Wyckoff Groundwater Treatment Plant: Second Quarter 2023 Bioassay Monitoring

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1. Introduction

This technical memorandum summarizes information obtained from the second quarter 2023 sampling event performed at the U.S. Environmental Protection Agency (EPA) Wyckoff/Eagle Harbor Superfund Site (the Site) groundwater treatment plant (GWTP) located at 5350 Creosote Place NE, Bainbridge Island, Washington. CH2M HILL Engineers, Inc. (CH2M)[1] conducted this sampling event to support the current biomonitoring requirements of the Site's National Pollutant Discharge Elimination System (NPDES).

Sampling was generally conducted in accordance with the final *Quality Assurance Project Plan, Groundwater Treatment Plant Operations and Maintenance* (QAPP; CH2M, 2022). While there were deviations from the QAPP as noted in the Laboratory Quality Data Review section, the data is deemed usable, and the sampling is considered to have met the monitoring requirements of the NPDES permit.

The current NPDES permit does not include effluent limits for chronic toxicity. Chronic toxicity testing was conducted on the effluent samples per the requirements outlined in the NPDES permit. The current NPDES permit does not include specific dilution series for chronic toxicity tests. For the mussel larvae chronic toxicity testing conducted during the second quarter 2023 sampling event, 100 percent effluent is the highest concentration tested due to the addition of artificial sea salts to achieve a salinity of 30 parts per trillion (ppt) per the *Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995).

No statistically significant effects on the survival endpoint were observed for all test concentrations and species, indicating no evidence of the presence of chronic toxicity for the survival endpoint. A statistically significant effect was detected at the highest test concentration (100 percent effluent concentration) for the development endpoint of the chronic toxicity test.

As stated above, the current NPDES permit does not include effluent limit for chronic toxicity. The chronic toxicity test requirement section of the permit (Section II.8) specifies the following:

"*EPA and Ecology will evaluate the results to determine whether they indicate the occurrence of chronic toxicity outside the mixing zone. If it appears that this may be occurring, a toxicity evaluation and reduction plan will be prepared within 90 days. The evaluation portion of the plan may include additional toxicity testing if needed to follow up on initial results or gather information for a possible toxicity limit in the future.*"

The observed results for the chronic developmental endpoint would therefore trigger this requirement.

[1] CH2M HILL Engineers, Inc. is now a wholly owned subsidiary of Jacobs Engineering Group Inc.

2. Sampling and Analysis Results

Biomonitoring samples were collected per the monitoring frequency included in the NPDES permit. Samples were collected from a 24-hr. autosampler collection point at the effluent tank of the treatment system. Water samples were collected on April 11, 2023. Chemical testing was conducted on a split of each sample collected for bioassay testing per the NPDES permit requirement. The bioassays were performed by EcoAnalysts, Inc. (EcoAnalysts), Port Gamble, Washington, a Washington State Department of Ecology accredited lab. Table 1 lists the sample Laboratory ID and sampling analysis methods. EcoAnalysts sampling analysis report for chronic toxicity testing is provided in Attachment 1.

Table 1. Biological Testing Summary

Laboratory	Laboratory ID	Method	Test Type/Descriptor/Species
EcoAnalysts	P230411.01	EPA/600/R-95-136 Method 1005.0; ASTM E724-89 TOX042.12	Chronic/48-hr Survival and Development/*Mytilus galloprovincialis* (Mussel)

No statistically significant effects were detected in any effluent concentration tested for the survival endpoint of the bivalve test. This result indicates a No Observed Effect Concentration of 100 percent of the effluent concentration and a chronic toxic unit of 1. A statistically significant effect was detected in the 100 percent effluent concentration for the development endpoint, which results in a No Observed Effect Concentration (NOEC) of 50 and a chronic toxic unit of 2. Overall, the Effect Concentration 50 is expected to affect 50 percent of the organisms and determined to be greater than 100 percent of the effluent concentration.

3. Laboratory Quality Data Review

A CH2M chemist validated the bioassay results Stage 2A in accordance with the QAPP. Additional examination of the data beyond the data validation scope was performed because a statistically significant biological response by the test organism was observed. The QAPP (CH2M 2022) was cited by EcoAnalysts and the appropriate species of mussel specified in the QAPP was used for the analytical testing.

The data were 100 percent complete, and method and QAPP quality control requirements were met, with the following exceptions noted:

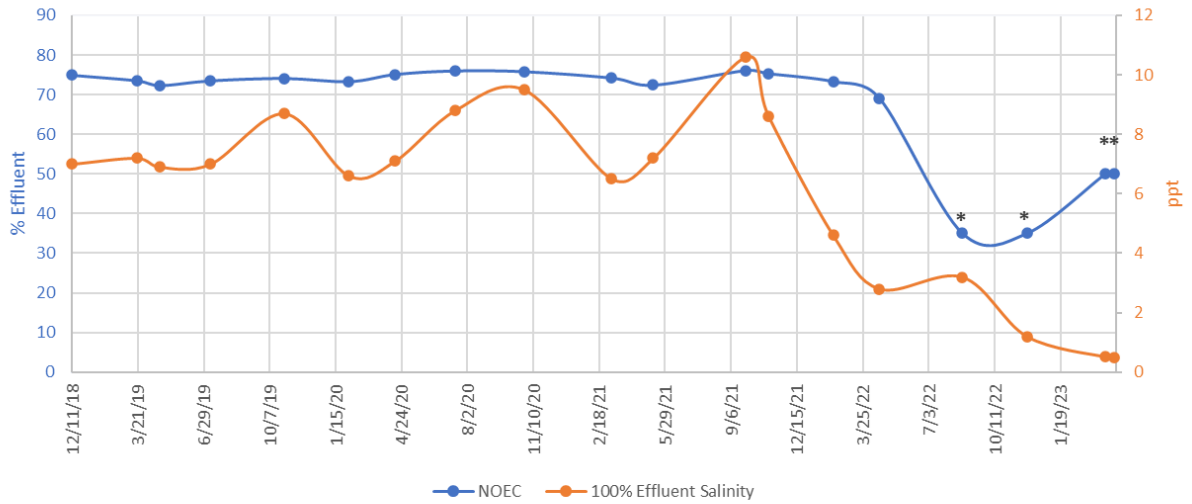
1. The QAPP reference toxicant copper sulfate was not used. The reference toxicant utilized was ammonia. A review of the total and unionized ammonia quality control data indicates the ammonia reference toxicant test results were within two standard deviations of the laboratory mean at the time of testing. There is no impact to the data and an addendum to the QAPP to utilize ammonia as reference toxicant has been requested in May 2023 after these samples were collected and analyzed.
2. The EPA method indicates that hypersaline brine (HSB) is to be used to adjust salinity. EcoAnalysts utilized artificial sea salts to adjust salinity. The method indicates that the use artificial sea salts is only necessary when high effluent concentrations preclude the use of HSB alone. The use of HSB was discussed with EcoAnalysts in May 2023 after these samples were collected and analyzed. EcoAnalysts has indicated they will follow method specification going forward.

4. Trends

A review of bioassay data collected from 2007 through the second quarter of 2023 indicated there were no statistically significant effect detected for the survival endpoint for any test concentrations and species. No statistically significant effect was detected for the sublethal endpoints with the exception for the sampling events since the third quarter of 2022. For these four sampling events, statistically significant effects were detected in the maximum test concentrations for the developmental endpoint of the chronic bioassay test.

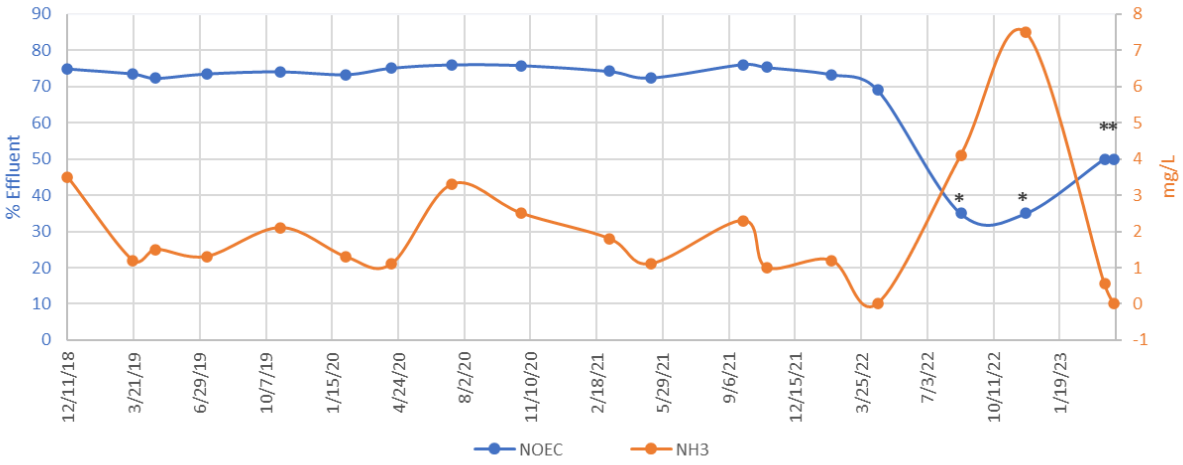
Figure 1 shows the bivalve chronic bioassay NOEC and salinity for the 100 percent effluent samples from December 2018 through April 2023. NOEC for bivalve chronic bioassay tests conducted prior to December 2018 were 70 percent. HSB with a fixed concentration was used for the salinity adjustment for chronic toxicity testing conducted prior to December 2018, therefore the maximum test concentrations remained the same for that test period. The laboratories that conducted the testing from December 2018 to November 2022 used HSB created at their laboratory (i.e. concentration varies slightly from batch to batch), therefore the resulting maximum test concentrations varies slightly for the different monitoring events. The maximum test concentration for the current quarter (i.e. first and second quarter of 2023) is higher than previous monitoring events (i.e. 100 percent versus ~70 percent) due to the use of artificial sea salts as opposed to HSB. This resulted in a higher NOEC than those reported for the third and fourth quarter of 2022 despite a statistically significant effect was only observed in the maximum test concentration in the samples in all three sampling events. A review of the water quality parameters measured for the bioassay samples indicated the lowest detected salinity levels were detected in the samples collected from the most recent four sampling events (see Figure 1). While the elevated ammonia concentrations detected in the third and fourth quarter 2022 may have contributed to the observed toxicity during those sampling events, ammonia does not appear to be contributing to the toxicity observed in the monitoring events for the first and second quarter of 2023 (see Figure 2).

Figure 1. Trends in Bivalve (*Mytilus galloprovincialis*) Chronic Bioassay NOEC and 100% Effluent Salinity (Dec 2018- April 2023)



* Statistically significant effect detected in the maximum test concentration

Figure 2. Trends in Bivalve (*Mytilus galloprovincialis*) Chronic Bioassay NOEC and 100% Effluent Ammonia Concentration (Dec 2018- April 2023)



* Statistically significant effect detected in the maximum test concentration

5. Overall Assessment

While the current NPDES permit does not include specific whole effluent toxicity (WET) limits, the Washington Administrative Code (WAC) 173-205-020 specifies the following:

> *"Whole effluent toxicity performance standard" means a level of effluent toxicity that is consistently so much lower than is necessary to meet state water quality standards (chapter 173-201A WAC) that no reasonable potential exists to violate the water quality standards. For acute toxicity, the performance standard is the median survival in one hundred percent effluent being equal to or greater than eighty percent and no individual test result showing less than sixty-five percent survival in one hundred percent effluent. For chronic toxicity, the performance standard is no chronic toxicity test demonstrating a statistically significant difference in response between the control and a test concentration equal to the acute critical effluent concentration. For permittees that are ineligible for an approved mixing zone, the performance standard will equal or be close to equal (in the case of acute toxicity) the water quality-based effluent toxicity limit.*

Based on sampling results, the survival endpoint of the chronic toxicity test met the WET performance standard because survival rates were within acceptable limits. While the development endpoint of the chronic toxicity test showed a statistically significant response relative to the lab control, uncertainty exists as the observed toxicity may be related to salinity adjustment using artificial sea salts. As there are no established chronic toxicity criteria included in the permit, CH2M recommends an accelerated schedule of WET testing to establish whether a pattern of chronic toxicity exists. Consistent with WAC 173-205-090(1)(b), it is recommended that the accelerated testing to be conducted monthly for three months using the same toxicity test as in the routine effluent WET testing where a statistically significant effect is detected. Due to uncertainties with the toxicity results relating to the deviations identified in Section 3, CH2M recommends triggering of the accelerated testing: 1) after EcoAnalysts switch to the use of HSB for salinity adjustment, 2) if the testing meets EPA test acceptability criteria, and 3) a statistically significant effect is detected when compared to the lab control.

CH2M will provide recommendations for next steps after review of bioassay data collected after EcoAnalysts makes the necessary adjustments to the testing procedures listed in Section 3.

6. References

CH2M HILL Engineers, Inc. (CH2M, now a wholly owned subsidiary of Jacobs Engineering Group Inc.). 2022. *Quality Assurance Project Plan, Groundwater Treatment Plant Operations and Maintenance.* Final. Prepared for Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington, U.S. Environmental Protection Agency, Region 10, Seattle, Washington. January.

EPA. 1995. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms, 1st ed.* EPA/600/R-95/136. U.S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, OH.

Washington Administrative Code (WAC) 173-205-020, "*Definitions*." Available at: https://app.leg.wa.gov/WAC/default.aspx?cite=173-205-020

WAC 173-205-090, "*Response to noncompliance with whole effluent toxicity limits.*" Available at: https://app.leg.wa.gov/WAC/default.aspx?cite=173-205-090

Attachment 1
EcoAnalysts Toxicity Testing Results
Wyckoff/Eagle Harbor Superfund Groundwater Treatment Plant

EcoAnalysts, Inc.

