	239	239	0	
22.1		1	1	280	233	233	0	
22.1		2	12	280	271	271	0	
22.1		3	2	280	291	291	0	
22.1		4	17	280	274	274	0	

CETIS Test Data Worksheet

Report Date: 24 Sep-21 08:50 (p 1 of 1)
Test Code/ID: P190612.202.uia / 03-1930-9595

Bivalve Larval Survival and Development Test — **EcoAnalysts**

Start Date: 02 Sep-21 17:22 **Species:** Mytilus galloprovincialis **Sample Code:** P190612.202
End Date: 04 Sep-21 15:32 **Protocol:** EPA/600/R-95/136 (1995) **Sample Source:** Reference Toxicant
Sample Date: 12 Jun-19 **Material:** Unionized Ammonia **Sample Station:** P190612.202

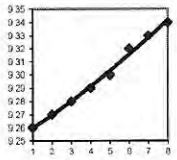
Conc-mg/L	Code	Rep	Pos	Initial Density	Final Density	# Counted	# Normal	Notes
0	D	1	3	280	272	272	197	
0	D	2	7	280	257	257	201	
0	D	3	22	280	257	257	190	
0	D	4	23	280	248	248	191	
0.03		1	6	280	244	244	193	
0.03		2	1	280	269	269	192	
0.03		3	13	280	259	259	186	
0.03		4	20	280	261	261	190	
0.077		1	12	280	260	260	175	
0.077		2	8	280	266	266	174	
0.077		3	2	280	247	247	169	
0.077		4	14	280	272	272	184	
0.159		1	9	280	230	230	81	
0.159		2	4	280	259	259	98	
0.159		3	5	280	261	261	101	
0.159		4	21	280	284	284	106	
0.247		1	10	280	277	277	0	
0.247		2	15	280	295	295	0	
0.247		3	17	280	218	218	0	
0.247		4	16	280	239	239	0	
0.413		1	24	280	233	233	0	
0.413		2	19	280	271	271	0	
0.413		3	18	280	291	291	0	
0.413		4	11	280	274	274	0	

Un-ionized Ammonia Calculator

CLIENT:	Various	Date of Test:	September 2, 2021
PROJECT:	Various	Test Type:	*M. gallo*
COMMENTS:	P190612.202		

To convert Total Ammonia (mg/L) to Free (un-ionized) Ammonia (mg/L) enter the corresponding total ammonia, salinity, temperature, and pH.

Ionic strength	pKa^s
1	9.26
2	9.27
3	9.28
4	9.29
5	9.30
6	9.32
7	9.33
8	9.34



$y = 0.0003x^2 + 0.0091x + 9.2502$

...

	Sample	Mod	*NH3T (mg/L)*	*salinity (ppt)*	*pH*	*temp (C)*	*temp (K)*	*pKa^s*		NH_3U (mg/L)
	Target / Sample Name		Actual	Actual	Actual	Actual	Calculated	Calculated		**Calculated**
	Example 3.5		2.000	10.0	7.5	5.0	278.15	9.2520		**0.008**
1										
2										
3	1.5		1.59	30	7.8	16.7	289.85	9.2559		**0.030**
4	3		3.27	30	7.9	16.7	289.85	9.2559		**0.077**
5	6		6.78	30	7.9	16.7	289.85	9.2559		**0.159**
6	12		13.2	30	7.8	16.7	289.85	9.2559		**0.247**
7	18		22.1	30	7.8	16.7	289.85	9.2559		**0.413**
8										
9										
10										
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QA / [illegible]

48 Hour Bivalve Development Reference Toxicant Test

Test ID: P210612.202	Replicates: 4	Study Director: J. Levengood	Location: Incubator 1
Dilution Water Batch: FSW090221.01	Organism Batch: TJ090121	Associated Test(s): Various	Organism: Mytilus sp.
Chamber Size/Type: 30 ml shell vial	Exposure Volume: 10 ml		
Toxicant: Ammonium Chloride		Date Prepared: 9/2/21	Initials: MS
Target Concentrations: See spiking worksheet		Quantity of Stock: Target: See spiking worksheet	Quantity of Diluent: Target: 250 mL
See spiking worksheet		Actual: See spiking worksheet	Actual: 200mL

0 Hours	Date: 9/2/21	WQ Time: 1520	Start Time: ② ~~1414~~ 1722	Initials: JL/MS

STOCK

	Control	1.5	3	6	12	18
D.O. (%) (>4.0 mg/L)	8.0	8.0	8.0	8.0	8.0	8.0
Temperature (16 ± 1°C) ①	16.7	16.7	16.7	16.7	16.7	16.7
Salinity (30 ± 2 ppt)	30	30	30	30	30	30
pH (6-9)	7.7	7.8	7.9	7.9	7.8	7.8
Meter #	8	8	8	8	8	8

Day 1	Temperature (16 ± 1°C)	15.1 ①	Meter # T16	Initials: NL
Day 2	Date: 9/4/21	WQ Time: 1415	End Time: 1532	Initials: NL
		Formalin Lot #: 200924-20	Rose Bengal Lot #: 5135	

STOCK

	Control	1.5	3	6	12	18
D.O. (%) (>4.0 mg/L)	7.9	8.0	8.0	8.1	8.1	8.0
Temperature (16 ± 1°C) ①	15.0	15.0	15.0	15.0	15.0	15.0
Salinity (30 ± 2 ppt)	31	31	31	31	31	32
pH (6-9)	8.0	8.1	8.0	8.0	8.0	8.0
Meter #	9	9	9	9	9	9

Notes: ① temp. taken from temp. blank vial - MS 9/2, NL 9/3, NL 9/4
② IE-MS 9/2

48 Hour Bivalve Development Reference Toxicant Test

Conc.	Rep	Number Normal	Number Abnormal	Date	Initials	
Control	1	197	75	9.10.21	MARH	
	2	201	52	9.10.21	MARH	
	3	190	67	9.10.21	MARH	N 194 A 66
	4	191	57	9.10.21	MARH	
1.5	1	193	51	9/22/21	DM	
	2	192	77	9/23/21	SH	
	3	186	73	9/23/21	SH	
	4	190	71	9/23/21	SH	N 193 A 70
3	1	175	85	9/23/21	SH	
	2	174	92	9/23/21	SH	N 173 A 96
	3	169	78	9/23/21	SH	
	4	184	88	9/23/21	SH	
6	1	81	149	9/23/21	SH	N 89 A 160
	2	98	161	9/23/21	SH	
	3	101	160	9/23/21	SH	
	4	106	178	9/23/21	SH	
12	1	0	277	9/23/21	SH	
	2	0	295	9/23/21	SH	
	3	0	218	9/23/21	SH	
	4	0	239	9/23/21	SH	
18	1	0	233	9/23/21	SH	
	2	0	271	9/23/21	SH	
	3	0	① ~~92~~ 291	9/23/21	SH	
	4	0	274	9/23/21	SH	

Stocking Density

Rep	Count	Init.
1	274	MARH
2	288	MARH
3	281	MARH
4	287	MARH
5	291	MARH
6	261	MARH
Mean:	280.3	

① I.E.- SH 9/23/21

QA

Ø Rep 3: N194 A66 %N = 74.6
%NA = 0.7% DM

3 Rep 2: N173 A96 %N = 64.3%
%NA = 1.1% DM

1.5 Rep 4: N193 A70 %N = 73.4%
%NA: 0.6% DM

6 Rep 1: N89 A160 %N = 35.7%
%NA = 0.5% DM

Ammonia Reference Toxicant
Spiking Worksheet

Reference Toxicant ID: P190612.202
Date Prepared: 9/2/2021
Technician Initials: MS

Biv / Echino NH_3 RT

Assumptions in Model
Stock ammonia concentration is 9,000 mg/L = 9 mg/mL

Date: 7/20/2021
Measurement: 9323.33

Test Solutions			Volume of stock to reach desired concentration	
Measured Concentration	**Desired Concentration**	**Volume**		
mg/L	mg/L	mL	mL stock to increase	
			[redacted]	SALT WATER
1.59	**1.5**	200		**0.048**
3.27	**3**	200		**0.097**
6.78	**6**	200		**0.193**
13.2	**12**	200		**0.386**
22.1	**18**	200		**0.579**