TOXICITY TESTING RESULTS

WYCKOFF/EAGLE HARBOR SUPERFUND SITE GROUNDWATER TREATMENT PLANT
BAINBRIDGE ISLAND, WA

NPDES TOXICITY TESTING: 2ND QUARTER 2023

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Contract: 68HE0318D0004
Task Order No: 68HE0722F0011

EcoAnalysts Report ID: PG1799Q2.01

Submittal Date: May 11, 2023

NELAP ACCREDITED TNI LABORATORY
Accredited in accordance with NELAP, ORELAP ID 4165

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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TABLES

APPENDICES

ACRONYMS AND ABBREVIATIONS

EC_{50}:	Effect Concentration to 50% of test population
EPA:	Environmental Protection Agency
LC_{50}:	Lethal Concentration to 50% of test population
LOEL:	Lowest Observed Effect Level
NOEL:	No Observed Effect Level
NPDES:	National Pollutant Discharge Elimination System
PMSD:	Percent Minimum Significant Difference
QAPP:	Quality Assurance Project Plan
QM:	Quality Manual
SOP:	Standard Operating Procedures
WET:	Whole Effluent Toxicity

1. EXECUTIVE SUMMARY

EcoAnalysts conducted Whole Effluent Toxicity (WET) testing as part of the biological compliance monitoring for Wyckoff/Eagle Harbor Superfund Site, in Bainbridge Island, Washington. The objective of this program was to assess the potential toxicity of discharge water to selected aquatic organisms following procedures defined under the facility's Quality Assurance Project Plan (QAPP) (CH2M HILL 2022). The results of the toxicity testing are contained in this report.

A statistically significant biological response of the test organisms was detected at the 100% effluent sample concentration for the proportional normal endpoint (Table 1-1).

Table 1-1. Toxicity Test Results Summary.

Test		NOEL (%)	LOEL (%)	LC_{50}/EC_{50} (%)
Chronic	*Mytilus galloprovincialis* 48-Hour Proportion Survived	100	>100	>100
	Mytilus galloprovincialis 48-Hour Proportion Normal	50	100	>100

NOEL = No Observed Effect Level
LOEL = Lowest Observed Effect Level
LC_{50}/EC_{50} = Lethal/Effect Concentration to 50% of test population

2. METHODS

The sample was analyzed for toxicity using criteria outlined in ASTM E724-89 and the Environmental Protection Agency's (EPA) most recently promulgated effluent guidance documents outlined in Section 4.

To evaluate the relative sensitivity of the organisms, reference toxicity tests were performed using standard reference toxicants (Lee 1980).

2.1 Sample Collection and Storage

Jacobs personnel collected a sample on April 11, 2023. The sample was transported by courier and received at the laboratory on the same day as collection. The sample temperature upon receipt was 0.5°C, below the 6°C threshold.

Additional sample conditions are summarized in Table 2-1. The samples were held in a walk-in cold room at 4 ± 2 °C in the dark until utilized for testing.

Table 2-1. Sample Conditions upon Receipt

Sample	041123
Laboratory ID	P230411.01
Date/Time sampled	4/11/23; 0127
Date/Time received	4/11/23; 1305
Dissolved Oxygen (mg/L) Recommended: >4.0 mg/L	9.0
Temperature (°C) Recommended: 0 – 6°C	0.5
pH (units) Recommended: 6 – 9	7.6
Conductivity (µS/cm)	843
Salinity (ppt)	0.5
Total Chlorine (mg/L)	0.01
Total Ammonia (mg/L)	0.00

2.2 Bioassay Testing

Bioassay testing for this project consisted of one chronic bioassay. The test conducted in support of this project is summarized in Table 2-2.

Table 2-2. Biological Testing Performed

Test Type	Test Descriptor	Species	Method
Chronic	48-Hour Survival and Development	*Mytilus galloprovincialis* (Mussel)	EPA/600/R-95-136 Method 1005.0; ASTM E724-89; TOX042.12

2.3 Organisms for Testing

Adult mussels (*Mytilus galloprovincialis*) were obtained from Taylor Shellfish in Shelton, Washington on April 10, 2023. They were shipped dry and maintained under ambient seawater flow-through conditions

at 12 ± 3˚C until utilized for testing. The overall health of the organisms was visually confirmed by a laboratory technician.

2.4 Water for Bioassay Testing

Seawater diluent used in this study came from the northern Hood Canal at Port Gamble, Washington. This water source has been used successfully on similar bioassay testing programs. Extensive testing on a variety of test species has shown that there is no significant potential for toxicity or bioaccumulation from this water supply. Chemical analysis of each water source is conducted and reviewed on an annual basis.

2.5 Sample Adjustment

Salinity adjustment was necessary to bring the sample within the recommended test salinity for the marine test species. The salinity of the effluent sample was adjusted with Crystal Sea® Marinemix bioassay-grade artificial salt to the desired test salinity for the marine acute and chronic tests.

Table 2-3 summarizes the salinity adjustment performed on the project sample in relation to marine test species.

An artificial salt control sample was created to evaluate any potential negative impacts to the test organisms from the salinity adjustment alone. Filtered seawater was diluted with laboratory deionized water to meet the salinity of the received effluent sample. Next, Crystal Sea® Marinemix was added to adjust the salinity to the test requirement. This sample was designated “Salt Control” and the results are discussed in the sections below.

Table 2-3. Salinity Adjustment of Project Samples

Sample ID: 041123	Sample Salinity Adjustment (ppt)
Sample 1: Collected 4/11/23	30 ± 2

2.6 Data Management and Analysis

Endpoint data was calculated for each replicate, and the mean value and standard deviation were determined for each sample concentration. 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 was reviewed for errors. Review counts were conducted on any apparent outliers.

Statistical comparisons were made according to the EPA guidance. Statistical comparisons were performed using CETIS™ software.

2.7 Quality Assurance/Quality Control

The quality assurance objectives for toxicity testing conducted by the testing laboratory are detailed in the method specific guidance documents and the laboratory’s quality manual (QM). These objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Source and Condition of Test Organisms
- Condition of Equipment
- Test Conditions
- Instrument Calibration
- Use of Reference Toxicants
- Record Keeping

- Data Evaluation

The batch of test organisms obtained was evaluated in a reference toxicant test that was run concurrently with the test period to establish the sensitivity of the test organisms. The reference toxicant LC_{50} or EC_{50} should fall within two standard deviations of the historical laboratory mean. Water quality measurements were monitored to ensure that they fell within prescribed limits.

The methods employed in every phase of the toxicity testing program are detailed in the EcoAnalysts Standard Operating Procedures (SOP). All EcoAnalysts staff members receive regular, documented training in all SOPs and test methods. Finally, all data collected and produced because of these analyses were recorded on approved data sheets. If an aspect of a test deviated from protocol, the test was evaluated to determine whether it was valid according to the regulatory agencies responsible for approval of the proposed permitting action.

3. RESULTS

The results of the effluent testing are presented in this section. Statistical comparisons and laboratory documents are provided in Appendix A. Chain-of-custody and sample receipt logs are provided in Appendix B.

3.1 *Mytilus galloprovincialis* Test Results

The chronic toxicity test with *M. galloprovincialis* was conducted on April 11, 2023. The test met EPA test acceptability criteria of ≥50% survival, ≥90% normal shell development and <25% Percent Minimum Significant Difference (PMSD) with 100% proportion survived, 95.1% proportion normal, and 2.7% PMSD for proportion normal in the laboratory control. Mean survival and proportion normal are summarized in Table 3-1. The test conditions are summarized in Table 3-2.

Concentrations of 6.25, 12.5, 25, 50, and 100% effluent were prepared utilizing laboratory water. Sample P230411.01 (received 4/11/23) was used for test initiation. Water quality parameters were within the acceptable limits throughout the duration of the 48-hour static test.

No significant difference was observed between the laboratory (dilution water) control and the salt control, indicating that the addition of artificial salts did not contribute to any negative biological effects. The statistics were run against both the dilution water and the salt control, and there was no difference in the statistical results. The 100% test concentration had significantly lower normality compared to both the dilution water and salt controls. It should be noted that the PMSD was low (2.7%), though acceptable (there is no minimum PMSD standard). As the difference in normality between the 100% and the controls was also low (8.2%), there is a chance that the statistical significance was a false positive.

The EC_{50} for the ammonia reference toxicant test was 7.8 mg/L total ammonia and was within two standard deviations of the laboratory mean (Table 3-2) at the time of testing. This indicates that the organisms are of a similar sensitivity to those previously tested at the EcoAnalysts laboratory.

Table 3-1. Results Summary for *Mytilus galloprovincialis* Embryo Development Test

Conc. (%)	Mean Proportion Survived (%)	Standard Deviation	NOEL (%)	LOEL (%)	EC_{50} Value (%)
0	100	0.0			
Salt Control	99.4	0.7			
6.25	96.7	3.4			
12.5	99.7	0.4	100[c,d]	>100[c,d]	>100
25	97.8	2.6			
50	100	0.0			
100	98.5	3.0			
Conc. (%)	**Mean Proportion Normal (%)**	**Standard Deviation**	**NOEL (%)**	**LOEL (%)**	**EC_{50} Value (%)**
0	95.1	1.6			
Salt Control	95.3	1.0			
6.25	95.7	1.0			
12.5	96.1	1.1	50[c,d]	100[c,d]	>100
25	96.5	1.6			
50	95.0	1.7			
100	**87.3**[a,b]	1.5			

BOLD = Significantly different than control; a = significant compared to dilution water control; b = significant compared to salt control; c = compared to dilution water control; d = compared to salt control
NOEL = No Observed Effect Level; LOEL = Lowest Observed Effect Level; LC_{50}/EC_{50} = Lethal/Effect Concentration to 50% of test population; proportion survived = total counted / stocking density; proportion normal = number normal/total counted;

Table 3-2. Test Condition Summary for *Mytilus galloprovincialis* Embryo Development Test.

Test Duration / Type	**48-Hour; Static**	
Species	*Mytilus galloprovincialis*	
Supplier	Taylor Shellfish	
Date acquired	4/10/23	
Test Dates	4/11/23 – 4/13/23	
Age at test initiation Recommended: <4-hour embryos	<4 hours	
Sample(s) used:	041123; P230411.01	
Holding Time at Initiation: Recommended: < 36 hours	15 hours	
Test Procedures	**EPA/600/R-95-136, Method 1005.0; SOP: TOX042.12**	
Test location	EcoAnalysts, Port Gamble, WA	
Control water / Diluent	0.45 µm-filtered, North Hood Canal seawater	
Test Lighting	16 hour light / 8 hour dark	
Test Chamber	30-mL Chamber	
Exposure volume	10 mL	
Organisms/replicate	Recommended: 150 –300	Actual: 254
Replicates/treatment	4	
Concentration/treatment	6.25, 12.5, 25, 50 and 100%	
Feeding	None	
Test solution renewal	None	
Test Water Quality		
Test Dissolved Oxygen	Recommended: > 4.0 mg/L	Actual: 7.3 – 8.6 mg/L
Test Temperature	Recommended: 16 ± 1°C	Actual: 14.9 – 17.3 °C
Test pH	Recommended: 7 – 9	Actual: 7.7 – 8.3
Test Salinity	Recommended: 30 ± 2 ppt	Actual: 29 – 32 ppt
Control performance standard (Survival, Normal shell development, PMSD)	Recommended: ≥50% survival, ≥90% normal development, <25% PMSD	Actual: 100% survival, 95.1% normal development, 2.7% PMSD; Pass
Reference Toxicant Date	4/11/23	
Reference Toxicant EC_{50}	7.8 mg/L total ammonia	
Laboratory Mean EC_{50}	6.7 mg/L total ammonia	
Acceptable Range EC_{50} (± 2 SD)	3.5 – 12.9 mg/L total ammonia (within range)	
Deviations from Test Protocol	None	

4. REFERENCES

ASTM. 1989. Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Saltwater Bivalve Molluscs, E724-89. ASTM International, West Conshohocken, PA.

CETIS. 2022. CETIS™ Comprehensive Environmental Toxicity Information System User's Guide. Tidepool Scientific Software. McKinleyville, CA.

CH2M HILL. 2022. Quality Assurance Project Plan, Groundwater Treatment Plant Operations and Maintenance, Final. Wyckoff/Eagle Harbor Superfund Site. Bainbridge Island, Washington.

USEPA. 1995. Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine Organisms and Estuarine Organisms, First Edition. EPA-600-R-95-136.