APPENDIX B. CHAIN-OF-CUSTODY FORMS, LOGS, AND PRE-TEST DOCUMENTS

1 of 1

CHAIN-OF-CUSTODY/TEST REQUEST FORM

Toxicity
№ 3959

Project/Client Name: Duwamish ACCY
Project Number: 180067-02.02
Contact Name: Amara Vanderwort
Sampled By: Windward

Ship to: EcoAnalysis Inc
Attn: Jay Ward
Shipper:
Form filled out by: Nicolas Eckhardt

Shipping Date:
Airbill Number:
Turnaround requested:

Sample Collection Date (m/d/y)	Time	Sample Identification	Volume of Sample / # of Containers	Matrix	Test(s) Requested (check test(s) required): 10 day Amphipod Survival	Bivalve/Echinoderm Embryo/Larval	20 d Juvenile Polych. Growth					Comments / Instructions [Jar tag number(s)]
7/14/21	0740	LDW21-IT682	3	Sediment	X	X	X			0.5°C		P 210830.02
↓	0920	LDW21-IT685	3	↓	X	X	X					
7/14/21	1130	LDW21-SC680	3	Sediment	X	X	X					
					7/14/21							
		Total Number of Containers	9	Purchase Order / Statement of Work # CLF 052021-ECO								

1) Released by:	1) Rec'd by:	2) Released by: (1)	2) Rec'd by: (2)
Print name: Kate McPeek	Jacob Shelite	Print name: Jacob Shelite	
Signature:	Company: ADE	Signature:	Company: YA YA SAFETY
Company: Windward		Company: ADE	
Date/Time: 7/14/21 1730	Date/Time: 07/14/2021 1730	Date/Time: 08/30/2021 1323	Date/Time: 08/30/2021 13:23 PM

* Distribution: White copies accompany shipment; yellow retained by consignor.

(3) SCOT YA YA SAFETY MET 4:08 PM 08/30/2021

Windward environmental LLC
200 1st Ave W, Suite 500
Seattle, WA 98119
206.378.1364

Julia Levengood 8/30/21 1609

To be completed by Laboratory upon sample receipt:

Date of receipt::	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

1 1

CHAIN-OF-CUSTODY/TEST REQUEST FORM

№ 4139

Project/Client Name: Duwamish AOCY
Project Number: 180067-02.02
Contact Name: Amara Vandervoet
Sampled By: Windward

Ship to: Eco Analysts Inc.
Attn: Jay Word
Shipper:
Form filled out by: K. McPeek

Shipping Date:
Airbill Number:
Turnaround requested: Std

Sample Collection Date (m/d/y)	Time	Sample Identification	Volume of Sample / # of Containers	Matrix	Test(s) Requested (check test(s) required): 10d amphipod survival bioassay	bivalve or echin. form embryo-larval	28d juvenile polychaete growth bioassay					Comments / Instructions [Jar tag number(s)]
7/13/21	0740	LDW21-SS682	3	Sediment	X	X	X				0.5°C	P210830.03
↓	0905	LDW21-SS685	3	↓	X	X	X					
↓	1040	LDW21-SS613	3	↓	X	X	X					
		Total Number of Containers	9	Purchase Order / Statement of Work # CLF-052021-ECO								

K. McPeek 7/13/21

1) Released by:	1) Rec'd by:	2) Released by:	2) Rec'd by:
Print name: Kate McPeek	Jacob Walter	Print name: Jacob Walter	
Signature:	Signature:	Signature:	Signature:
Company: Windward	Company: ATI	Company: ATI	Company: YA YA SAFETY
Date/Time: 7/13/21 1725	Date/Time: 07/13/2021 17:25	Date/Time: 08/30/2021 1323	Date/Time: 08/30/2021 13:23PM

* Distribution: White copies accompany shipment; yellow retained by consignor.