APPENDIX A

Statistical Comparisons and Laboratory Documents

APPENDIX A.1

Mytilus galloprovincialis 48-Hour Survival and Development Test

Statistical Comparison and Laboratory Data Sheets

CETIS Summary Report

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

Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**			
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater		
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix		
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish	**Age:**	<4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W		
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff		
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123		
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff				

Multiple Comparison Summary — Against dilution control

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	PMSD	TU	S
13-4273-5465	Proportion Normal	Dunnett Multiple Comparison Test		50	100	70.71	2.73%	2	1
15-7875-5056	Proportion Survived	Steel Many-One Rank Sum Test		100	>100	---	2.56%	1	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
10-6814-5445	Proportion Normal	Linear Interpolation (ICPIN)	✓	EC15	>100	---	---	<1	1
			✓	EC20	>100	---	---	<1	
			✓	EC25	>100	---	---	<1	
			✓	EC40	>100	---	---	<1	
			✓	EC50	>100	---	---	<1	
13-7435-1578	Proportion Survived	Linear Interpolation (ICPIN)	✓	EC15	>100	---	---	<1	1
			✓	EC20	>100	---	---	<1	
			✓	EC25	>100	---	---	<1	
			✓	EC40	>100	---	---	<1	
			✓	EC50	>100	---	---	<1	

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
10-6814-5445	Proportion Normal	Control Resp	0.9507	0.9	<<	Yes	Passes Criteria
13-4273-5465	Proportion Normal	Control Resp	0.9507	0.9	<<	Yes	Passes Criteria
13-7435-1578	Proportion Survived	Control Resp	1	0.5	<<	Yes	Passes Criteria
15-7875-5056	Proportion Survived	Control Resp	1	0.5	<<	Yes	Passes Criteria

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	4	0.9507	0.9250	0.9764	0.9345	0.9672	0.0081	0.0162	1.70%	0.00%
0	SC	4	0.9529	0.9366	0.9692	0.9377	0.9602	0.0051	0.0102	1.07%	-0.23%
6.25		4	0.9567	0.9414	0.9721	0.9426	0.9640	0.0048	0.0096	1.01%	-0.64%
12.5		4	0.9605	0.9439	0.9772	0.9476	0.9723	0.0052	0.0105	1.09%	-1.04%
25		4	0.9649	0.9400	0.9898	0.9419	0.9767	0.0078	0.0156	1.62%	-1.50%
50		4	0.9503	0.9235	0.9771	0.9370	0.9745	0.0084	0.0169	1.77%	0.04%
100		4	0.8729	0.8493	0.8966	0.8582	0.8870	0.0074	0.0148	1.70%	8.18%

Proportion Survived Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	SC	4	0.9941	0.9832	1.0050	0.9882	1.0000	0.0034	0.0068	0.69%	0.59%
6.25		4	0.9665	0.9120	1.0210	0.9213	1.0000	0.0171	0.0343	3.54%	3.35%
12.5		4	0.9970	0.9910	1.0030	0.9921	1.0000	0.0019	0.0038	0.38%	0.30%
25		4	0.9783	0.9373	1.0190	0.9488	1.0000	0.0129	0.0258	2.64%	2.17%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	0.9852	0.9383	1.0320	0.9409	1.0000	0.0148	0.0295	3.00%	1.48%

Bivalve Larval Survival and Development Test EcoAnalysts

Proportion Normal Detail MD5: AC97CE4F7B4BDBCA87BCD976613F43AB

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.9672	0.9617	0.9345	0.9393
0	SC	0.9562	0.9574	0.9377	0.9602
6.25		0.9426	0.9640	0.9588	0.9615
12.5		0.9643	0.9723	0.9476	0.9579
25		0.9767	0.9419	0.9714	0.9696
50		0.9490	0.9745	0.9407	0.9370
100		0.8622	0.8843	0.8870	0.8582

Proportion Survived Detail MD5: 34274F2C473BCA45C41E89F9A34590F6

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.0000	1.0000	1.0000	1.0000
0	SC	0.9882	1.0000	1.0000	0.9882
6.25		0.9606	0.9843	1.0000	0.9213
12.5		0.9921	0.9961	1.0000	1.0000
25		1.0000	0.9488	0.9646	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	0.9409	1.0000

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	265/274	251/261	257/275	263/280
0	SC	240/251	270/282	256/273	241/251
6.25		230/244	241/250	256/267	225/234
12.5		243/252	246/253	253/267	250/261
25		252/258	227/241	238/245	255/263
50		242/255	267/274	254/270	253/270
100		244/283	237/268	212/239	230/268

Proportion Survived Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	254/254	254/254	254/254	254/254
0	SC	251/254	254/254	254/254	251/254
6.25		244/254	250/254	254/254	234/254
12.5		252/254	253/254	254/254	254/254
25		254/254	241/254	245/254	254/254
50		254/254	254/254	254/254	254/254
100		254/254	254/254	239/254	254/254

Bivalve Larval Survival and Development Test

EcoAnalysts

Analysis ID:	13-4273-5465	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 14:56	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	E180DCA46C11FB7FBA8A52D5BDAE3DA	**Editor ID:**	006-677-240-1
Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**	
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish **Age:** <4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff		

Agonst Dilution water control

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	50	100	70.71	2	0.02597	2.73%

Dunnett Multiple Comparison Test

Control	vs	Conc-%	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	6	-0.5603	2.407	0.05625	CDF	0.9475	Non-Significant Effect
		12.5	6	-0.9832	2.407	0.05625	CDF	0.9819	Non-Significant Effect
		25	6	-1.554	2.407	0.05625	CDF	0.9965	Non-Significant Effect
		50	6	0.009355	2.407	0.05625	CDF	0.8306	Non-Significant Effect
		100*	6	6.091	2.407	0.05625	CDF	4.8E-05	Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.9507	0.9	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.085811	0.0171622	5	15.72	<1.0E-05	Significant Effect
Error	0.0196564	0.0010920	18			
Total	0.105467		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	2.113	15.09	0.8333	Equal Variances
	Levene Equality of Variance Test	0.776	4.248	0.5796	Equal Variances
	Mod Levene Equality of Variance Test	0.3638	4.248	0.8666	Equal Variances
Distribution	Anderson-Darling A2 Test	0.3582	3.878	0.4570	Normal Distribution
	D'Agostino Kurtosis Test	0.5387	2.576	0.5901	Normal Distribution
	D'Agostino Skewness Test	0.01523	2.576	0.9878	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	0.2905	9.21	0.8648	Normal Distribution
	Kolmogorov-Smirnov D Test	0.1161	0.2056	0.5568	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9749	0.884	0.7876	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	0.9507	0.9250	0.9764	0.9505	0.9345	0.9672	0.0081	1.70%	0.00%
6.25		4	0.9567	0.9414	0.9721	0.9602	0.9426	0.9640	0.0048	1.01%	-0.64%
12.5		4	0.9605	0.9439	0.9772	0.9611	0.9476	0.9723	0.0052	1.09%	-1.04%
25		4	0.9649	0.9400	0.9898	0.9705	0.9419	0.9767	0.0078	1.62%	-1.50%
50		4	0.9503	0.9235	0.9771	0.9449	0.9370	0.9745	0.0084	1.77%	0.04%
100		4	0.8729	0.8493	0.8966	0.8733	0.8582	0.8870	0.0074	1.70%	8.18%

Bivalve Larval Survival and Development Test

EcoAnalysts

Analysis ID:	13-4273-5465	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 14:56	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	E180DCA46C11FB7FBA8A52D5BDAE3DA	**Editor ID:**	006-677-240-1

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	1.3490	1.2890	1.4090	1.3480	1.3120	1.3890	0.0189	2.80%	0.00%
6.25		4	1.3620	1.3260	1.3980	1.3700	1.3290	1.3800	0.0114	1.68%	-0.97%
12.5		4	1.3720	1.3290	1.4150	1.3720	1.3400	1.4040	0.0135	1.97%	-1.70%
25		4	1.3850	1.3220	1.4490	1.3980	1.3270	1.4180	0.0199	2.87%	-2.69%
50		4	1.3490	1.2810	1.4160	1.3340	1.3170	1.4100	0.0212	3.14%	0.02%
100		4	1.2070	1.1710	1.2420	1.2070	1.1850	1.2280	0.0112	1.85%	10.55%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.9672	0.9617	0.9345	0.9393
6.25		0.9426	0.9640	0.9588	0.9615
12.5		0.9643	0.9723	0.9476	0.9579
25		0.9767	0.9419	0.9714	0.9696
50		0.9490	0.9745	0.9407	0.9370
100		0.8622	0.8843	0.8870	0.8582

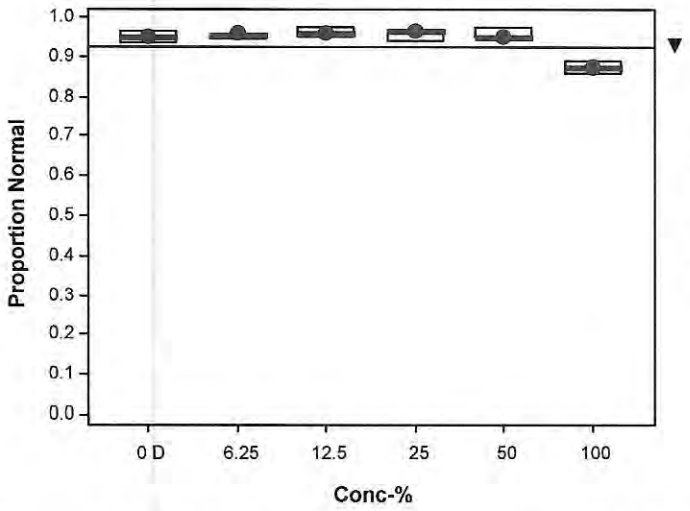
Angular (Corrected) Transformed Detail

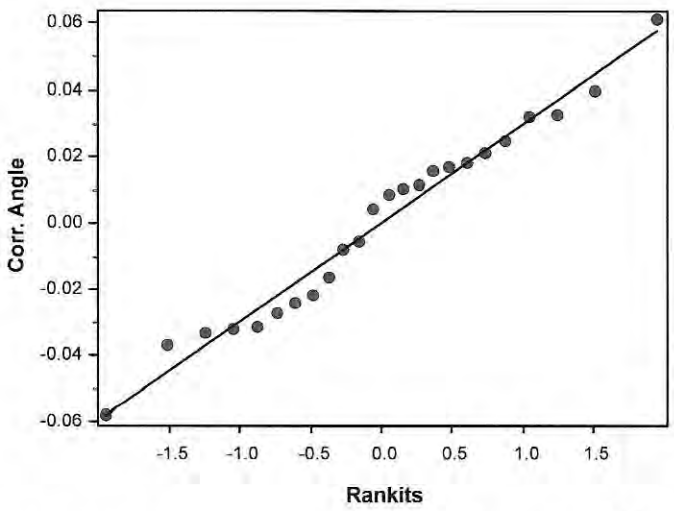
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.3890	1.3740	1.3120	1.3220
6.25		1.3290	1.3800	1.3660	1.3730
12.5		1.3810	1.4040	1.3400	1.3640
25		1.4180	1.3270	1.4010	1.3950
50		1.3430	1.4100	1.3250	1.3170
100		1.1900	1.2240	1.2280	1.1850

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	265/274	251/261	257/275	263/280
6.25		230/244	241/250	256/267	225/234
12.5		243/252	246/253	253/267	250/261
25		252/258	227/241	238/245	255/263
50		242/255	267/274	254/270	253/270
100		244/283	237/268	212/239	230/268

Graphics





Bivalve Larval Survival and Development Test

EcoAnalysts

Analysis ID:	15-7875-5056	**Endpoint:**	Proportion Survived	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 14:56	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	C97390078BCFAFC85E5C06B7C9BD7CA	**Editor ID:**	006-677-240-1
Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**	
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish **Age:** <4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	100	>100	---	1	0.02556	2.56%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	df	Test Stat	Critical	Ties	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	6	12	10	1	CDF	0.1424	Non-Significant Effect
		12.5	6	14	10	1	CDF	0.3451	Non-Significant Effect
		25	6	14	10	1	CDF	0.3451	Non-Significant Effect
		50	6	18	10	1	CDF	0.8333	Non-Significant Effect
		100	6	16	10	1	CDF	0.6105	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	1	0.5	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0540415	0.0108083	5	1.876	0.1487	Non-Significant Effect
Error	0.103693	0.0057607	18			
Total	0.157734		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test				Indeterminate
	Levene Equality of Variance Test	7.367	4.248	0.0006	Unequal Variances
	Mod Levene Equality of Variance Test	2.55	4.248	0.0651	Equal Variances
Distribution	Anderson-Darling A2 Test	0.829	3.878	0.0322	Normal Distribution
	D'Agostino Kurtosis Test	0.9441	2.576	0.3451	Normal Distribution
	D'Agostino Skewness Test	1.261	2.576	0.2074	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	2.481	9.21	0.2893	Normal Distribution
	Kolmogorov-Smirnov D Test	0.2083	0.2056	0.0084	Non-Normal Distribution
	Shapiro-Wilk W Normality Test	0.9403	0.884	0.1653	Normal Distribution

Proportion Survived Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
6.25		4	0.9665	0.9120	1.0000	0.9724	0.9213	1.0000	0.0171	3.54%	3.35%
12.5		4	0.9970	0.9911	1.0000	0.9987	0.9921	1.0000	0.0019	0.38%	0.30%
25		4	0.9783	0.9373	1.0000	0.9882	0.9488	1.0000	0.0129	2.64%	2.17%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	0.9852	0.9383	1.0000	1.0000	0.9409	1.0000	0.0148	3.00%	1.48%

Bivalve Larval Survival and Development Test EcoAnalysts

Analysis ID:	15-7875-5056	**Endpoint:**	Proportion Survived	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 14:56	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	C97390078BCFAFC85E5C06B7C9BD7CA	**Editor ID:**	006-677-240-1

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	1.5390	1.5390	1.5400	1.5390	1.5390	1.5390	0.0000	0.00%	0.00%
6.25		4	1.4100	1.2390	1.5820	1.4080	1.2860	1.5390	0.0538	7.63%	8.38%
12.5		4	1.5170	1.4730	1.5610	1.5290	1.4820	1.5390	0.0139	1.83%	1.44%
25		4	1.4510	1.2860	1.6160	1.4870	1.3430	1.5390	0.0518	7.14%	5.76%
50		4	1.5390	1.5390	1.5400	1.5390	1.5390	1.5390	0.0000	0.00%	0.00%
100		4	1.4860	1.3160	1.6560	1.5390	1.3250	1.5390	0.0535	7.20%	3.48%

Proportion Survived Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.0000	1.0000	1.0000	1.0000
6.25		0.9606	0.9843	1.0000	0.9213
12.5		0.9921	0.9961	1.0000	1.0000
25		1.0000	0.9488	0.9646	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	0.9409	1.0000

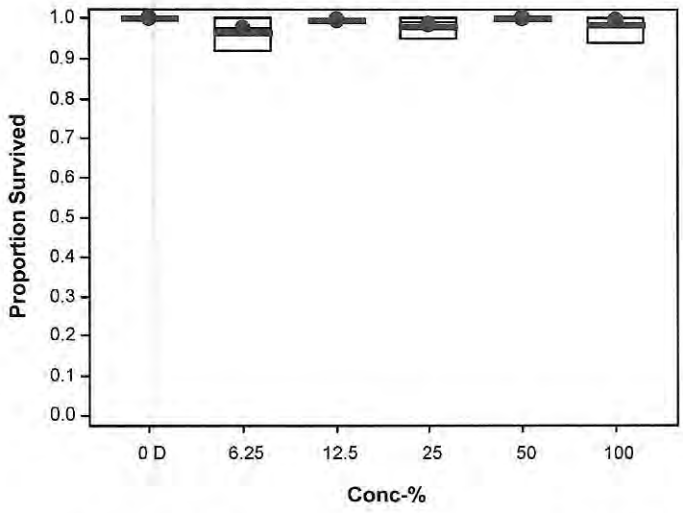
Angular (Corrected) Transformed Detail

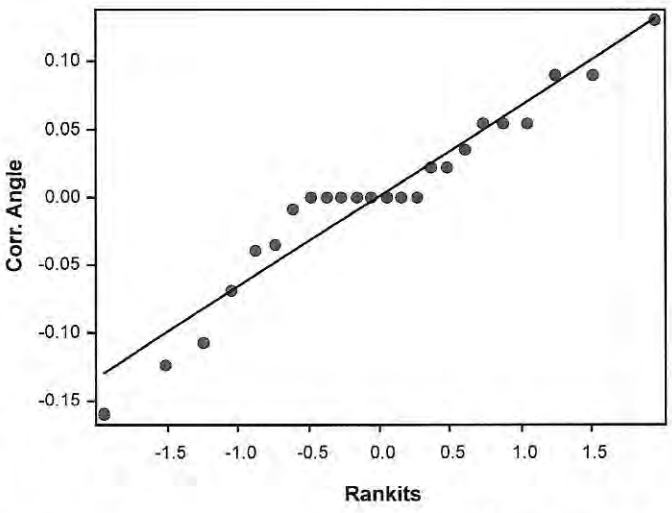
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.5390	1.5390	1.5390	1.5390
6.25		1.3710	1.4450	1.5390	1.2860
12.5		1.4820	1.5080	1.5390	1.5390
25		1.5390	1.3430	1.3810	1.5390
50		1.5390	1.5390	1.5390	1.5390
100		1.5390	1.5390	1.3250	1.5390

Proportion Survived Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	254/254	254/254	254/254	254/254
6.25		244/254	250/254	254/254	234/254
12.5		252/254	253/254	254/254	254/254
25		254/254	241/254	245/254	254/254
50		254/254	254/254	254/254	254/254
100		254/254	254/254	239/254	254/254

Graphics





CETIS Test Data Worksheet

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

Start Date:	11 Apr-23 16:39	**Species:**	Mytilus galloprovincialis	**Sample Code:**	P230411.01
End Date:	13 Apr-23 14:43	**Protocol:**	EPA/600/R-95/136 (1995)	**Sample Source:**	Jacobs Wyckoff
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Sample Station:**	041123

Conc-%	Code	Rep	Pos	Initial Density	Final Density	# Counted	# Normal	Notes
0	D	1	1	254	274	274	265	
0	D	2	26	254	261	261	251	
0	D	3	23	254	275	275	257	
0	D	4	2	254	280	280	263	
0	SC	1	20	254	251	251	240	
0	SC	2	11	254	282	282	270	
0	SC	3	17	254	273	273	256	
0	SC	4	15	254	251	251	241	
6.25		1	7	254	244	244	230	
6.25		2	14	254	250	250	241	
6.25		3	24	254	267	267	256	
6.25		4	12	254	234	234	225	
12.5		1	10	254	252	252	243	
12.5		2	28	254	253	253	246	
12.5		3	21	254	267	267	253	
12.5		4	16	254	261	261	250	
25		1	27	254	258	258	252	
25		2	19	254	241	241	227	
25		3	4	254	245	245	238	
25		4	25	254	263	263	255	
50		1	13	254	255	255	242	
50		2	6	254	274	274	267	
50		3	9	254	270	270	254	
50		4	18	254	270	270	253	
100		1	5	254	283	283	244	
100		2	3	254	268	268	237	
100		3	22	254	239	239	212	
100		4	8	254	268	268	.230	

Analyst: JV QA: MSM4

CETIS Summary Report

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

Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**			
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater		
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix		
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish	**Age:**	<4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W		
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff		
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123		
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff				

Multiple Comparison Summary — Against Salt Control

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	PMSD	TU	S
04-8050-7479	Proportion Normal	Dunnett Multiple Comparison Test	✓	50	100	70.71	2.53%	2	1
05-2590-3784	Proportion Survived	Steel Many-One Rank Sum Test	✓	100	>100	---	3.5%	1	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
14-3639-5141	Proportion Normal	Linear Interpolation (ICPIN)	✓	EC15	>100	---	---	<1	1
			✓	EC20	>100	---	---	<1	
			✓	EC25	>100	---	---	<1	
			✓	EC40	>100	---	---	<1	
			✓	EC50	>100	---	---	<1	
15-8751-8497	Proportion Survived	Linear Interpolation (ICPIN)	✓	EC15	>100	---	---	<1	1
			✓	EC20	>100	---	---	<1	
			✓	EC25	>100	---	---	<1	
			✓	EC40	>100	---	---	<1	
			✓	EC50	>100	---	---	<1	

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
04-8050-7479	Proportion Normal	Control Resp	0.9529	0.9	<<	Yes	Passes Criteria
14-3639-5141	Proportion Normal	Control Resp	0.9529	0.9	<<	Yes	Passes Criteria
05-2590-3784	Proportion Survived	Control Resp	0.9941	0.5	<<	Yes	Passes Criteria
15-8751-8497	Proportion Survived	Control Resp	0.9941	0.5	<<	Yes	Passes Criteria

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	4	0.9507	0.9250	0.9764	0.9345	0.9672	0.0081	0.0162	1.70%	0.00%
0	SC	4	0.9529	0.9366	0.9692	0.9377	0.9602	0.0051	0.0102	1.07%	-0.23%
6.25		4	0.9567	0.9414	0.9721	0.9426	0.9640	0.0048	0.0096	1.01%	-0.64%
12.5		4	0.9605	0.9439	0.9772	0.9476	0.9723	0.0052	0.0105	1.09%	-1.04%
25		4	0.9649	0.9400	0.9898	0.9419	0.9767	0.0078	0.0156	1.62%	-1.50%
50		4	0.9503	0.9235	0.9771	0.9370	0.9745	0.0084	0.0169	1.77%	0.04%
100		4	0.8729	0.8493	0.8966	0.8582	0.8870	0.0074	0.0148	1.70%	8.18%

Proportion Survived Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	SC	4	0.9941	0.9832	1.0050	0.9882	1.0000	0.0034	0.0068	0.69%	0.59%
6.25		4	0.9665	0.9120	1.0210	0.9213	1.0000	0.0171	0.0343	3.54%	3.35%
12.5		4	0.9970	0.9910	1.0030	0.9921	1.0000	0.0019	0.0038	0.38%	0.30%
25		4	0.9783	0.9373	1.0190	0.9488	1.0000	0.0129	0.0258	2.64%	2.17%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	0.9852	0.9383	1.0320	0.9409	1.0000	0.0148	0.0295	3.00%	1.48%

Bivalve Larval Survival and Development Test EcoAnalysts

Proportion Normal Detail MD5: AC97CE4F7B4BDBCA87BCD976613F43AB

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.9672	0.9617	0.9345	0.9393
0	SC	0.9562	0.9574	0.9377	0.9602
6.25		0.9426	0.9640	0.9588	0.9615
12.5		0.9643	0.9723	0.9476	0.9579
25		0.9767	0.9419	0.9714	0.9696
50		0.9490	0.9745	0.9407	0.9370
100		0.8622	0.8843	0.8870	0.8582

Proportion Survived Detail MD5: 34274F2C473BCA45C41E89F9A34590F6

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.0000	1.0000	1.0000	1.0000
0	SC	0.9882	1.0000	1.0000	0.9882
6.25		0.9606	0.9843	1.0000	0.9213
12.5		0.9921	0.9961	1.0000	1.0000
25		1.0000	0.9488	0.9646	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	0.9409	1.0000

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	265/274	251/261	257/275	263/280
0	SC	240/251	270/282	256/273	241/251
6.25		230/244	241/250	256/267	225/234
12.5		243/252	246/253	253/267	250/261
25		252/258	227/241	238/245	255/263
50		242/255	267/274	254/270	253/270
100		244/283	237/268	212/239	230/268

Proportion Survived Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	254/254	254/254	254/254	254/254
0	SC	251/254	254/254	254/254	251/254
6.25		244/254	250/254	254/254	234/254
12.5		252/254	253/254	254/254	254/254
25		254/254	241/254	245/254	254/254
50		254/254	254/254	254/254	254/254
100		254/254	254/254	239/254	254/254

Bivalve Larval Survival and Development Test

EcoAnalysts

Analysis ID:	04-8050-7479	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv2.1.4
Analyzed:	26 Apr-23 10:35	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	74B728472AAD8891B08EF07D2AD67213	**Editor ID:**	006-677-240-1
Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**	
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish **Age:** <4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	50	100	70.71	2	0.02415	2.53%

Dunnett Multiple Comparison Test

Control	vs	Conc-%	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Salt Control		6.25	6	-0.4288	2.407	0.0523	CDF	0.9291	Non-Significant Effect
		12.5	6	-0.8837	2.407	0.0523	CDF	0.9765	Non-Significant Effect
		25	6	-1.498	2.407	0.0523	CDF	0.9958	Non-Significant Effect
		50	6	0.1838	2.407	0.0523	CDF	0.7735	Non-Significant Effect
		100*	6	6.725	2.407	0.0523	CDF	3.3E-05	Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.9529	0.9	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0862117	0.0172423	5	18.27	<1.0E-05	Significant Effect
Error	0.0169921	0.0009440	18			
Total	0.103204		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	2.379	15.09	0.7946	Equal Variances
	Levene Equality of Variance Test	0.607	4.248	0.6956	Equal Variances
	Mod Levene Equality of Variance Test	0.2372	4.248	0.9409	Equal Variances
Distribution	Anderson-Darling A2 Test	0.525	3.878	0.1847	Normal Distribution
	D'Agostino Kurtosis Test	0.277	2.576	0.7818	Normal Distribution
	D'Agostino Skewness Test	0.1924	2.576	0.8475	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	0.1137	9.21	0.9447	Normal Distribution
	Kolmogorov-Smirnov D Test	0.1454	0.2056	0.2079	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9642	0.884	0.5282	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	4	0.9529	0.9366	0.9692	0.9568	0.9377	0.9602	0.0051	1.07%	0.00%
6.25		4	0.9567	0.9414	0.9721	0.9602	0.9426	0.9640	0.0048	1.01%	-0.41%
12.5		4	0.9605	0.9439	0.9772	0.9611	0.9476	0.9723	0.0052	1.09%	-0.80%
25		4	0.9649	0.9400	0.9898	0.9705	0.9419	0.9767	0.0078	1.62%	-1.26%
50		4	0.9503	0.9235	0.9771	0.9449	0.9370	0.9745	0.0084	1.77%	0.27%
100		4	0.8729	0.8493	0.8966	0.8733	0.8582	0.8870	0.0074	1.70%	8.39%

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

Analysis ID:	04-8050-7479	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv2.1.4
Analyzed:	26 Apr-23 10:35	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	74B728472AAD8891B08EF07D2AD67213	**Editor ID:**	006-677-240-1

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	4	1.3530	1.3160	1.3900	1.3610	1.3190	1.3700	0.0116	1.72%	0.00%
6.25		4	1.3620	1.3260	1.3980	1.3700	1.3290	1.3800	0.0114	1.68%	-0.69%
12.5		4	1.3720	1.3290	1.4150	1.3720	1.3400	1.4040	0.0135	1.97%	-1.42%
25		4	1.3850	1.3220	1.4490	1.3980	1.3270	1.4180	0.0199	2.87%	-2.41%
50		4	1.3490	1.2810	1.4160	1.3340	1.3170	1.4100	0.0212	3.14%	0.30%
100		4	1.2070	1.1710	1.2420	1.2070	1.1850	1.2280	0.0112	1.85%	10.80%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	0.9562	0.9574	0.9377	0.9602
6.25		0.9426	0.9640	0.9588	0.9615
12.5		0.9643	0.9723	0.9476	0.9579
25		0.9767	0.9419	0.9714	0.9696
50		0.9490	0.9745	0.9407	0.9370
100		0.8622	0.8843	0.8870	0.8582

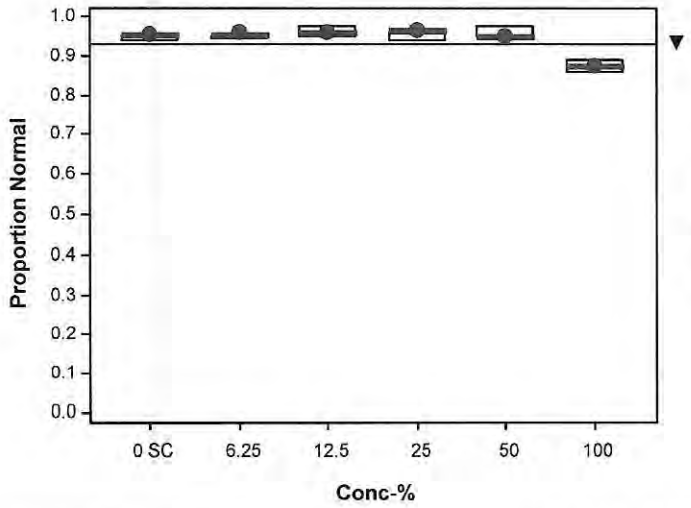
Angular (Corrected) Transformed Detail

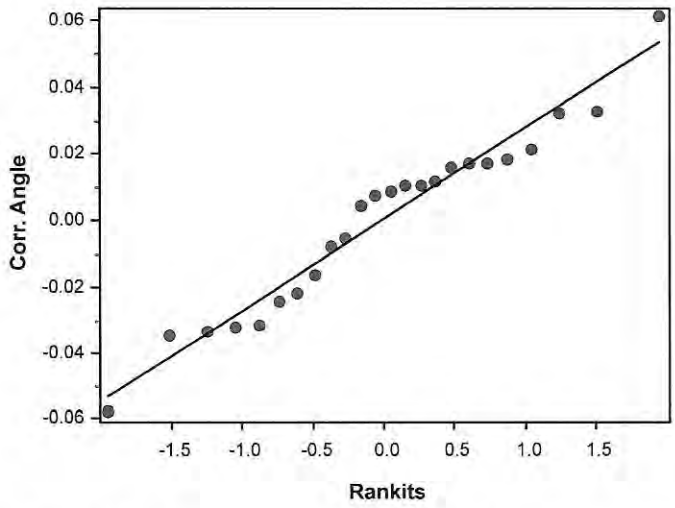
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	1.3600	1.3630	1.3190	1.3700
6.25		1.3290	1.3800	1.3660	1.3730
12.5		1.3810	1.4040	1.3400	1.3640
25		1.4180	1.3270	1.4010	1.3950
50		1.3430	1.4100	1.3250	1.3170
100		1.1900	1.2240	1.2280	1.1850