(3) Steve YA YA SAFETY 08/30/21 4:09PM

Steinmetz 8/30/21 1609

Wind Ward environmental LLC
200 1st Ave W, Suite 500
Seattle, WA 98119
206.378.1364

To be completed by Laboratory upon sample receipt:

Date of receipt::	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

SAMPLE RECEIPT LOG FOR SEDIMENTS IN COOLERS

Client/Project:	Anchor / Winward / Duwamish ACC4
Date/Time Received:	8/30/21 1609
Delivery Method:	FedEx / UPS / Hand Delivered / Other:
Airbill #:	NA
Received By:	SH JL ①

*Notify project manager or study director if temperatures exceed 6°C. Client must be notified ASAP.

Cooler #	Client ID	Lab ID	Sample Type (Sediment, Sitewater, Soil, Other)	#/Type & Volume of Container	Custody Seal Intact? Intact / Broken / Not Present	Condition of Container	Condition of Wet or Blue Ice: Frozen (Ice Present) / Ice-Water Mix / Water (Thawed)	Corrected Temperature (°C) Instrument #: T16
1	LDW21-IT682	P210830.02	Sed	32oz jar x 3	Not present	Good	Frozen	0.5
2	LDW21-SS682	P210830.03	Sed	32oz. jar x 3	Not present	Good	Frozen	0.5

① illegible - SH 8/30/21

CHAIN OF CUSTODY

EcoAnalysts
LIFE IN WATER

EcoAnalysts, In
4770 NE View Dr., Por amble, WA. 983
Tel: (360) 297-60

Destination: EcoAnalysts	Sample Originator (Organization): EcoAnalysts	Report Results To:	Phone:
Destination Contact: M. Seibert	PERSON WHO COLLECTED SAMPLE: Marisa Seibert	Contact Name:	Fax:
Date: 7/28/21	Address:	Address:	Email:
Turn-Around-Time:			
Project Name: T-91 Reference collection	Phone:	Analyses:	Invoicing To:
	Fax:		Comments or Special Instructions:
Contract/PO:	E-mail		

No.	Sample ID	Matrix	Volume & Type of Container	Date & Time	Preservation	Sample Temp Upon Receipt	LAB ID
1	CARR58-REF	Sed	6L	7/28/21 0845			P210728.01
2	CARR32-REF	Sed	6L	7/28/21 0930			P210728.02
3							
4							
5							
6							
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16							
17							
18							
19							
20							

Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name: Marisa Seibert	Print Name: Samantha Heinicke	Print Name:	Print Name:
Signature: [signature]	Signature: [signature]	Signature:	Signature:
Affiliation: EcoAnalysts	Affiliation: EcoAnalysts	Affiliation:	Affiliation:
Date/Time: 7/28/21 1150	Date/Time: 7/28/21 1151	Date/Time:	Date/Time:

Matrix Codes

FW = Fresh Water
SB = Salt & Brackish Water
SS = Soil & Sediment

Version 1.0, Effective 7/1/14

SAMPLE RECEIPT LOG FOR SEDIMENTS IN COOLERS

Client/Project:	Windward / Port of Seattle T-91 Reference Sed.
Date/Time Received:	7/28/21 1150
Delivery Method:	FedEx / UPS / Hand Delivered / Other:
Airbill #:	NA
Received By:	Samantha Hennicke

*Notify project manager or study director if temperatures exceed 6°C. Client must be notified ASAP.

Cooler #	Client ID	Lab ID	Sample Type (Sediment, Sitewater, Soil, Other)	#/Type & Volume of Container	Custody Seal Intact? Intact / Broken / Not Present	Condition of Container	Condition of Wet or Blue Ice: Frozen (Ice Present) / Ice-Water Mix / Water (Thawed)	Corrected Temperature (°C) Instrument #:_____
1	CARR58-REF	P210728.01	Sed	1 bag, ~6L	Not present	Good	①	①
2	CARR32-REF	P210728.02	Sed	1 bag, ~6L	Not present	Good	①	①

① collected and delivered to lab w/in 2hrs of collection. MS 7/29

Wet-Sieve Procedure for Determining Percent Fines (<63 µm) of Sediment

DATE: 7/28/21	CLIENT: Windward	PROJECT: T-91 Reference collection

Procedure:

1. **Collect 50 mL of sediment to be analyzed**
2. **Transfer sediment to a #230 (63 µm) testing sieve**
3. **Rinse sieve thoroughly with a stream of water until water flowing through the sieve is clear**
4. **Transfer all retained material to a 100mL graduated cylinder using a small funnel and DI squirt bottle**
5. **Allow sediment to settle. Record the volume of sediment retained below.**

SAMPLE ID:	A) INITIAL VOLUME OF SEDIMENT (mL)	B) VOLUME OF SEDIMENT RETAINED (mL)	A - B =	Multiplier	Estimated Percent Fines
Example	50	22	28	x2 =	56
Carr 58	50	21	29	x2 =	58
carr32	50	34	16	x2 =	32
				x2 =	
				x2 =	
				x2 =	
				x2 =	
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ECOANALYSTS

Page ____ of ____

STATION COORDINATE LOG
For Van Veen

Project: Port of Seattle T-91 Recorder: Samantha Heinicke

DATE	TIME	STATION	DROP NO.	LATITUDE	LONGITUDE	DEPTH (ft)	RECOVERY DEPTH (cm)	Tidal Height	COMMENTS
7/28/21	854	Carr58 20	1-3	N 47.33299	W 122.66968 ①	34 ft			carr58
7/28/21	928	Carr CR20	4	N47.33199	W122.67065	5.5'			carr32

① I.E. – 3H 7/28

ECOANALYSTS

Page ____ of ____

STATION COORDINATE LOG
For Van Veen

Project: Port of Seattle T-91 Recorder: Samantha Heinicke

DATE	TIME	STATION	DROP NO.	LATITUDE	LONGITUDE	DEPTH (ft)	RECOVERY DEPTH (cm)	Tidal Height	COMMENTS
7/28/21	854	Carr58 20	1-3	N 47.33299	W 122.66968 ①	34 ft			carr58
7/28/21	928	Carr CR20	4	N47.33199	W122.67065	5.5'			carr32

① I.E. – 3H 7/28

CLIENT	PROJECT	SPECIES
Anchor	Lower Duwamish AOC4	
Calibration Standards Temperature: 20.7	Date: 8/31/2021 Tech: JL	

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Material	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 sample temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Porewater salinity (ppt)*	*Porewater pH*	*Projected test temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Record			Record	Record	Record	Record	Record	Record	Calculated	Record	Record	Record	Calculated	Calculated	Calculated	Calculated	Calculated	
SS682	Bulk	Porewater	15.9	20.9	9	0	10	1.0	0	21	7.2	20.0	293.15	9.25	0.097	6.62	0.000	
IT682	Bulk	Porewater	8.52	20.4	9	1	10	1.0	1	11	7.2	20.0	293.15	9.25	0.052	6.69	0.304	

T.1

CLIENT	PROJECT	SPECIES
Anchor	Lower Duwamish	*Mytilus galloprovincialis*
Calibration Standards Temperature: --	Date: 8/31/2021 Tech: MK	

NH_3 sample temperature should be within +/- 1°C of standard temp at time and date of analysis

Sample	Material	Overlying/ Porewater	*Total NH_3 (mg/L)*	*NH_3 Sample Temp*	*WQ/Temp Meter*	*Measured Total Dissolved Sulfide (µg/L as S)*	*Sulfide Sample Volume (ml)*	*Sulfide Multiplier*	*Calculated Total Dissolved Sulfide (µg/L as S)*	*Actual Salinity (ppt)*	*Projected Salinity (ppt)*	*Actual pH*	*Projected Test Temp (C)*	*Temp (K)*	*NH_3 pKa[5]*	*Unionized NH_3 (mg/L)*	*H_2S pKa **	*Undissociated Sulfide (µg/L as H_2S)*	Notes
Record			Record	Record	Record	Record	Record	Record	Calculated	Record	Record	Record	Record	Calculated	Calculated	Calculated	Calculated	Calculated	Notes
IT682	Mock	Overlying	NM	NM	9	NM	NM	NM	NM	30	28	7.5	16.0	289.15	9.26	NM	6.66	NM	Mock test to determine if test salinity & pH would be in range. MK
	Mock	Overlying									28			273.15					
	Mock	Overlying									28			273.15					
	Mock	Overlying									28			273.15					
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ORGANISM RECEIPT LOG

Date:	Time:	Batch No.
9/2/21	1215	NWA090221

Organism:

① Northwest Amphipod, LLC

Source / Supplier:

Eohaustorius estuarius

No. Ordered:	No. Received:	Source Batch: Collection date, hatch date, etc.):
726 ~~~145~~ ②	~~~145~~ ② 726 ± 10%	collected 8/31/21

Condition of Organisms:	Approximate Size or Age: (Days from hatch, life stage, size class, etc.):
good	3.5mm

Shipper:	B of L (Tracking No.)
FedEx	815291691392

Condition of Container:	Received By:
Good	MS

Container	D.O. (mg/L)	Temp. (°C)	Cond. or Sal. (Include Units)	pH (Units)	# Dead	% Dead*	Tech. (Initials)
1	②	12.9°C			0	—	MS

**if >10% contact lab manager*

Notes: ② received on moist sand

① switched spots - MS 9/2 ② IE. MK 9/3.

Northwest Amphipod, LLC
3101 SE Ferry Slip Rd #803, P.O. Box 542, Newport, OR 97365
Tel: 541-867-7225, nwamphipod@gmail.com

NWA 090221

SUBJECT: Animal Collection Data Sheet (shipping)

SOLD TO:

EcoAnalysts
4770 NE View Dr.
P.O. Box 216
Port Gamble WA 98364

Brian Hester/Collin Ray/Hillary Eicholer, Michelle Knowlen, Lauren Brandkamp, Julia Levengood
360.297.6040
Julia Levengood
360.509.4141

FedEx# 1817-5747-7

P.O. # 2110

DATE OF SHIPMENT: 9-1-21

ANIMAL HISTORY

Species	Age/Size	Number Shipped
Eohaustorius estuarius	3-5mm	726 + 10%

WATER QUALITY AT TIME OF SHIPMENT

Temperature (°C): 14.6	pH: 8-1	Salinity (ppt): 34.5	D.O. (mg/L): 8-3
Other:			

PACKAGED BY: GAB **DATE:** 9-1-2021

FIELD COLLECTION/CULTURE NOTES

Collected 8-31-21 from Yaquina Bay, OR
Interstitial WQ: Temp 8.0°C, Salinity 40.0 ppt; salinity adjusted ~5 ppt up or down as needed.
Held at ~15°C in aerated water.

ADDITIONAL COMMENTS

2-liters of 0.5 mm sieved home sediment included.

PLEASE RETURN ALL SHIPPING MATERIALS
If you have any questions, please call Yves Nakahama, Gary Buhler or Gerald Irissarri at (541) 867-7225.
Thank You.

ORGANISM RECEIPT LOG

Date:	Time:	Batch No.
9/2/21	1315	ATS090221.01

Organism: Neanthes a.

Source / Supplier: Aquatic Toxicology Support

No. Ordered:	No. Received:	Source Batch: Collection date, hatch date, etc.):
462	~508	8/18/21

Condition of Organisms:	Approximate Size or Age: (Days from hatch, life stage, size class, etc.):
Good	① ~~8/18/21~~ 15 days

Shipper:	B of L (Tracking No.)
Courier	NA

Condition of Container:	Received By:
Good	SH

Container	D.O. (mg/L)	Temp. (°C)	Cond. or Sal. (Include Units)	pH (Units)	# Dead	% Dead*	Tech. (Initials)
1-5	22.9	21.4	31 ppt	7.7	0	—	SH

*if >10% contact lab manager

Notes: ① D.W.C. – SH ~~8~~ ② 9/2/21 ② wrong date - SH 9/2/21

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

Order Summary

Species: *Neanthes arenaceodentata**	Emerge Date: 18 Aug '21
Number Ordered: 462	Number Shipped: 462 + 10%
Date Shipped: 2 Sept. '21	Salinity (ppt): 31

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

ORGANISM RECEIPT LOG

Date: 9/1/21	Time: 1630	Batch No. TS090121

Organism: Mytilus galio

Source / Supplier: Taylor Shellfish

No. Ordered:	No. Received:	Source Batch: Collection date, hatch date, etc.):
1 batch	1 batch	(1) ~~collate~~ collected 9/1

Condition of Organisms:	Approximate Size or Age: (Days from hatch, life stage, size class, etc.):
Good	Adult

Shipper:	B of L (Tracking No.)
Couler / Gordon	NA

Condition of Container:	Received By:
Good	NL

Container	D.O. (mg/L)	Temp. (°C)	Cond. or Sal. (Include Units)	pH (Units)	# Dead	% Dead*	Tech. (Initials)
(2)							NL

**if >10% contact lab manager*

Notes: (1) IE - NL 9/1/21 (2) Received Dry - NL 9/1/21

MAINTENANCE LOG FOR CULTURES

ORGANISM: Eoh
LOCATION: Bath 5

Batch Number: NWA090221	Date Received: 9/2/21	Initial # of Organisms: 799

Date	Feed AM/PM	Tub No.	D.O.	Temp (°C)	Cond/ Sal ppt	pH	H_2O Change	Organisms appear healthy (Y/N)	# Mort	% Mort*	Init.	Comments
9/3/21	—	1	8.4	14.7	28	7.9	N	Y	6	<1%	MK	
9/4/21	—	1	8.2	15.4	28	8.0	Y	Y	—	—	NL	
9/5/21	—	1	7.7	16.1	28	7.9	Y	Y	—	—	NL	
9/6/21	—	1	8.0	15.5	29	8.0	N	Y	—	—	DM	

end of culture

FT = Flow-through
*if >10% notify lab manager

MAINTENANCE LOG FOR CULTURES

ORGANISM: Neanthes
LOCATION: Bath 6

Batch Number: ATS090221.01	Date Received: 9/2/21	Initial # of Organisms: SDB

Date	Feed AM/PM	Tub No.	D.O.	Temp (°C)	Cond/ Sal ppt	pH	H_2O Change	Organisms appear healthy (Y/N)	# Mort	% Mort*	Init.	Comments
9/3/21	—	1	7.8	19.9	31	7.9	N	Y	—		MK	
9/3/21	—	2	7.8	20.1	31	8.0	N	Y	—		MK	
9/3/21	—	3	7.6	20.1	31	8.0	N	Y	—		MK	
9/3/21	—	4	7.5	20.3	30	8.0	N	Y	—		MK	
9/3/21	—	5	7.4	20.3	30	8.0	N	Y	—		MK	
9/4/21	—	1	7.3	20.3	31	8.0	Y	Y	—		NL	
9/4/21	—	2	7.1	20.1	31	7.9	Y	Y	—		NL	
9/5/21	—	1	6.8	20.9	31	7.9	Y	Y	—		NL	
9/5/21	—	2	7.2	20.6	30	7.9	Y	Y	—		NL	
9/6/21	—	1	7.5	20.5	31	7.9	N	Y	—		DM	
↓	—	2	7.3	20.3	31	8.0	N	Y	—		DM	

FT = Flow-through
if >10% notify lab manager

MAINTENANCE LOG FOR CULTURES

ORGANISM: Mussels
LOCATION: B Culture Tub #3

Batch Number: TS090121	Date Received: 9/1/21	Initial # of Organisms:

Date	Feed AM	Feed PM	Tub No.	D.O.	Temp (°C)	Cond/ Sal	pH	H_2O Change	Organisms appear healthy (Y/N)	# Mort	% Mort*	Init.	Comments
9/8/21	—	✓	1	6.7	14.5	31	7.8	FT	Y	0	—	SH	
9/10/21	✓		1	5.6	13.9	30	7.7	FT	Y	—	—	MS	
9/13/21	✓		1	6.4	15.6	31	7.6	FT	Y	—	—	MS	
9/15/21	✓		1	6.3	15.2	31	7.6	FT	Y	—	—	MS	
9/20/21		✓	1	6.4	15.3	30	7.6	FT	Y	—	—	MS	
9/22/21	✓		1	6.2	13.5	30	7.7	FT	Y	—	—	MS	
9/24/21	✓		1	6.6	15.2	30	7.6	FT	Y	0	—	SH	
9/27/21	✓		1	6.9	14.1	30	7.7	FT	Y	0	—	SH	

FT = Flow-through
*if >10% notify lab manager