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	240/251	270/282	256/273	241/251
6.25		230/244	241/250	256/267	225/234
12.5		243/252	246/253	253/267	250/261
25		252/258	227/241	238/245	255/263
50		242/255	267/274	254/270	253/270
100		244/283	237/268	212/239	230/268

Graphics





Bivalve Larval Survival and Development Test

EcoAnalysts

Analysis ID:	05-2590-3784	**Endpoint:**	Proportion Survived	**CETIS Version:**	CETISv2.1.4
Analyzed:	26 Apr-23 10:36	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	2B4B120B481FCDD0A8B754AA78F5B06F	**Editor ID:**	006-677-240-1
Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**	
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish **Age:** <4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	100	>100	---	1	0.03475	3.50%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	df	Test Stat	Critical	Ties	P-Type	P-Value	Decision(α:5%)
Salt Control		6.25	6	13	10	2	CDF	0.2311	Non-Significant Effect
		12.5	6	20	10	2	CDF	0.9516	Non-Significant Effect
		25	6	16	10	2	CDF	0.6105	Non-Significant Effect
		50	6	22	10	2	CDF	0.9908	Non-Significant Effect
		100	6	19	10	2	CDF	0.9055	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.9941	0.5	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.043886	0.0087772	5	1.44	0.2578	Non-Significant Effect
Error	0.109701	0.0060945	18			
Total	0.153587		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test				Indeterminate
	Levene Equality of Variance Test	5.52	4.248	0.0030	Unequal Variances
	Mod Levene Equality of Variance Test	1.92	4.248	0.1408	Equal Variances
Distribution	Anderson-Darling A2 Test	0.4022	3.878	0.3629	Normal Distribution
	D'Agostino Kurtosis Test	0.555	2.576	0.5789	Normal Distribution
	D'Agostino Skewness Test	1.164	2.576	0.2444	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	1.663	9.21	0.4354	Normal Distribution
	Kolmogorov-Smirnov D Test	0.125	0.2056	0.4276	Normal Distribution
	Shapiro-Wilk W Normality Test	0.967	0.884	0.5938	Normal Distribution

Proportion Survived Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	4	0.9941	0.9832	1.0000	0.9941	0.9882	1.0000	0.0034	0.69%	0.00%
6.25		4	0.9665	0.9120	1.0000	0.9724	0.9213	1.0000	0.0171	3.54%	2.77%
12.5		4	0.9970	0.9911	1.0000	0.9987	0.9921	1.0000	0.0019	0.38%	-0.30%
25		4	0.9783	0.9373	1.0000	0.9882	0.9488	1.0000	0.0129	2.64%	1.58%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-0.59%
100		4	0.9852	0.9383	1.0000	1.0000	0.9409	1.0000	0.0148	3.00%	0.89%

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

Analysis ID:	05-2590-3784	**Endpoint:**	Proportion Survived	**CETIS Version:**	CETISv2.1.4
Analyzed:	26 Apr-23 10:36	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	2B4B120B481FCDD0A8B754AA78F5B06F	**Editor ID:**	006-677-240-1

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	4	1.5010	1.4290	1.5720	1.5010	1.4620	1.5390	0.0224	2.98%	0.00%
6.25		4	1.4100	1.2390	1.5820	1.4080	1.2860	1.5390	0.0538	7.63%	6.01%
12.5		4	1.5170	1.4730	1.5610	1.5290	1.4820	1.5390	0.0139	1.83%	-1.10%
25		4	1.4510	1.2860	1.6160	1.4870	1.3430	1.5390	0.0518	7.14%	3.33%
50		4	1.5390	1.5390	1.5400	1.5390	1.5390	1.5390	0.0000	0.00%	-2.58%
100		4	1.4860	1.3160	1.6560	1.5390	1.3250	1.5390	0.0535	7.20%	0.98%

Proportion Survived Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	0.9882	1.0000	1.0000	0.9882
6.25		0.9606	0.9843	1.0000	0.9213
12.5		0.9921	0.9961	1.0000	1.0000
25		1.0000	0.9488	0.9646	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	0.9409	1.0000

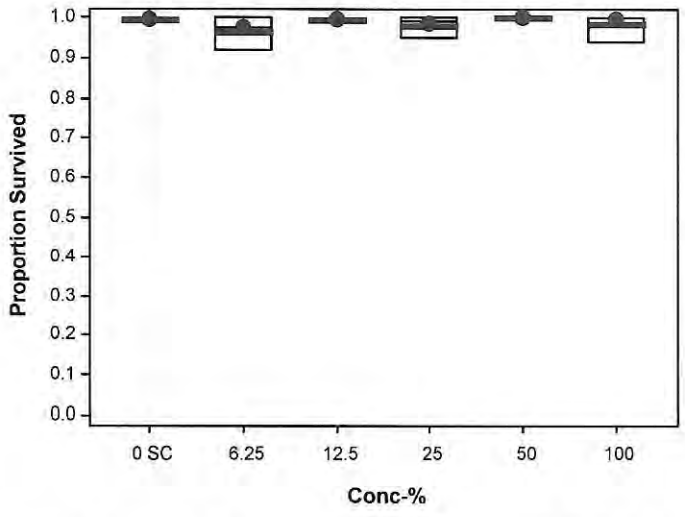
Angular (Corrected) Transformed Detail

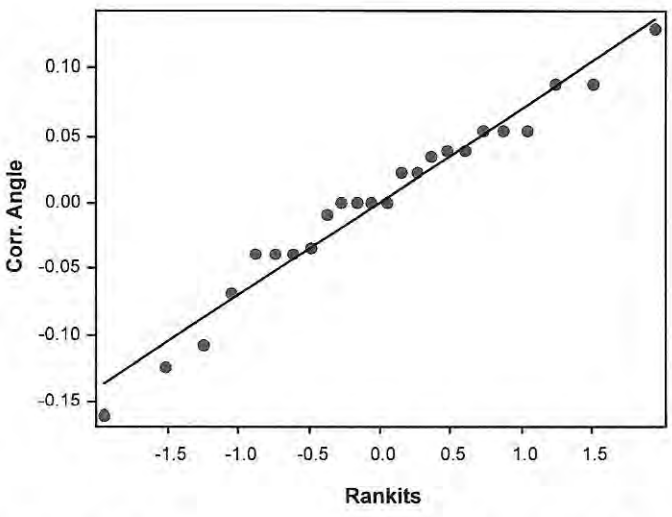
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	1.4620	1.5390	1.5390	1.4620
6.25		1.3710	1.4450	1.5390	1.2860
12.5		1.4820	1.5080	1.5390	1.5390
25		1.5390	1.3430	1.3810	1.5390
50		1.5390	1.5390	1.5390	1.5390
100		1.5390	1.5390	1.3250	1.5390

Proportion Survived Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	251/254	254/254	254/254	251/254
6.25		244/254	250/254	254/254	234/254
12.5		252/254	253/254	254/254	254/254
25		254/254	241/254	245/254	254/254
50		254/254	254/254	254/254	254/254
100		254/254	254/254	239/254	254/254

Graphics





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

Analysis ID:	19-9074-0866	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 15:00	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	11D1A41E623BF4457AB01BA4E103A2E5	**Editor ID:**	006-677-240-1

Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**		
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater	
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix	
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish	**Age:** <4h

Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Salt Control passed proportion normal endpoint	2.02%

Equal Variance t Two-Sample Test

Control I	vs	Control II	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		Salt Control	6	-0.1703	1.943	0.04307	CDF	0.5648	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.9529	0.9	<<	Yes	Passes Criteria
Control Resp	0.9507	0.9	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.851E-05	2.851E-05	1	0.02902	0.8703	Non-Significant Effect
Error	0.0058957	0.0009826	6			
Total	0.0059242		7			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Levene Equality of Variance Test	4.495	13.75	0.0783	Equal Variances
	Mod Levene Equality of Variance Test	3.077	13.75	0.1299	Equal Variances
	Variance Ratio F Test	2.649	47.47	0.4448	Equal Variances
Distribution	Anderson-Darling A2 Test	0.4461	3.878	0.2864	Normal Distribution
	Kolmogorov-Smirnov D Test	0.221	0.3313	0.3372	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9001	0.6451	0.2896	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	0.9507	0.9250	0.9764	0.9505	0.9345	0.9672	0.0081	1.70%	0.00%
0	SC	4	0.9529	0.9366	0.9692	0.9568	0.9377	0.9602	0.0051	1.07%	-0.23%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	1.3490	1.2890	1.4090	1.3480	1.3120	1.3890	0.0189	2.80%	0.00%
0	SC	4	1.3530	1.3160	1.3900	1.3610	1.3190	1.3700	0.0116	1.72%	-0.28%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.9672	0.9617	0.9345	0.9393
0	SC	0.9562	0.9574	0.9377	0.9602

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

Analysis ID:	19-9074-0866	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 15:00	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	11D1A41E623BF4457AB01BA4E103A2E5	**Editor ID:**	006-677-240-1

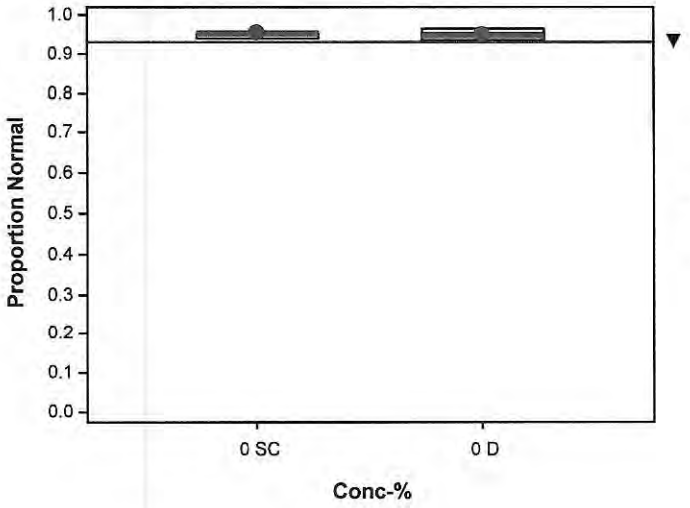
Angular (Corrected) Transformed Detail

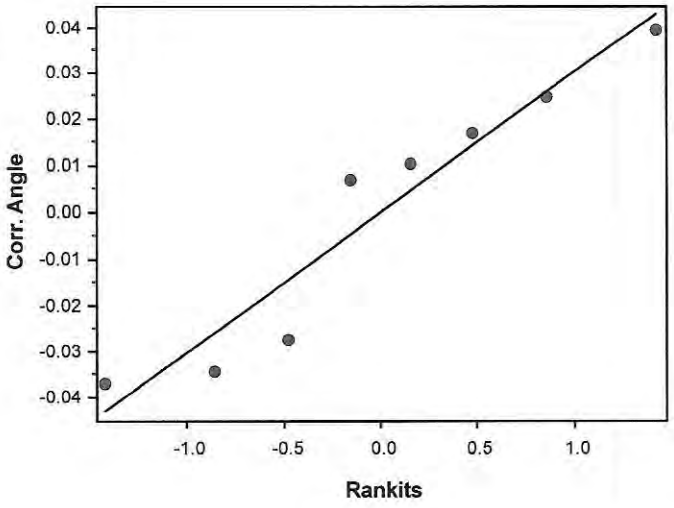
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.3890	1.3740	1.3120	1.3220
0	SC	1.3600	1.3630	1.3190	1.3700

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	265/274	251/261	257/275	263/280
0	SC	240/251	270/282	256/273	241/251

Graphics





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

Analysis ID:	08-8567-2197	**Endpoint:**	Proportion Survived	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 15:00	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	317C009E761D3EBD1AF3141C0A0E95AE	**Editor ID:**	006-677-240-1
Batch ID:	06-2153-7552	**Test Type:**	Development-Survival	**Analyst:**	
Start Date:	11 Apr-23 16:39	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater
Ending Date:	13 Apr-23 14:43	**Species:**	Mytilus galloprovincialis	**Brine:**	Crystal Sea Marine Mix
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish **Age:** <4h
Sample ID:	08-1100-2764	**Code:**	P230411.01	**Project:**	Wyckoff Eagle Harbor GWTP 2023/W
Sample Date:	11 Apr-23 01:27	**Material:**	Treated Groundwater	**Source:**	Jacobs Wyckoff
Receipt Date:	11 Apr-23 13:05	**CAS (PC):**		**Station:**	041123
Sample Age:	15h (0.5 °C)	**Client:**	Jacobs Wyckoff		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Salt Control passed proportion survived endpoint	0.70%

Unequal Variance t Two-Sample Test

Control I	vs	Control II	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		Salt Control	3	1.732	2.353	0.05266	CDF	0.0908	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.9941	0.5	<<	Yes	Passes Criteria
Control Resp	1	0.5	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0030043	0.0030043	1	3	0.1340	Non-Significant Effect
Error	0.0060087	0.0010015	6			
Total	0.0090130		7			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Variance Ratio F Test				Indeterminate
Distribution	Anderson-Darling A2 Test	0.6699	3.878	0.0804	Normal Distribution
	Kolmogorov-Smirnov D Test	0.25	0.3313	0.1599	Normal Distribution
	Shapiro-Wilk W Normality Test	0.8489	0.6451	0.0929	Normal Distribution

Proportion Survived Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0	SC	4	0.9941	0.9832	1.0000	0.9941	0.9882	1.0000	0.0034	0.69%	0.59%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	1.5390	1.5390	1.5400	1.5390	1.5390	1.5390	0.0000	0.00%	0.00%
0	SC	4	1.5010	1.4290	1.5720	1.5010	1.4620	1.5390	0.0224	2.98%	2.52%

Proportion Survived Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.0000	1.0000	1.0000	1.0000
0	SC	0.9882	1.0000	1.0000	0.9882

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	1.5390	1.5390	1.5390	1.5390
0	SC	1.4620	1.5390	1.5390	1.4620

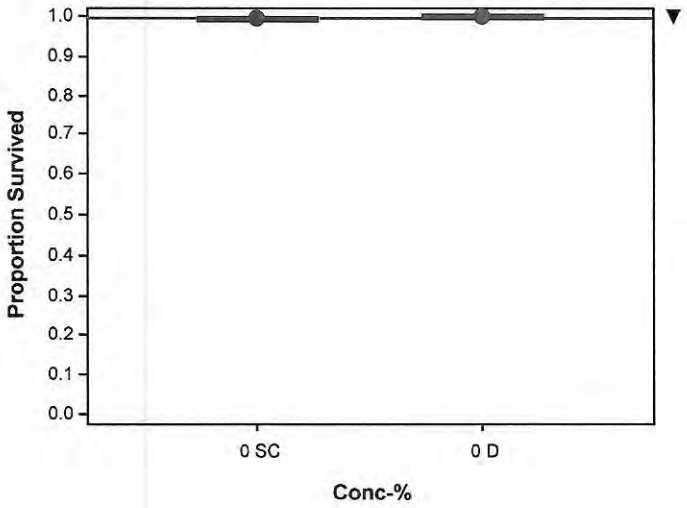
Bivalve Larval Survival and Development Test — **EcoAnalysts**

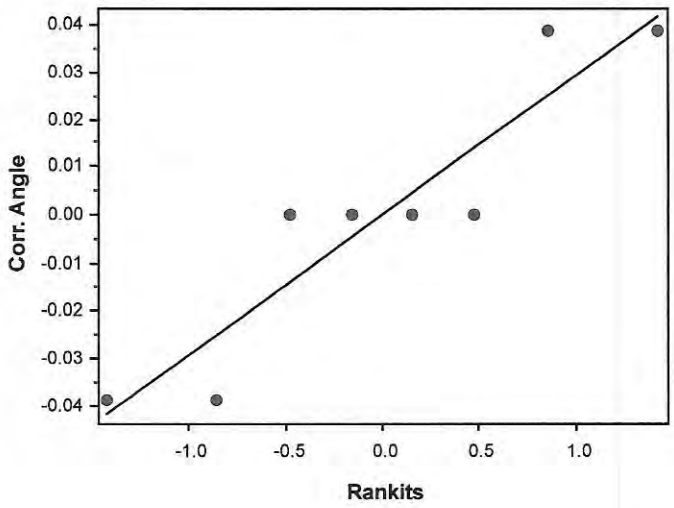
Analysis ID:	08-8567-2197	**Endpoint:**	Proportion Survived	**CETIS Version:**	CETISv2.1.4
Analyzed:	25 Apr-23 15:00	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	25 Apr-23 14:16	**MD5 Hash:**	317C009E761D3EBD1AF3141C0A0E95AE	**Editor ID:**	006-677-240-1

Proportion Survived Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	254/254	254/254	254/254	254/254
0	SC	251/254	254/254	254/254	251/254

Graphics





ECO ANALYSTS, INC.

48-Hour Chronic WET Test

Version V.2

GENERAL

Client	Jacobs- Wyckoff
Project	Wyckoff Eagle Harbor GWTP 2023/WA
Project Number	PG1799
Project Manager	J. Levengood
Date Sample Received	4/11/2023
Test type	48-Hour Chronic Toxicity Using Bivalve Larvae
Matrix	Liquid
Test Acceptability	≥90% normal shell development, ≥50% survival (mussels) or ≥70% survival (oysters), MSD <25%
Test Start Date	04/11/23
Test Species	Mytilus spp.
Organism Batch	TS041023.01
Organism Acquired	4/10/2023
Organism Acclimation	1
Organism Age	<4 hr old embryos
Test Protocol	TOX 042
Test Location	Incubator 1
Light Intensity	50-100 foot candles
Light Cycle	16L:8D
Water Description	0.45 um filtered seawater
Organisms per Replicate	150 - 300
Test Chamber Size	30 mL
Exposure Volume	10 mL
Test Dissolved Oxygen	> 4.0
Test Temperature	16 ± 1
Test Salinity	30 ± 2
Test pH	8 ± 1

Note: input lowest and highest decimal for temp

Test Parameters		
	Min	Max
DO	4.0	
Temp	15	17
Salinity	28	32
pH	7	9

TEST START TIME/INIT:	1639 DM/MS
TEST END TIME/INIT:	1443 SZ

CLIENT SAMPLE ID	LAB ID
41123	P230411.01

Salinity Adjustment CSMM Batch #
C4661304

Formalin Lot #
220304-50

Rose Bangel Batch #
5135

	Concentrations
1	Control
2	Salt Control
3	6.25%
4	12.5%
5	25%
6	50%
7	100%
8	.
9	.

ECO ANALYSTS, INC.

48-Hour Chronic WET Test

v.2

CLIENT	Jacobs- Wyckoff	**DATE RECEIVED**	3/28/23	**PROTOCOL**	TOX 042
PROJECT	Wyckoff Eagle Harbor GWTP 2023/WA	**TEST START DATE**	4/11/23	**PROJECT MANAGER**	J. Levengood
CLIENT SAMPLE ID	41123	**TEST END DATE**	4/13/23	**SPECIES**	*Mytilus spp.*
LAB SAMPLE ID	P230411.01	**MATRIX**	Liquid	**NO. OF ORGANISMS**	150 - 300

48-Hour Chronic Toxicity Using Bivalve Larvae

Day of Test	Concentration	Vol. Effluent Sample Added (mL)	Vol. Diluent Added (mL)	Total Volume (mL)	Diluent Type	FSW
0	0%	0	250.0	250		
	Salt Control	#VALUE!	#VALUE!	250		
	6.25%	15.6	234.4	250		
	12.5%	31.25	218.75	250		
	25%	62.5	187.5	250		
	50%	125	125.0	250		
	100%	250	0.0	250		

Test Dilution Prep

Date	Balance ID	Sample ID (P#)	Water Batch ID	Initials
4/11/23	5	P230411.01	FSW041123.01	LG

48-Hour Chronic WET Test

V.2

CLIENT	Jacobs- Wyckoff	**DATE RECEIVED**	4/11/23	**PROTOCOL**	TOX 042
PROJECT	Wyckoff Eagle Harbor GWTP 2023/WA	**TEST START DATE**	4/11/23	**PROJECT MANAGER**	J. Levengood
CLIENT SAMPLE ID	41123	**TEST END DATE**	4/13/23	**SPECIES**	*Mytilus spp.*
LAB SAMPLE ID	P230411.01	**MATRIX**	Liquid	**NO. OF ORGANISMS**	150 - 300

48-Hour Chronic Toxicity Using Bivalve Larvae

SPAWNING METHOD	**INITIAL SPAWNING TIME**		**FINAL SPAWNING TIME**
Heat Shock	1341		1430
MALES	**FEMALES**	**SPERM VIABILITY**	**EGG CONDITION**
2	4	Good	Good
BEGIN FERTILIZATION	**END FERTILIZATION**		**CONDITION OF EMBRYOS**
1430	1637		Good

TIME OF INITIATION	**INITIALS**
1639	DM/MS

EMBRYO DENSITY CALCULATIONS

# of embryos in 1 mL of 100X diluted embryo stock

Count 1	**Count 2**	**Mean**
152	135	143.5

 # embryos in original stock = # of embryos in diluted stock x 100

14350

Percentage of embryo stock needed = 2500 embryos per 1 mL/# embryos in original stock

0.17

mL of egg stock to add to FSW to achieve total volume = percentage of embro stock needed * 40 mL (or desired volume of embryo stock)

6.968641115 **Add this volume to beaker and dilute to 40 mL (or desired volume of embryo stock) with FSW = final embryo stock**

Add 0.1 mL of final embryo stock to test chambers

ECO ANALYSTS, INC.

48-Hour Chronic WET Test

V.2

CLIENT	Jacobs- Wyckoff	**DATE RECEIVED**	3/28/23	**PROTOCOL**	TOX 042
PROJECT	coff Eagle Harbor GWTP 2023/WA	**TEST START DATE**	4/11/23	**PROJECT MANAGER**	J. Levengood
CLIENT SAMPLE ID	41123	**TEST END DATE**	4/13/23	**SPECIES**	*Mytilus spp.*
LAB SAMPLE ID	P230411.01	**MATRIX**	Liquid	**NO. OF ORGANISMS**	150 - 300

48-Hour Chronic Toxicity Using Bivalve Larvae

		DO (mg/L)	TEMP (°C)	SALINITY (ppt)	pH
	Concentration (%)	> 4.0	15 - 17	28 - 32	7 - 9
Day 0	Control	7.9	17.3	29	7.9
Stock	Salt Control	8.3	17.0	29	8.1
Date 4/11/23	6.25%	8.3	16.9	30	7.9
Time 1448	12.5%	8.4	16.9	30	7.9
Tech LG	25%	8.4	16.9	30	7.8
Meter # 8	50%	8.5	16.6	30	7.7
	100%	8.6	16.0	30	7.7
Day 1	Control		15.9 ①		
Surrogate	Salt Control		15.9 ①		
Date 4/12/23	6.25%		15.9 ①		
Time 0959	12.5%		15.9 ①		
Tech SZ	25%		15.9 ①		
Meter # T16	50%		15.9 ①		
	100%		15.9 ①		
Day 2	Control	7.3	14.9 ①	29	7.8
Surrogate	Salt Control	7.8	14.9 ①	30	8.1
Date 4/13/23	6.25%	7.9	14.9 ①	31	8.1
Time 1029	12.5%	7.8	14.9 ①	32	8.1
Tech MS	25%	7.8	14.9 ①	31	8.2
Meter # 9	50%	7.4	14.9 ①	30	8.2
	100%	7.4	14.9 ①	30	8.3

① Temp taken from temp blank - SZ 4/12/23

ECO ANALYSTS, INC.

48-Hour Chronic WET Test

V.2

CLIENT	Jacobs- Wyckoff	**DATE RECEIVED**	3/28/23	**PROTOCOL**	TOX 042
PROJECT	Wyckoff Eagle Harbor GWTP 2023/WA	**TEST START DATE**	4/11/23	**PROJECT MANAGER**	J. Levengood
CLIENT SAMPLE ID	41123	**TEST END DATE**	4/13/23	**SPECIES**	*Mytilus spp.*
LAB SAMPLE ID	P230411.01	**MATRIX**	Liquid	**NO. OF ORGANISMS**	150 - 300

48-Hour Chronic Toxicity Using Bivalve Larvae

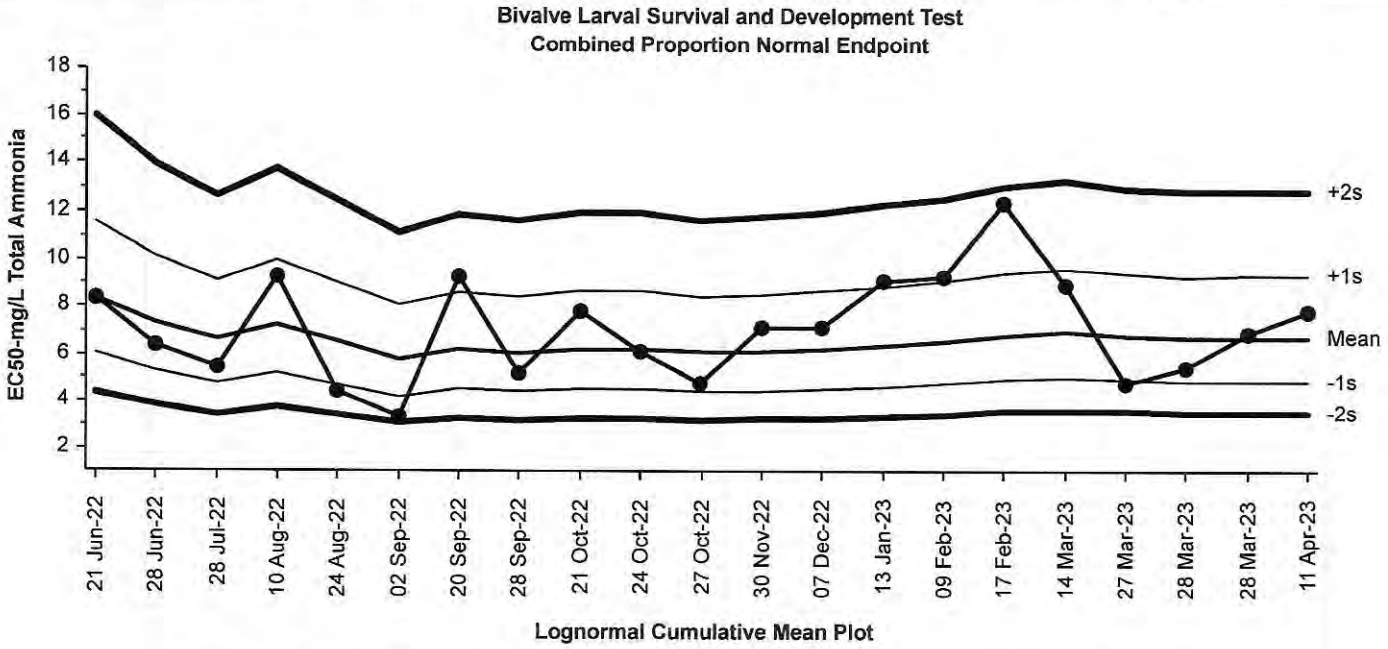
Concentration (%)	REP	Normal	Abnormal	Date	Tech	Comments/QA Counts
Stocking Density	1	264		4/21/23	NL	
	2	265		4/21/23	NL	
	3	262		4/21/23	NL	
	4	240		4/21/23	NL	
	5	234		4/21/23	NL	
	6	261		4/21/23	NL	
Control	1	265	9	4/21/23	MS	
	2	251	10	4/21/23	SZ	
	3	257	18	4/21/23	SZ	
	4	263	17	4/21/23	SZ	
Salt Control	1	240	11	4/21/23	SZ	
	2	270	12	4/21/23	SZ	
	3	256	17	4/21/23	SZ	
	4	241	10	4/21/23	SZ	
6.25%	1	230	14	4/21/23	SZ	
	2	241	9	4/21/23	SZ	N:244 A:8 244/251= 97% Δ=1% NL 4/22
	3	256	11	4/21/23	SZ	
	4	225	9	4/21/23	SZ	
12.5%	1	243	9	4/21/23	SZ	
	2	246	7	4/21/23	SZ	
	3	253	14	4/21/23	SZ	
	4	250	11	4/21/23	SZ	
25%	1	252	6	4/21/23	SZ	
	2	227	14	4/21/23	SZ	
	3	238	7	4/21/23	SZ	
	4	255	8	4/21/23	SZ	N:255 A:8 255/263 97 Δ= 0% NL 4/22
50%	1	242	13	4/21/23	SZ	N:246 A:13 246/259=95 Δ= 0% NL 4/22
	2	267	7	4/21/23	SZ	
	3	254	16	4/22/23	NL	
	4	253	17	4/22/23	NL	
100%	1	244	39	4/22/23	NL	
	2	237	31	4/22/23	NL	
	3	212	27	4/22/23	NL	
	4	230	38	4/22/23	NL	

OIE - NL 4/22

CETIS QC Plot

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

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



Lognormal Cumulative Mean Plot

Mean:	6.746	**Count:**	20	**-1s Warning Limit:**	4.87	**-2s Action Limit:**	3.52
Sigma:	NA	**CV:**	33.40%	**+1s Warning Limit:**	9.34	**+2s Action Limit:**	12.9

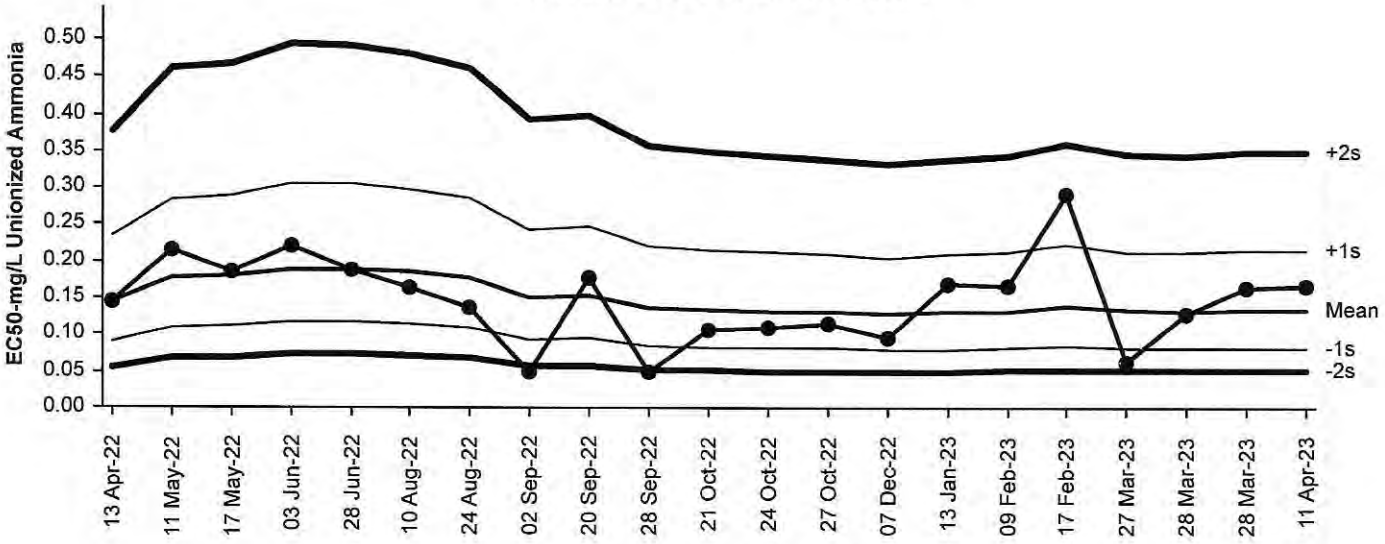
Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2022	Jun	21	17:46	8.368	1.621	0.6627			03-7983-1979	17-5961-0612	EcoAnalysts
2			28	16:05	6.362	-0.3843	-0.1805			08-5637-7603	04-5931-5430	EcoAnalysts
3		Jul	28	15:55	5.431	-1.315	-0.6671			19-6544-8440	11-0281-7196	EcoAnalysts
4		Aug	10	16:57	9.323	2.576	0.9952			20-5736-9281	08-2934-0504	EcoAnalysts
5			24	16:43	4.439	-2.307	-1.288	(-)		10-4871-9595	11-0042-4049	EcoAnalysts
6		Sep	2	14:54	3.311	-3.435	-2.19	(-)	(-)	16-0701-8534	00-0124-1152	EcoAnalysts
7			20	16:02	9.267	2.521	0.9769			11-7896-9547	00-7476-6700	EcoAnalysts
8			28	16:31	5.182	-1.565	-0.8119			10-3818-0354	11-9896-8834	EcoAnalysts
9		Oct	21	14:16	7.804	1.058	0.4483			05-2022-4267	03-4308-3965	EcoAnalysts
10			24	15:17	6.15	-0.5965	-0.2849			01-4864-2336	19-5269-5566	EcoAnalysts
11			27	17:02	4.776	-1.97	-1.063	(-)		12-4527-0974	13-7457-7890	EcoAnalysts
12		Nov	30	14:32	7.166	0.4193	0.1856			11-2220-4195	10-4569-3704	EcoAnalysts
13		Dec	7	17:43	7.159	0.4125	0.1826			19-4874-8030	20-9525-0017	EcoAnalysts
14	2023	Jan	13	15:30	9.078	2.331	0.9132			14-2219-3979	18-3945-1944	EcoAnalysts
15		Feb	9	15:28	9.246	2.5	0.9699			00-8572-7368	10-5325-0783	EcoAnalysts
16			17	14:30	12.4	5.651	1.872	(+)		20-3891-7103	06-7296-3936	EcoAnalysts
17		Mar	14	15:15	8.955	2.209	0.8715			00-9622-9067	21-3408-3763	EcoAnalysts
18			27	16:54	4.818	-1.928	-1.036	(-)		13-8989-7877	05-5295-3514	EcoAnalysts
19			28	15:46	5.455	-1.291	-0.6538			02-2233-3890	16-3797-4494	EcoAnalysts
20			28	15:47	6.941	0.1943	0.08735			01-6969-0938	06-4639-7696	EcoAnalysts
21		Apr	11	16:37	7.809	1.063	0.4502			14-1713-1401	15-2064-5147	EcoAnalysts

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

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

Bivalve Larval Survival and Development Test
Combined Proportion Normal Endpoint



Lognormal Cumulative Mean Plot

Mean:	0.1336	**Count:**	20	**-1s Warning Limit:**	0.0827	**-2s Action Limit:**	0.0512
Sigma:	NA	**CV:**	50.80%	**+1s Warning Limit:**	0.216	**+2s Action Limit:**	0.349

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID	Laboratory
1	2022	Apr	13	15:38	0.1448	0.01121	0.168			18-9475-6703	13-3543-8688	EcoAnalysts
2		May	11	15:54	0.2152	0.08161	0.9944			19-4844-7090	04-7446-5371	EcoAnalysts
3			17	16:11	0.185	0.05143	0.6792			21-0960-1917	00-4551-7197	EcoAnalysts
4		Jun	3	16:12	0.2219	0.08835	1.059	(+)		21-4199-4121	20-5427-8206	EcoAnalysts
5			28	16:05	0.188	0.05444	0.7129			19-3785-6817	00-8378-9623	EcoAnalysts
6		Aug	10	16:57	0.1651	0.03156	0.4422			09-3839-8015	12-5640-2017	EcoAnalysts
7			24	16:43	0.1359	0.00228	0.0353			00-7678-9875	07-1760-4646	EcoAnalysts
8		Sep	2	14:54	0.04851	-0.08508	-2.113	(-)	(-)	13-9573-6141	09-4475-1376	EcoAnalysts
9			20	16:02	0.1767	0.04315	0.5838			13-8303-2046	02-4939-5521	EcoAnalysts
10			28	16:31	0.04973	-0.08386	-2.061	(-)	(-)	14-4835-8902	06-7637-8760	EcoAnalysts
11		Oct	21	14:16	0.1071	-0.0265	-0.4611			20-9426-4253	15-1656-6246	EcoAnalysts
12			24	15:17	0.1096	-0.024	-0.4129			18-7734-9147	06-4748-9707	EcoAnalysts
13			27	17:02	0.1156	-0.018	-0.3018			01-3898-0369	19-9850-5740	EcoAnalysts
14		Dec	7	17:43	0.09634	-0.03725	-0.6818			15-6747-3203	15-5237-0673	EcoAnalysts
15	2023	Jan	13	15:30	0.1703	0.03673	0.5066			14-6111-3358	19-5184-9524	EcoAnalysts
16		Feb	9	15:28	0.1664	0.03277	0.4575			11-1705-9064	00-9866-2896	EcoAnalysts
17			17	14:30	0.2912	0.1576	1.625	(+)		05-8051-1741	00-4535-0428	EcoAnalysts
18		Mar	27	16:54	0.06349	-0.0701	-1.551	(-)		01-2022-2925	11-3364-1842	EcoAnalysts
19			28	15:46	0.1275	-0.00612	-0.09772			08-8126-4059	10-2993-2407	EcoAnalysts
20			28	15:47	0.1637	0.03008	0.4236			03-3638-8838	12-4289-2851	EcoAnalysts
21		Apr	11	16:37	0.1673	0.03376	0.4698			13-1124-3474	18-0348-0749	EcoAnalysts

CETIS Summary Report

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

Batch ID:	12-6778-5180	**Test Type:**	Development-Survival	**Analyst:**	Julia Levengood	
Start Date:	11 Apr-23 16:37	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater	
Ending Date:	13 Apr-23 14:42	**Species:**	Mytilus galloprovincialis	**Brine:**	Not Applicable	
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish	**Age:** <4h
Sample ID:	09-5090-7122	**Code:**	P220819.45	**Project:**	Reference Toxicant	
Sample Date:	19 Aug-22	**Material:**	Total Ammonia	**Source:**	Reference Toxicant	
Receipt Date:	19 Aug-22	**CAS (PC):**		**Station:**	P220819.45	
Sample Age:	235d 17h	**Client:**	Internal Lab			

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	PMSD	S
12-5775-8348	Combined Proportion Norma	Dunnett Multiple Comparison Test		5.55	11.2	7.884	8.77%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	S
15-2064-5147	Combined Proportion Norma	Trimmed Spearman-Kärber		EC50	7.809	7.754	7.865	1

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
12-5775-8348	Combined Proportion Norma	PMSD	0.08766	<<	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	0.9695	0.8929	1.0460	0.8976	1.0000	0.0241	0.0482	4.97%	0.00%
1.34		4	0.9026	0.7529	1.0520	0.7756	1.0000	0.0470	0.0941	10.42%	6.90%
2.64		4	0.9203	0.8346	1.0060	0.8504	0.9646	0.0269	0.0538	5.85%	5.08%
5.55		4	0.9193	0.8487	0.9899	0.8780	0.9803	0.0222	0.0444	4.83%	5.18%
11.2		4	0.0315	-0.0085	0.0715	0.0079	0.0551	0.0126	0.0251	79.71%	96.75%
18		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	---	100.00%

Combined Proportion Normal Detail — MD5: CC934FDD4CCEA65E5CF84D0504BE0F81

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.8976	0.9882	0.9921	1.0000
1.34		0.9331	1.0000	0.7756	0.9016
2.64		0.9646	0.9055	0.9606	0.8504
5.55		0.9213	0.9803	0.8976	0.8780
11.2		0.0551	0.0079	0.0118	0.0512
18		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	228/254	251/254	252/254	272/272
1.34		237/254	269/269	197/254	229/254
2.64		245/254	230/254	244/254	216/254
5.55		234/254	249/254	228/254	223/254
11.2		14/254	2/254	3/254	13/254
18		0/254	0/254	0/254	0/254

CETIS Test Data Worksheet

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

Start Date:	11 Apr-23 16:37	**Species:**	Mytilus galloprovincialis	**Sample Code:**	P220819.45
End Date:	13 Apr-23 14:42	**Protocol:**	EPA/600/R-95/136 (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	19 Aug-22	**Material:**	Total Ammonia	**Sample Station:**	P220819.45

Conc-mg/L	Code	Rep	Pos	Initial Density	Final Density	# Counted	# Normal	Notes
0	D	1	14	254	242	242	228	
0	D	2	24	254	262	262	251	
0	D	3	3	254	270	270	252	
0	D	4	23	254	286	286	272	
1.34		1	15	254	247	247	237	
1.34		2	2	254	281	281	269	
1.34		3	11	254	209	209	197	
1.34		4	6	254	239	239	229	
2.64		1	21	254	252	252	245	
2.64		2	9	254	237	237	230	
2.64		3	8	254	254	254	244	
2.64		4	17	254	226	226	216	
5.55		1	7	254	261	261	234	
5.55		2	16	254	274	274	249	
5.55		3	4	254	249	249	228	
5.55		4	10	254	248	248	223	
11.2		1	19	254	263	263	14	
11.2		2	5	254	235	235	2	
11.2		3	13	254	238	238	3	
11.2		4	20	254	289	289	13	
18		1	22	254	267	267	0	
18		2	18	254	230	230	0	
18		3	12	254	229	229	0	
18		4	1	254	268	268	0	

CETIS Summary Report

Bivalve Larval Survival and Development Test — EcoAnalysts

Batch ID:	06-0385-8455	**Test Type:**	Development-Survival	**Analyst:**	Julia Levengood		
Start Date:	11 Apr-23 16:37	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Laboratory Seawater		
Ending Date:	13 Apr-23 14:42	**Species:**	Mytilus galloprovincialis	**Brine:**	Not Applicable		
Test Length:	46h	**Taxon:**	Bivalvia	**Source:**	Taylor Shellfish	**Age:**	<4h
Sample ID:	02-6788-7277	**Code:**	P220819.45UIA	**Project:**	Reference Toxicant		
Sample Date:	19 Aug-22	**Material:**	Unionized Ammonia	**Source:**	Reference Toxicant		
Receipt Date:	19 Aug-22	**CAS (PC):**		**Station:**	P220819.45UIA		
Sample Age:	235d 17h	**Client:**	Internal Lab				

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	PMSD	S
01-0944-0679	Combined Proportion Norma	Dunnett Multiple Comparison Test		0.118	0.242	0.169	8.77%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	S
18-0348-0749	Combined Proportion Norma	Trimmed Spearman-Kärber		EC50	0.1673	0.1661	0.1686	1

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
01-0944-0679	Combined Proportion Norma	PMSD	0.08766	<<	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	0.9695	0.8929	1.0460	0.8976	1.0000	0.0241	0.0482	4.97%	0.00%
0.029		4	0.9026	0.7529	1.0520	0.7756	1.0000	0.0470	0.0941	10.42%	6.90%
0.057		4	0.9203	0.8346	1.0060	0.8504	0.9646	0.0269	0.0538	5.85%	5.08%
0.118		4	0.9193	0.8487	0.9899	0.8780	0.9803	0.0222	0.0444	4.83%	5.18%
0.242		4	0.0315	-0.0085	0.0715	0.0079	0.0551	0.0126	0.0251	79.71%	96.75%
0.308		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	---	100.00%

Combined Proportion Normal Detail — MD5: B76DD8B6FCFF97450768BA06D24ED403

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.8976	0.9882	0.9921	1.0000
0.029		0.9331	1.0000	0.7756	0.9016
0.057		0.9646	0.9055	0.9606	0.8504
0.118		0.9213	0.9803	0.8976	0.8780
0.242		0.0551	0.0079	0.0118	0.0512
0.308		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	228/254	251/254	252/254	272/272
0.029		237/254	269/269	197/254	229/254
0.057		245/254	230/254	244/254	216/254
0.118		234/254	249/254	228/254	223/254
0.242		14/254	2/254	3/254	13/254
0.308		0/254	0/254	0/254	0/254

CETIS Test Data Worksheet

Test Code/ID: P220819.45UIA / 13-1124-3474

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

Start Date:	11 Apr-23 16:37	**Species:**	Mytilus galloprovincialis	**Sample Code:**	P220819.45UIA
End Date:	13 Apr-23 14:42	**Protocol:**	EPA/600/R-95/136 (1995)	**Sample Source:**	Reference Toxicant
Sample Date:	19 Aug-22	**Material:**	Unionized Ammonia	**Sample Station:**	P220819.45UIA

Conc-mg/L	Code	Rep	Pos	Initial Density	Final Density	# Counted	# Normal	Notes
0	D	1	17	254	242	242	228	
0	D	2	2	254	262	262	251	
0	D	3	12	254	270	270	252	
0	D	4	4	254	286	286	272	
0.029		1	8	254	247	247	237	
0.029		2	13	254	281	281	269	
0.029		3	9	254	209	209	197	
0.029		4	16	254	239	239	229	
0.057		1	14	254	252	252	245	
0.057		2	15	254	237	237	230	
0.057		3	21	254	254	254	244	
0.057		4	11	254	226	226	216	
0.118		1	19	254	261	261	234	
0.118		2	23	254	274	274	249	
0.118		3	1	254	249	249	228	
0.118		4	10	254	248	248	223	
0.242		1	20	254	263	263	14	
0.242		2	18	254	235	235	2	
0.242		3	3	254	238	238	3	
0.242		4	5	254	289	289	13	
0.308		1	22	254	267	267	0	
0.308		2	6	254	230	230	0	
0.308		3	7	254	229	229	0	
0.308		4	24	254	268	268	0	

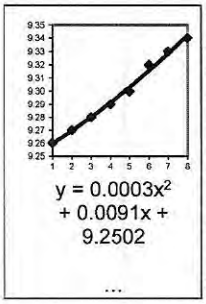
Analyst:_____ QA:_____

Un-ionized Ammonia Calculator

CLIENT:	Jacobs	Date of Test:	April 11, 2023
PROJECT:	Wyckoff	Test Type:	*Mytilus galloprovincialis*
COMMENTS:	P220819.45		

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



	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		1.34	30	7.9	15.8	288.95	9.2559		**0.029**
4	3		2.64	30	7.9	15.7	288.85	9.2559		**0.057**
5	6		5.55	30	7.9	15.4	288.55	9.2559		**0.118**
6	12		11.2	30	7.9	15.6	288.75	9.2559		**0.242**
7	18		18	30	7.8	15.5	288.65	9.2559		**0.308**
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48 Hour Bivalve Development Reference Toxicant Test

Test ID: P220819.45	Replicates: 4	Study Director: J. Levengood	Location: Incubator 1
Dilution Water Batch: FSW041123.01	Organism Batch: TS041123.01	Associated Test(s): Various	Organism: Mytilus spp.
Chamber Size/Type: 30 ml shell vial	Exposure Volume: 10 ml		
Toxicant: Ammonium Chloride		Date Prepared: 4/11/23	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: 250 mL

SPAWNING DATA

Initial Spawning Time:	Final Spawning Time: 1436	Fertilization Time: 1430	No. of Females: 4	No. of Males: 2
Embryo Density (count/mL):	1. 152	2. 135	3. —	Mean: 143.5

Stocking Volume Calculation: 2500/14350 = 0.17 x 40mL = 6.97 mL egg stock 40mL - 6.97 = 33.03mL FSW

0 Hours	Date: 4/11/23	WQ Time: 1404	Start Time: 1637	Initials: BM/MS

STOCK

	Control	1.5	3	6	12	18
D.O. (%) (>4.0 mg/L)	8.0	8.4	8.5	8.5	8.6	8.6
Temperature (16 ± 1°C)	16.4	15.8	15.7	15.4	15.6	15.5
Salinity (30 ± 2 ppt)	29	30	30	30	30	30
pH (6-9)	7.9	7.9	7.9	7.9	7.9	7.8
Meter #	8	8	8	8	8	8

Day 1	Temperature (16 ± 1°C)	15.9	Meter #	T16	Initials: SZ
Day 2	Date: 4/13/23	WQ Time: 1038 MS		End Time: 1442	Initials: SZ
		Formalin Lot #: 220304-50		Rose Bengal Lot #: 5135	5135

STOCK

	Control	1.5	3	6	12	18
D.O. (%) (>4.0 mg/L)	7.7	7.8	8.1	8.1	8.1	8.1
Temperature (16 ± 1°C)	14.9 ①	14.9 ①	14.9 ①	14.9 ①	14.9 ①	14.9 ①
Salinity (30 ± 2 ppt)	29	29	30	30	30	30
pH (6-9)	8.0	8.0	8.0	8.0	8.0	8.0
Meter #	9	9	9	9	9	9

① Temp. blank used - MS 4/13

48 Hour Bivalve Development Reference Toxicant Test

Conc.	Rep	Number Normal	Number Abnormal	Date	Initials
Control	1	228	14	4/20/23	SZ
	2	251	11	4/20/23	SZ
	3	252	18	4/20/23	SZ
	4	272	14	4/20/23	SZ
1.5	1	237	10	4/20/23	SZ
	2	269	12	4/20/23	SZ
	3	197	12	4/20/23	SZ
	4	229	10	4/20/23	SZ
3	1	245	7	4/20/23	SZ
	2	230	7	4/20/23	SZ
	3	244	10	4/20/23	SZ
	4	216	10	4/20/23	SZ
6	1	234	27	4/20/23	SZ
	2	249	25	4/20/23	SZ
	3	228	21	4/20/23	SZ
	4	223	25	4/20/23	SZ
12	1	14	249	4/21/23	SZ
	2	2	233	4/21/23	SZ
	3	3	235	4/21/23	SZ
	4	13	276	4/21/23	SZ
18	1	0	267	4/21/23	SZ
	2	0	230	4/21/23	SZ
	3	0	229	4/21/23	SZ
	4	0	268	4/21/23	SZ

Stocking Density

Rep	Count	Init.
1	① ~~168~~ 264	NL
2	① ~~204~~ 265	NL
3	① ~~228~~ 262	NL
4	① ~~215~~ 240	NL
5	① ~~230~~ 234	NL
6	① ~~218~~ 261	NL
Mean:	① ~~211~~ 254	SZ

QA: 0, 233N 12A
233/245 = 95.1%
orig: 228/242 = 94.2%
%Δ = 0.9% DM 4/21/23

1.5₃ 195N 13A
195/208 = 93.8%
orig: 197/209 = 94.3%
%Δ = 0.5% DM 4/21/23

3₄ 211N 8A
211/219 = 96.3%
orig: 216/226 = 95.6%
%Δ = 0.7% DM 4/21/23

OE - SZ 4/21/23

Ammonia Reference Toxicant
Spiking Worksheet

Reference Toxicant ID: P220819.45
Date Prepared: 4/11/23
Technician Initials: MS

Biv / Echino NH_3 RT

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

Date: 4/7/2023
Measurement: 7610

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
1.34	**1.5**	250		**0.074**
2.64	**3**	250		**0.148**
5.55	**6**	250		**0.296**
11.2	**12**	250		**0.591**
18.0	**18**	250		**0.887**

ORGANISM RECEIPT LOG

Date: 4/10/23	Time: 1326	Batch No. TSOA1023.01
Organism: M. sp.		
Source / Supplier: Taylor Shellfish		
No. Ordered: 10 lbs	No. Received: 10 lbs	Source Batch: Collection date, hatch date, etc.): Harvest date: 4/10/23
Condition of Organisms: Good	Approximate Size or Age: (Days from hatch, life stage, size class, etc.): Adult	
Shipper: Courier	B of L (Tracking No.) NA	
Condition of Container: Good	Received By: DM	

Container	D.O. (mg/L)	Temp. (°C)	Cond. or Sal. (Include Units)	pH (Units)	# Dead	% Dead*	Tech. (Initials)
1	①	10.1	①	-	→	→	DM

*if >10% contact lab manager

Notes: ① Received Dry - DM - 4/10/23

TAYLOR SHELLFISH FARMS
SE 130 LYNCH RD, SHELTON, WA 98584
PH: (360) 426-6178 FAX: (360) 426-3643
WASHINGTON CERTIFICATION #. WA 46SP

10 lbs
Unprocessed Mussels

Original Harvesters Cert#: WA 0046 SP
Original Harvest Date: 4/10/2023
Final Harvest Date: 4/10/2023
Harvested In: Washington State
Harvest Area: Totten Inlet - I2
Wet Stored:
SHIP TO:

BEST BY	BB DATE
PO #	PO#
ITEM #	Lot# 3100003

Perishable Keep Refrigerated
Farm Raised Shellfish -

Airbill #

151

APPENDIX B

Chain-of-Custody and Sample Receipt Forms

EcoAnalysts, Inc (REGION COPY)
DateShipped: 4/11/2023
CarrierName: EcoAaylists (hand delivery)
AirbillNo:

Jacobs, Wyckoff-
Wyckoff Eagle Harbor GWTP 2023/WA
Project Code: WEH-031W
Cooler #: 1 of 1

No: 10-041123-102811-0683
IFD10W2LA0010PXTSDDD2
Contact Name: Daniel Baca
Contact Phone: 661-313-3807

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	Sample Type
041123 (1)		Ground Water/ D. Baca	Composite	CHRTOX(8 Weeks)	N (1)	SP-11	04/11/2023 01:27	Field Sample

Special Instructions: 2023 Week 13-2nd Quarter Bioassay-Chronic Toxicity Bivalve Test.
SP-11 is our Effluent Sampling Point.

Analysis Key: CHRTOX=Chronic Toxicity

Shipment for Case Complete? N

Samples Transferred From Chain of Custody #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
	@ JACOBS	4-11-23 @ 1057	EcoAnalysts	4/11/23 1305	Good

(1) Received sample @ 0.5°C, Lab ID: P230411.01 - DM-4/11/23

SAMPLE RECEIPT

Client:	Client ID:	Lab ID:	Renewals:	
Jacobs-Wyckoff	041123	P230411.01		
Project: Wyckoff Eagle Harbor GWTP 2023/NA				
Date/Time Received:		4/11/23 1305		
Airbill #:		courier		
Shipper Tracking Information Kept for Records: (Y/N/NA)		NA		
Collection Date/Time:		4/11/23 0127		
Sample Holding Time (must be ≤36 hours at test initiation)		✓		
Condition of Shipping Container:		Good		
Type and Capacity of Sample Container:		4 L cubi		
Total Sample Volume (L):		4 L		
Condition of Sampling Container:		Good		
Sample Container Appropriate: (Y/N)		✓		
Custody Seals Intact: (Intact/Broken/Not Present)		Intact		
Frozen Wet or Blue Ice Present During Shipment/Transport: (Y/N)		Frozen + Blue Ice		
Sampler's Name Present on COC Form: (Print Name/Not Present)		D. Baca		
Color:		clear/colorless		

TAKE THE FOLLOWING MEASUREMENTS UPON ARRIVAL

LAB ID	Meter #	Temp. (°C) (0-6°C) *	Meter #	Dissolved Oxygen (mg/L)	Meter #	pH	Meter #	Cond. (µS/cm)	Meter #	Sal. (ppt)	Hardness (mg $CaCO_3$/L)	Alkalinity (mg $CaCO_3$/L)	Total Chlorine (mg/L)	Total NH3 (mg/L)	Tech
P230411.01	T2	0.5	9	9.0	9	7.6	9	843	9	0.5	—	—	0.01	0.00	DM/MS

*Notify project manager or study director of temperatures above 6°C or ≥36 hours holding time. Client must be notified ASAP.

If there are sample receipt problems, complete the following:	
Reason for unacceptability:	
Name of Client Contact:	Contacted by:
Client Response and/or Action to be Taken:	Date Action Taken: