Toxicity testing on weathered groundwater diesel

Environmental Assessment Program (EAP)

Final Report

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SIGNATURE PAGE

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This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

1.0 INTRODUCTION

The Washington State Department of Ecology (Ecology) Environmental Assessment Program (EAP) requested Nautilus Environmental to characterize the toxicity of weathered diesel to freshwater and marine organisms. Currently, there are few aquatic toxicity studies on weathered diesel in the literature. This project was conducted to obtain toxicity information on weathered diesel for developing water quality objectives. Specifically, the goal of the project was to estimate the no-observed effects levels (NOEL) and low-observed effects levels (LOEL) of weathered diesel in contaminated groundwater on freshwater and marine organisms. These effects levels will be directly applicable to WET testing that is carried out under the Model Toxics Control Act (MTCA) as it pertains to the cleanup and investigation of hydrocarbon-contaminated sites by Ecology's Toxics Cleanup Program (TCP). TCP will use the NOEL values to establish a screening level for hydrocarbon contamination in fresh and marine waters. Previous studies had been conducted on gasoline and diesel for this purpose.

Tests were conducted on diesel contaminated groundwater DW-3, that was collected from a site in Washington State. The contaminated groundwater was analysed to determine the concentration of hydrocarbons in the diesel range and was also tested for metals, TDS, and other constituents that might affect toxicity to aquatic organisms. Samples of the groundwater were shipped by EAP to Nautilus for toxicity testing. The following toxicity tests were performed on the groundwater sample:

- Topsmelt survival and growth (EPA/600/R-95/136)
- Echinoderm fertilization (EPA/600/R-95/136)
- Fathead minnow survival and growth (EPA-821-R-02_013)
- *Ceriodaphnia dubia* survival and reproduction (EPA-821-R-02-013)

The results of these toxicity tests are presented in this report. Copies of laboratory data sheets and printouts of statistical analyses are provided in Appendices A to D; analytical chemistry is provided in Appendix E; and the chain-of-custody form is provided in Appendix F.

2.0 METHODS

Methods for the toxicity tests are summarized in Tables 1 to 4. Testing was conducted according to procedures described by the US EPA (1995, 2002) and the Washington Department of Ecology (WDOE, 2016).

Preliminary toxicity tests using *C. dubia* were conducted in December 2018 with uncontaminated groundwater to ensure that it was non-toxic to the study organisms. This was done to ensure that any observable effects could be attributed to the weathered diesel contamination. Sample MW-11 was chosen as the site control for further testing based on the results of these tests; results of these tests are presented in a separate report.

The groundwater DW-3 used for the range finding tests was collected January 29, 2019 and received on January 30, 2019. Subsamples of 100% and 50% strength dilutions were sent to Ecology's Manchester Environmental Laboratory for initial analysis of groundwater diesel prior to testing to ensure the diesel concentrations were within detection limits.

To determine an appropriate concentration series that would capture NOEC and LOEC values, range-finding tests were performed for each test species prior to initiation of the definitive tests. Subsamples of the test solutions were taken at various points of the tests to determine the concentration and stability of weathered diesel in the toxicity tests. Samples were shipped to Manchester Environmental Laboratory for analysis.

Additional groundwater sample and site control was collected March 19, received on March 20, 2019 and was homogenized with the samples from January. Subsamples were collected and sent for re-analysis of diesel prior to definitive testing to ensure concentrations were similar to those used in the range-finding tests. Measured concentrations of the refresh sample were lower than the initial measurements though were comparable.

Definitive tests using topsmelt and fathead minnow were initiated on April 23, 2019; the echinoderm test was initiated May 1, 2019; and the definitive test using *C. dubia* was initiated on May 14, 2019. Subsamples of test solutions were once again taken a various time points and sent to Manchester Environmental Laboratory for analysis. The average measured concentration of DW-3 for the duration of the range-finding tests was 5.95 mg/L diesel; the average measured concentration for the definitive tests was 4.80 mg/L diesel. Statistical analyses were performed using the site control (MW-11) as the negative control with CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 7-d topsmelt (*Atherinops affinis*) survival and growth test.

Test species	*Atherinops affinis*
Organism source	Commercial supplier
Organism age	9-to 15-days post-hatch
Test type	Static-renewal
Test duration	7 days
Test vessel	500-mL glass container with lid
Test volume	500 mL
Test concentrations	Six concentrations, plus laboratory and methanol control
Test replicates	5 per treatment
Number of organisms	5 per replicate
Control/dilution water	Natural seawater
Test solution renewal	Daily (80% renewal)
Test temperature	20 ± 1°C
Test salinity	30 ± 2 ppt; sample salinity adjusted by addition of H_2Ocean Pro+ marine salts
Feeding	Twice a day with newly hatched brine shrimp nauplii (*Artemia sp*.)
Light intensity	Ambient laboratory lighting
Photoperiod	16 hours light / 8 hours dark
Aeration	None, unless dissolved oxygen falls below 4.0 mg/L
Test measurements	Temperature, dissolved oxygen, pH and salinity measured daily; survival checked daily
Test protocol	EPA/600/R-95/136
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival and biomass
Test acceptability criteria for controls	≥80% survival; ≥0.85 mg mean dry weight
Reference toxicant	Copper (added as $CuCl_2$)

Table 2. Summary of test conditions: 40-min echinoderm fertilization test.

Test species	*Strongylocentrotus purpuratus*
Organism source	Commercial supplier
Organism age	< 3 hours post gamete collection
Test type	Static
Test duration	10 minutes sperm exposure; 10 minutes egg fertilization
Test vessel	30-mL glass vials with snap cap
Test volume	30 mL
Test concentrations	Six concentrations, plus laboratory and methanol control
Test replicates	4 per treatment
Number of organisms	2000 eggs per replicate
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	12 ± 1°C
Test salinity	30 ± 2 ppt; sample salinity adjusted by addition of H_2Ocean Pro+ marine salts
Feeding	None
Light intensity	Ambient laboratory lighting
Photoperiod	None
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and salinity measured at test initiation
Test protocol	EPA/600/R-95/136
Statistical software	CETIS Version 1.9.4
Test endpoint	Fertilization
Test acceptability criterion for controls	≥60% and <98% mean fertilization
Reference toxicant	Copper (added as $CuCl_2$)

Table 3. Summary of test conditions: 7-d fathead minnow (*Pimephales promelas*) survival and growth test.

Test species	*Pimephales promelas*
Organism source	Commercial supplier
Organism age	<24 hours post-hatch
Test type	Static-renewal
Test duration	7 days
Test vessel	375-mL glass container with lid
Test volume	375 mL
Test concentrations	Six concentrations, plus laboratory and methanol control
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day with approximately 1500-2250 newly hatched brine shrimp nauplii (*Artemia sp*.) in each test container
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None, unless dissolved oxygen falls to <40% saturation
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	EPA-821-R-02_013
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival and biomass
Test acceptability criteria for controls	≥80% survival; ≥250 µg mean dry weight
Reference toxicant	Sodium chloride (NaCl)

Table 4. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test species	*Ceriodaphnia dubia*
Organism source	In-house culture
Organism age	<24 hour old neonates, produced within a 8 hour window
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20-mL glass test tube with snap cap
Test volume	20 mL
Test concentrations	Six concentrations, plus laboratory and methanol control
Test replicates	10 per treatment
Number of organisms	1 per replicate
Control/dilution water	20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and YCT (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction checked daily
Test protocol	EPA-821-R-02-013
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods; no ephippia present
Reference toxicant	Sodium chloride (NaCl)

2.1 Subsampling Test Solutions

Subsamples of the fresh test solutions were taken during the filling of the test chambers. Subsamples of the stale test vessel solutions were collected as a composite of the test vessel replicates prior to renewal or at the end of the tests.

Test solutions were renewed daily for tests with topsmelt, fathead minnow and *C. dubia*; the 40 minute exposure echinoderm test did not require renewal of test solution. The site control MW-11 was used to calculate all test endpoints.

3.0 RESULTS

Samples of the fresh and stale test solutions were analyzed by the Manchester Environmental Laboratory. The nominal and measured concentrations for the range-finding tests are presented in Tables 5 to 7. The nominal and measured concentrations for the definitive tests are presented in Tables 8 to 10. Only the 100%, 6.3%, 0.39%, and lab (0%) and site control samples were analysed. Mean measured concentrations used for statistical analysis were calculated by plotting the measured concentrations as the dependent variable (y axis) vs. the nominal concentrations as the independent variable (x axis) for all time points in Microsoft Excel and then fitting a regression line to the data. Some data points were judged to be outliers and were not included in the regression analyses. The lab control was used in the regression lines as it was part of the test dilution series and the site control was not. The lab control concentrations were at or below detection limits. The reported analytical values were used for the lab control. The equation of the best fit regression line was then used to calculate the mean measured concentration at each time point and concentration. In all cases, an order 2 polynomial equation fit the plotted data best. The plots used to calculate the mean measured concentrations are shown in Figures 1 to 4. The calculated or mean measured concentrations are presented in Table 8.

Table 5. Results: Topsmelt and echinoderm nominal and measured test concentrations (mg diesel/L) (Range-finder).

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)								
	t=0	t=24		t=48	t=72	t=96	t=120	t=144	t=168
	fresh	stale	fresh	fresh	fresh	fresh	fresh	fresh	stale
100	6.1	5.62	5.26	5.88	3.96	5.26	4.15	3.86	4.4
100 dupl.	6.08	--	--	--	--	--	--	--	--
25	--	--	--	--	--	--	--	--	--
6.25	0.38	0.2	0.3	0.31	0.22	0.34	0.36	0.16	0.25
6.25 dupl.	0.26	--	0.25	-	0.21	0.35	--	0.15	--
1.56	--	--	--	--	--	--	--	--	--
0.39	0.19	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14
0.10	--	--	--	--	--	--	--	--	--
Site Control	0.31	--	--	--	--	--	--	0.26	--
Lab Control	0.15	--	--	--	--	--	--	0.15	--

t = time, Detection Limit = 0.15

Figure 1. Polynomial Regression of Test Solution Concentrations vs. Measured Concentrations – Topsmelt Range-finding Test

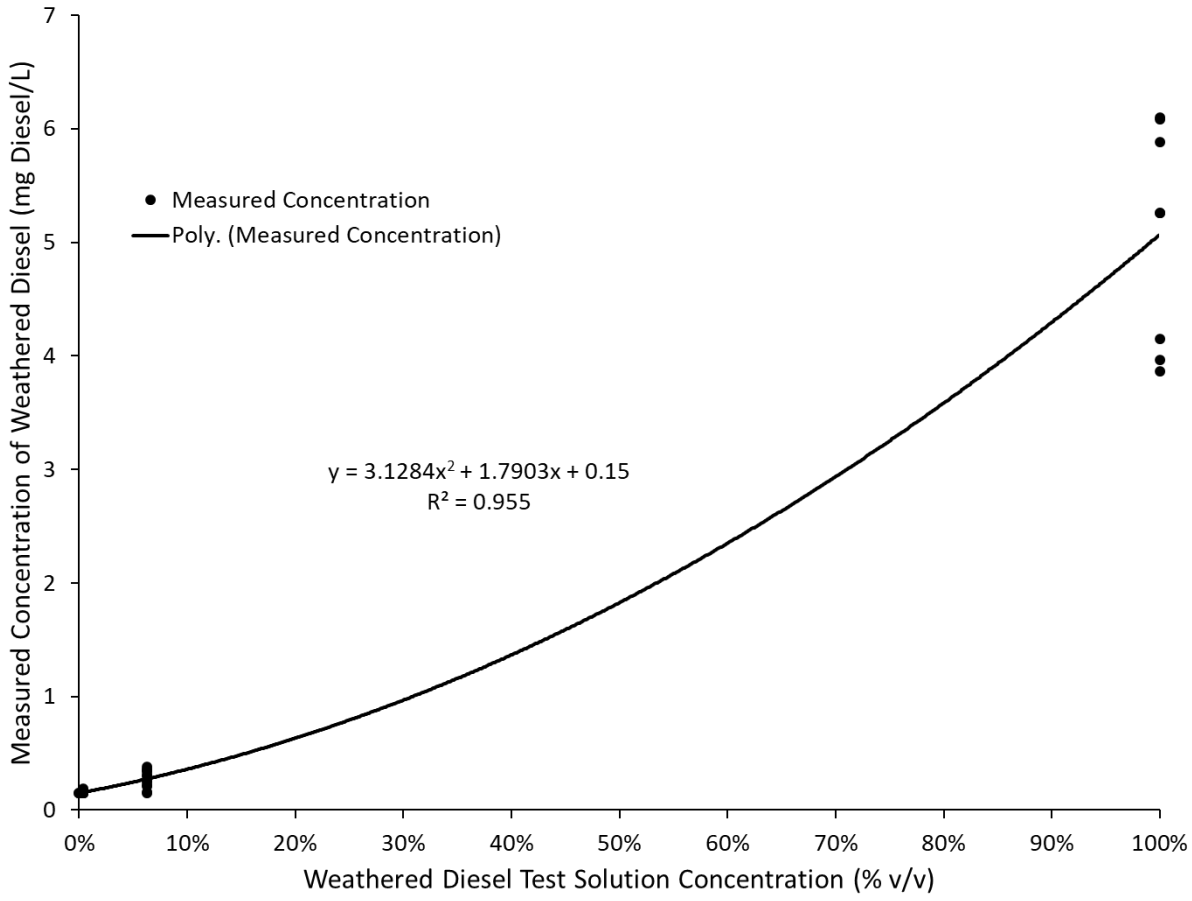

Table 6. Results: Fathead minnow nominal and measured test concentrations (mg diesel/L) (Range-finder).

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)									
	t=0	t=24		t=48	t=72	t=96	t=120	t=144	t=168	
	fresh	stale	fresh	fresh	fresh	fresh	fresh	fresh	stale	fresh
100	6.16	5.39	6.33	6.35	7.04	0.32	4.8	6.63	5.7	6.69
100 dupl.	6.27	--	--	--	--	--	--	--	--	6.85
25	--	--	--	--	--	--	--	--	--	--
6.25	0.39	0.35	0.29	0.39	0.26	0.15	0.33	0.28	0.3	--
6.25 dupl.	0.29	--	0.3	-	0.4	0.15	--	0.28	--	--
1.56	--	--	--	--	--	--	--	--	--	--
0.39	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	--
0.10	--	--	--	--	--	--	--	--	--	--
Site Control	0.15	--	--	--	--	--	--	0.25	--	--
Lab Control	0.15	--	--	--	--	--	--	0.16	--	--

t = time, Detection Limit = 0.15

Figure 2. Polynomial Regression of Test Solution Concentrations vs. Measured Concentrations – Fathead Minnow Range-finding Test

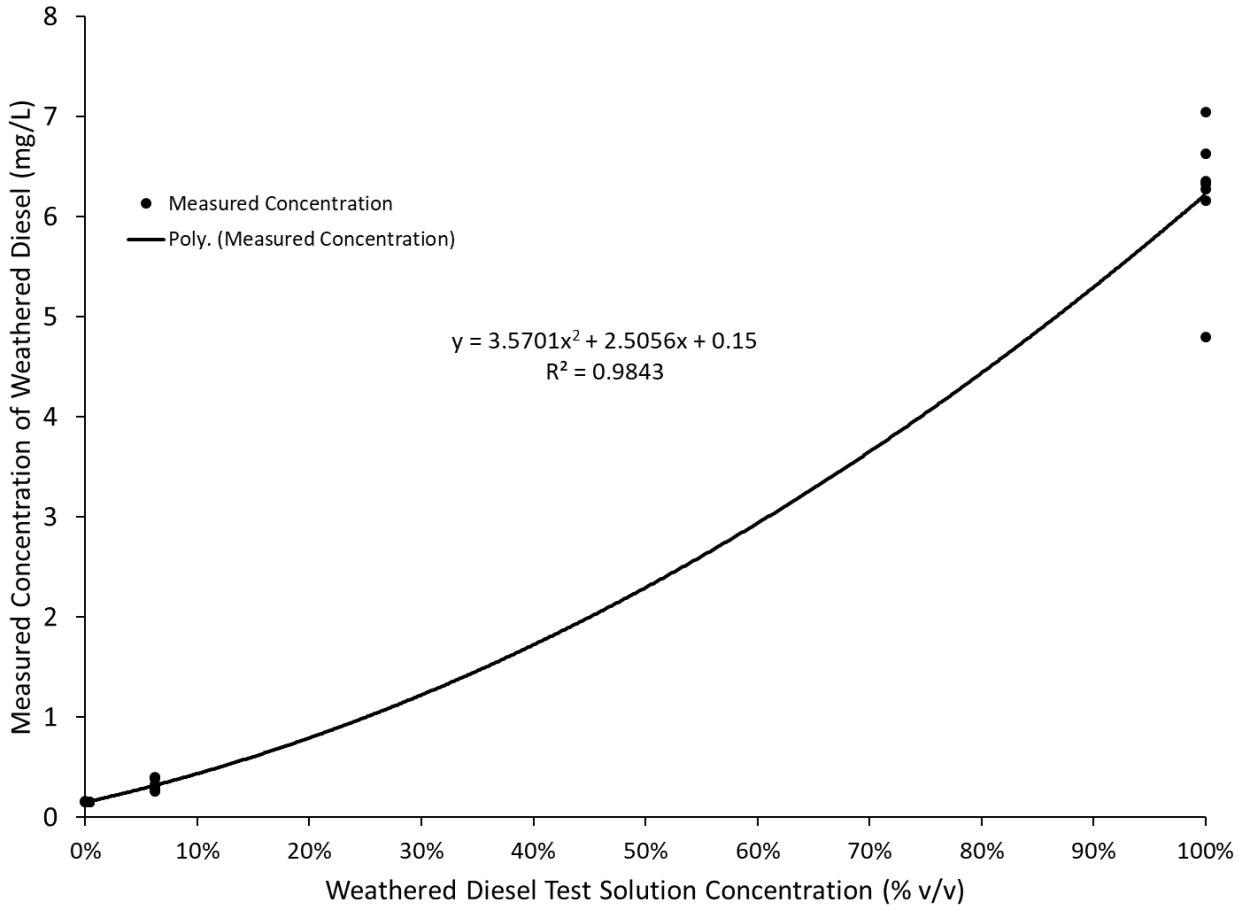

Table 7. **Results: *Ceriodaphnia dubia* nominal and measured test concentrations (mg diesel/L) (Range-finder).**

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)						
	t = 0	t=24	t=48	t=72	t = 96	t = 120	t=144
	fresh	fresh	fresh	fresh	fresh	fresh	fresh
100	6.16	6.29	5.53	5.48	3.75	5.24	--
100 dupl.	6.26	--	--	--	--	--	--
25	--	--	--	--	--	--	--
6.25	0.32	0.34	0.27	0.28	0.25	0.30	--
6.25 dupl.	0.42	0.28	--	0.27	0.24	--	--
1.56	-	-	-	-	-	-	-
0.39	0.15	0.16	0.15	0.17	0.17	0.17	-
0.10	--	--	--	--	--	--	--
Site Control	0.28	--	--	--	--	--	0.23
Lab Control	0.22	--	--	--	--	--	0.16

t = time, Detection Limit = 0.16

Figure 3. Polynomial Regression of Test Solution Concentrations vs. Measured Concentrations – *C. dubia* Range-finding Test

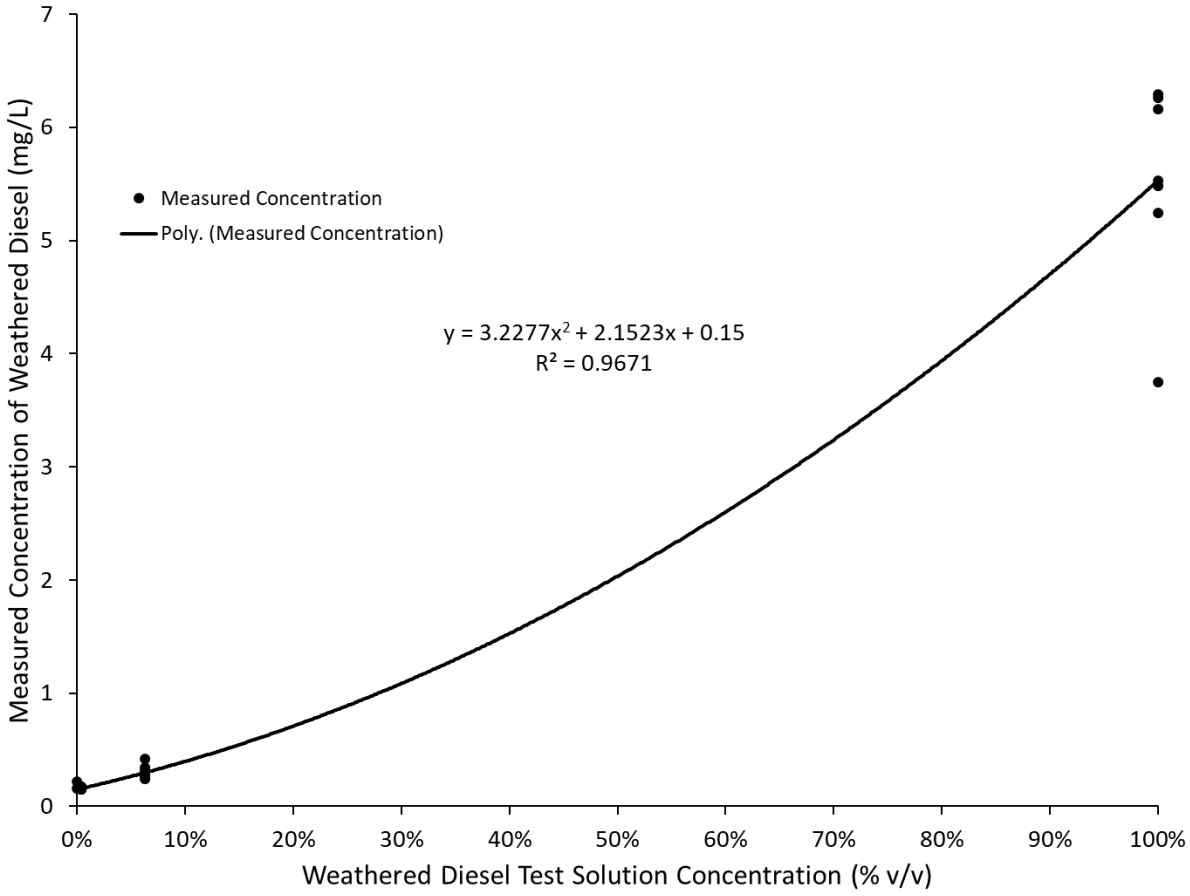

Table 8. Results: Topsmelt and echinoderm nominal and measured test concentrations (mg diesel/L) (Definitive).

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)							
	t=0	t=24	t=48	t=72	t=96	t=120	t=144	t=168
	fresh	fresh	fresh	fresh	fresh	fresh	fresh	stale
100	3.94	2.74	3.06	3.19	4.43	2.97	2.66	2.86
100 dupl.	2.84	--	3.22	--	2.76	--	2.69	--
75	--	--	--	--	--	--	--	--
50	1.41	0.43	1.43	1.35	1.23	1.13	0.42	0.14
50 dupl.	--	--	--	--	0.27	--	1.2	--
25	0.67	0.62	0.65	0.62	0.55	0.58	0.64	0.51
12.5	--	--	--	--	--	--	--	--
Site Control	0.22	--	--	--	--	--	0.17	--
Lab Control	0.17	--	--	--	--	--	0.15	--

t = time

Table 9. Results: Echinoderm nominal and measured test concentrations (mg diesel/L) (Definitive).

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)	Mean Value
	t=0	t=0
	fresh	fresh
100	2.83	2.71
100 dupl.	2.59	-
Site Control	0.28	0.22
Site Control dupl.	0.16	-
Lab Control dupl.	0.16	0.16
Lab Control	0.15	-

t = time

Figure 4. Polynomial Regression of Test Solution Concentrations vs. Measured Concentrations – Topsmelt Definitive Test

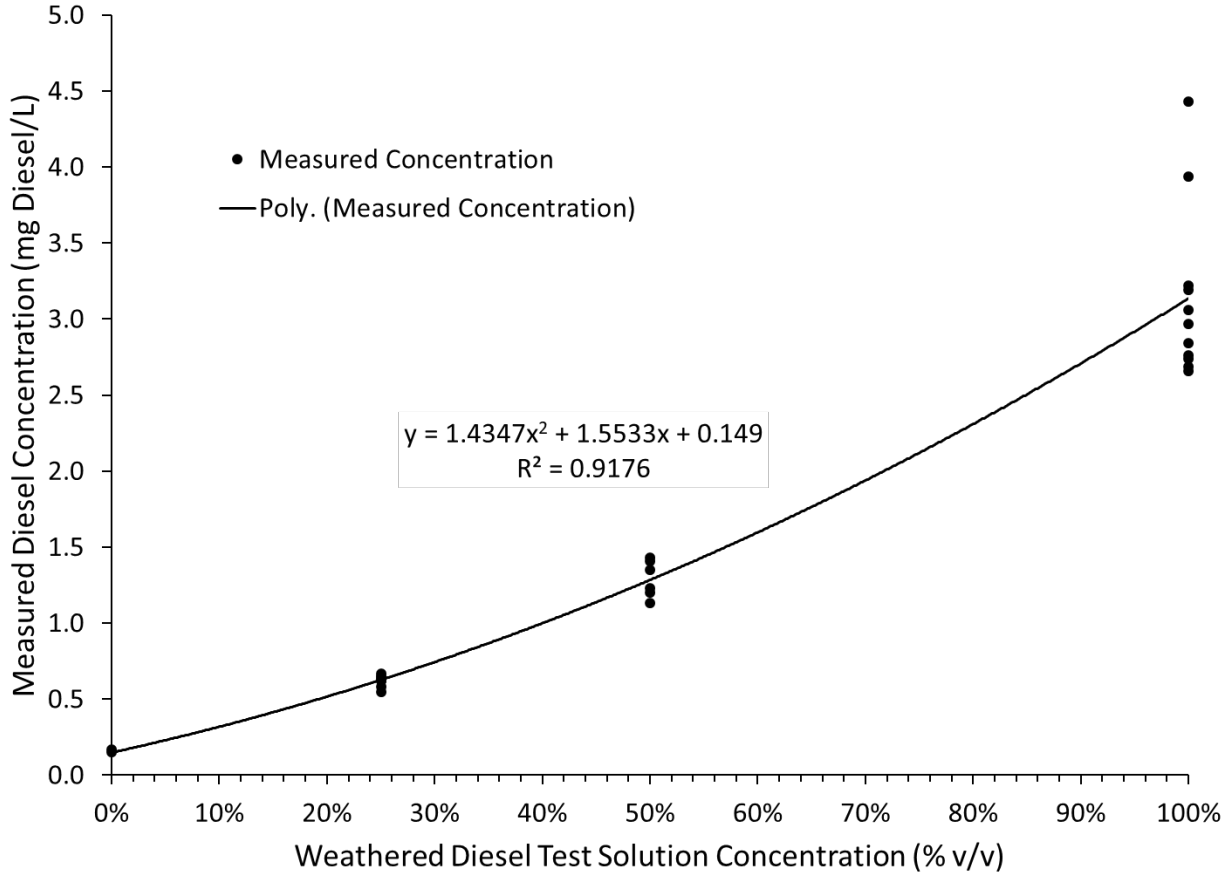

Table 10. Results: Fathead minnow nominal and measured test concentrations (mg diesel/L) (Definitive).

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)							
	t=0	t=24	t=48	t=72	t=96	t=120	t=144	t=168
	fresh	fresh	fresh	fresh	fresh	fresh	fresh	stale
100	5.39	0.22	3.76	3.93	4	3.11	3.98	3.56
100 dupl.	5.83	--	3.98	--	4.12	--	4.02	--
75	--	--	--	--	--	--	--	--
50	2.28	0.19	1.8	1.97	1.82	2.42	1.89	1.72
50 dupl.	--	--	--	--	1.76	--	1.75	--
25	0.94	0.81	0.93	0.86	0.83	0.95	0.89	0.81
12.5	--	--	--	--	--	--	--	--
Site Control	0.2	--	--	--	--	--	0.21	--
Lab Control	0.17	--	--	--	--	--	0.17	--

t = time

Figure 5. Polynomial Regression of Test Solution Concentrations vs. Measured Concentrations – Fathead Minnow Definitive Test

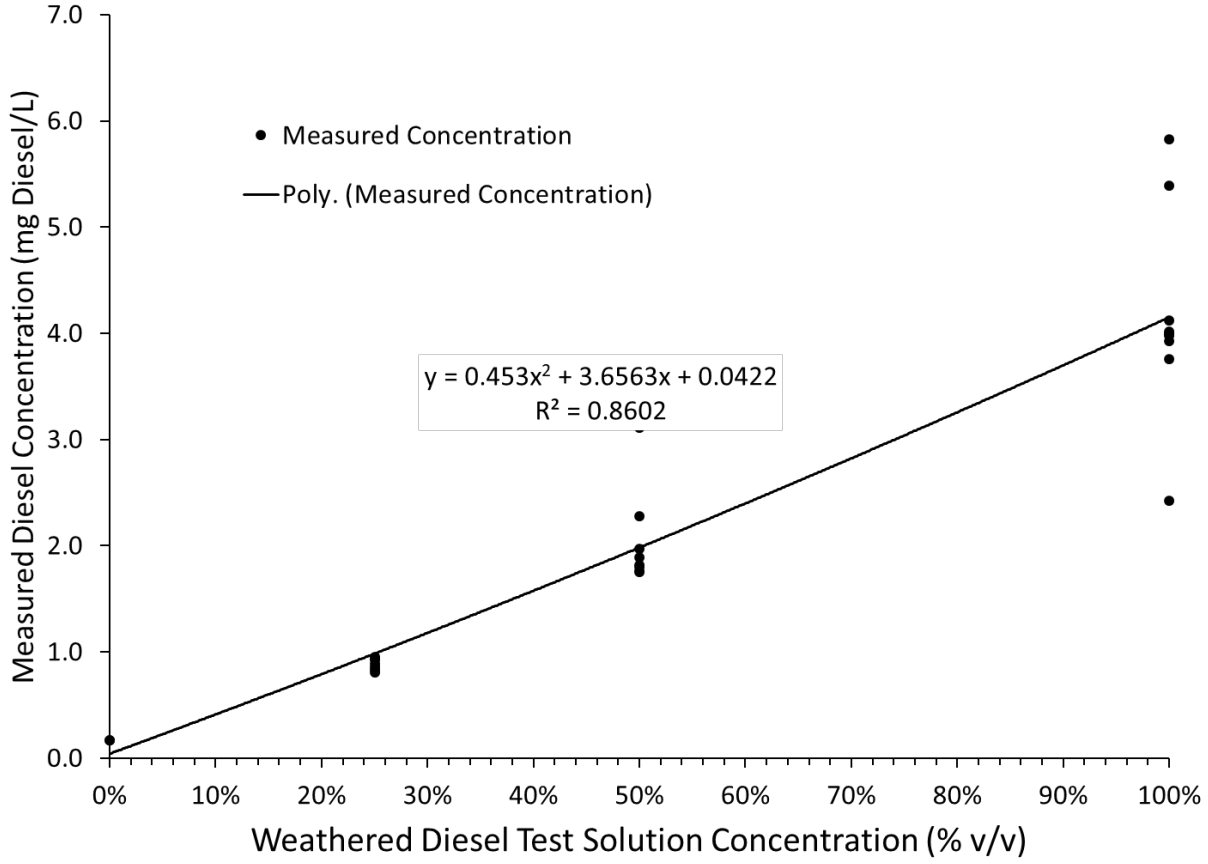

Table 11. Results: *Ceriodaphnia dubia* nominal and measured test concentrations (mg diesel/L) (Definitive).

Nominal Conc. (% v/v)	Measured Concentration (mg diesel/L)					
	t = 0	t=24	t=48	t=72	t = 96	t = 120
	fresh	fresh	fresh	fresh	fresh	fresh
100	3.76	4.02	4.13	4.24	4.02	--
100 dupl.	4.38	--	4.24	--	4.13	--
Site Control	0.22	--	--	--	--	0.28
Lab Control	0.17	--	--	--	--	0.16

t = time

3.1 Range-finding Toxicity Test Results

The results of the range-finding tests conducted in February 2019 are summarized in Tables 11 to 14. Results were compared against the laboratory control. Results of these tests were used to determine concentrations to use for the definitive tests.

Table 12. Results: Topsmelt 7-day survival and growth test (Range-finder).

Weathered Diesel Concentrations		Survival (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Nominal (% v/v)	**Mean Measured (mg diesel/L)**			
Laboratory control	0.15 (DL)	100 ± 0.0	1.18 ± 0.02	1.18 ± 0.02
MW-11 (Site Control)	0.29	86.7 ± 11.6	1.04 ± 0.31	1.18 ± 0.19
0.10	*0.15*	93.3 ± 11.6	1.08 ± 0.18	1.16 ± 0.10
0.39	0.16	93.3 ± 11.6	1.16 ± 0.10	1.25 ± 0.05
1.6	*0.18*	93.3 ± 11.6	1.16 ± 0.13	1.25 ± 0.17
6.3	0.27	100 ± 0.0	1.25 ± 0.17	1.25 ± 0.17
25	*0.79*	93.3 ± 11.6	1.06 ± 0.14	1.16 ± 0.30
100	5.07	20.0 ± 20.0	0.13 ± 0.13	0.62 ± 0.07
Test endpoint (mg diesel/L) *				
LC50 (95% CL)		2.4 (1.7 – 3.3)	--	--
IC25 (95% CL)		--	1.3 (0.5 – 1.8)	2.1 (N/A – 2.9)
IC50 (95% CL)		--	2.3 (1.4 – 3.2)	>5.1 (N/A)_
NOEC		0.8	0.8	0.8
LOEC		5.1	5.1	5.1

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, NOEC = No Observed Effect Concentration, LOEC = Lowest Observed Effect Concentration, DL = Detection Limit (0.15 mg Diesel/L), N/A = Not Available

* = result was calculated using the laboratory control as the negative control

Calculated concentrations are represented in italics.

Table 13. Results: Echinoderm (*Strongylocentrotus purpuratus)* fertilization test (Range-finder)

Weathered Diesel Concentrations		Fertilized eggs (%) (Mean ± SD)
Nominal (% v/v)	**Mean Measured (mg diesel/L)**	
Laboratory control	0.15 (DL)	86.0 ± 3.8
Salt-adjusted control	-	91.2 ± 3.0
MW-11 (Site Control)	0.31	90.8 ± 2.5
0.1	--	87.2 ± 7.3
0.39	0.19	94.0 ± 3.2
1.6	--	91.2 ± 1.9
6.3	0.32	89.0 ± 2.2
25	--	90.0 ± 3.6
100	6.1	86.0 ± 3.4
Test endpoint (mg diesel/L) *		
IC25		>6.1
IC50		>6.1
NOEC		6.1
LOEC		>6.1

SD = Standard Deviation, IC = Inhibition Concentration, NOEC = No Observed Effect Concentration, LOEC = Lowest Observed Effect Concentration, DL = Detection Limit (0.15 mg Diesel/L)
(*) = Result was calculated using nominal values and the laboratory control as the negative control

Table 14. Results: Fathead minnow 7-day survival and growth test (Range-finder).

Weathered Diesel Concentrations		Survival (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Nominal (% v/v)	**Mean Measured (mg diesel/L)**			
Laboratory control	0.16	100 ± 0.0	0.69 ± 0.14	0.69 ± 0.14
MW-11 (Site Control)	0.20	96.7 ± 5.8	0.80 ± 0.12	0.82 ± 0.09
0.10	*0.15*	93.3 ± 5.8	0.63 ± 0.06	0.67 ± 0.06
0.39	0.15	100 ± 0.0	0.75 ± 0.03	0.75 ± 0.03
1.6	*0.19*	100 ± 0.0	0.75 ± 0.04	0.75 ± 0.04
6.3	0.32	93.3 ± 11.6	0.66 ± 0.19	0.70 ± 0.13
25	*1.00*	96.7 ± 5.8	0.69 ± 0.03	0.71 ± 0.01
100	6.23	86.7 ± 15.3	0.35 ± 0.13	0.40 ± 0.08
Test endpoint (mg diesel /L) *				
LC50 (95% CL)		>6.28	--	--
IC25 (95% CL)		--	2.6 (N/A – 5.4)	3.1 (0.4– 4.9)
IC50 (95% CL)		--	>6.2	>6.2
NOEC		6.28	1.0	0.65
LOEC		>6.28	6.28	1.30

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available, NOEC = No Observed Effect Concentration, LOEC = Lowest Observed Effect Concentration, DL = Detection Limit (0.15 mg Diesel/L)

* = result was calculated using the laboratory control as the negative control

Calculated concentrations are represented in italics.

Table 15. Results: *C. dubia* survival and reproduction test (Range-finder).

Weathered Diesel Concentrations		Survival (%)	Reproduction (Mean ± SD)
Nominal (% v/v)	**Mean Measured (mg diesel/L)**		
Laboratory control	0.19	100	18.2 ± 0.8
MW-11 (Site Control)	0.26	100	6.4 ± 1.3
0.1	*0.15*	100	20.6 ± 1.3
0.39	0.16	100	17.2 ± 5.8
1.6	*0.19*	100	20.0 ± 1.9
6.25	0.30	100	19.6 ± 1.7
25	*0.89*	100	19.6 ± 1.8
100	5.53	100	22.0 ± 2.2
Test endpoint (mg diesel /L) *			
LC50		>5.53	--
IC25 (95% CL)		--	>5.53
IC50 (95% CL)		--	>5.53
NOEC		5.53	5.53
LOEC		>5.53	>5.53

SD = Standard Deviation, DL = Detection Limit (0.16 mg Diesel/L)

(*) = Result was calculated using nominal values and the laboratory control as the negative control

3.2 Definitive Toxicity Test Results

The results of the definitive toxicity tests are summarized in Tables 15 to 18. All endpoints were calculated in CETIS using the site control as the negative control. Confidence limits (95%) are shown in brackets.

The results of the 7-day Topsmelt test are shown in 15. The LC50 estimate for survival was >3.14 mg weathered diesel/L and the IC25 estimate for biomass and dry weight was 2.0 (1.4 – 2.6) and 2.4 (1.7 – 3.0) mg weathered diesel/L, respectively. The resulting LOEC estimates for survival, biomass and dry weight were >3.14, 3.14 and 3.14 mg weathered diesel/L, respectively.

The results of the Echinoderm fertilization test are shown in Table 16. No significant difference was observed in the % fertilization when the highest concentration of the weathered diesel test sample, DW-3 (100% v/v) was compared to the laboratory control.

The results of the 7-day Fathead minnow test are shown in Table 17. The lethal concentration (LC50) estimate for survival was >4.33 mg weathered diesel/L, and the 25% inhibitive concentrations (IC25) estimate for biomass and dry weight were 4.3 (3.8 – 4.6) and 4.8 (N/A – 6.0) mg weathered diesel/L, respectively.

The results of the *C. dubia* survival and reproduction test are shown in Table 19. No significant effects were observed on either survival or reproduction when the highest concentration of the weathered diesel test sample, DW-3 (100% v/v) was compared to the laboratory control.

Table 16. Results: Topsmelt 7-day survival and growth test (Definitive).

Diesel Concentrations		Survival (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Nominal (% v/v)	**Mean Measured (mg diesel/L)**			
Laboratory control	0.16	100 ± 0.0	1.83 ± 0.41	1.83 ± 0.41
MW-11 (Site Control)	0.20	100 ± 0.0	2.04 ± 0.26	2.04 ± 0.26
12.5	0.37*	92.0 ± 11.0	1.71 ± 0.33	1.86 ± 0.25
25	0.62	100 ± 0.0	1.93 ± 0.31	1.93 ± 0.31
50	1.29	92.0 ± 11.0	1.65 ± 0.47	1.77 ± 0.32
75	2.12*	92.0 ± 11.0	1.30 ± 0.26	1.42 ± 0.33
100	3.14	72.0 ± 17.9	0.90 ± 0.40	1.21 ± 0.28
Test endpoint (mg diesel/L)				
LC25 (95% CL)		3.0 (2.3 – N/A)	--	--
LC50 (95% CL)		>3.14	--	--
IC25 (95% CL)		--	2.0 (1.4 – 2.6)	2.4 (1.7 – 3.0)
IC50 (95% CL)		--	3.1 (2.4 – 4.0)	>3.14
NOEC		3.14	2.12	2.12
LOEC		>3.14	3.14	3.14

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, NOEC = No Observed Effect Concentration, LOEC = Lowest Observed Effect Concentration, N/A = Not Available, DL = Detection Limit (0.15 mg Diesel/L)

(*) Value interpolated from nominal-measured relationship; results are calculated using the laboratory control as the negative control

Table 17. Results: Echinoderm (*Strongylocentrotus purpuratus)* fertilization test (Definitive).

Sample ID	Analytical (mg diesel/L)	Fertilized eggs (%) (Mean ± SD)
Laboratory control	0.16	78.2 ± 3.5
Salt-adjusted control	-	75.2 ± 6.2
MW-11 (Site control)	0.22	78.2 ± 5.2
DW-3 (100% v/v)	2.71	79.2 ± 4.8

SD = Standard Deviation, DL = Detection Limit (0.15 mg Diesel/L)

Table 18. Results: Fathead minnow 7-day survival and growth test (Definitive).

Diesel Concentrations		Survival (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Nominal (% v/v)	Mean Measured (mg diesel/L)			
Laboratory control	0.17	100 ± 0.0	0.63 ± 0.03	0.63 ± 0.03
MW-11 (Site Control)	0.21	95.0 ± 5.8	0.62 ± 0.05	0.65 ± 0.03
12.5	0.51*	97.5 ± 5.0	0.59 ± 0.04	0.61 ± 0.02
25	0.89	97.5 ± 5.0	0.58 ± 0.05	0.60 ± 0.03
50	1.90	87.5 ± 12.6	0.60 ± 0.09	0.69 ± 0.05
75	3.04*	95.0 ± 5.8	0.58 ± 0.05	0.61 ± 0.05
100	4.33	82.5 ± 12.6	0.44 ± 0.10	0.54 ± 0.07
Test endpoint (mg diesel/L)				
LC50 (95% CL)		>4.33	--	--
IC25 (95% CL)		--	4.3 (3.8 – 4.6)	>4.33
IC50 (95% CL)		--	>4.33	>4.33
NOEC		3.04	3.04	3.04
LOEC		4.33	4.33	4.33

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, N/A = Not Available, NOEC = No Observed Effect Concentration, LOEC = Lowest Observed Effect Concentration, DL = Detection Limit (0.15 mg Diesel/L)

(*) Value interpolated from nominal-measured relationship; results are calculated using the laboratory control as the negative control

Table 19. Results: *C. dubia* survival and reproduction test (Definitive).

Diesel Concentrations		Survival (%)	Reproduction (Mean ± SD)
Sample ID	Mean Measured (mg diesel/L)		
Laboratory Control	0.17	100	18.8 ± 2.4
MW-11 (Site Control)	0.25	100	15.5 ± 3.7
DW-3 (100% v/v)	4.12	100	17.4 ± 4.2

SD = Standard Deviation, DL = Detection Limit (0.15 mg Diesel/L)

4.0 QA/QC

The health history of the test organisms used in the exposures was acceptable and met the requirements of the USEPA protocol. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. There were no deviations from the test methodologies, aside from decreased test replicates for the range-finding tests and the sample being outside of holding time for all tests. Subsamples were analyzed each testing period to ensure the diesel in the sample remained stable for the duration of the tests. Uncertainty associated with the test is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Results of the reference toxicant test conducted during the testing program are summarized in Table 19. Results for this test fell within the range for organism performance of the mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in this test was appropriate. The reference toxicant test was performed under the same conditions as those used for the sample.

Table 20. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2SD Range)	CV (%)	Test Date
A. affinis	Survival (LC50): 100.1 µg/L Cu	91.3 (60.4 – 138.0)	21	February 19, 2019
	Biomass (IC50): 101.1 µg/L Cu	96.0 (65.0 – 141.6)	20	
	Survival (LC50): 104.0 µg/L Cu	95.9 (68.6 – 133.9)	17	April 23, 2019
	Biomass (IC50): 95.1 µg/L Cu	91.3 (66.1 – 126.1)	16	
S. purpuratus	Fertilization (IC50): 16.4 µg/L Cu	18.4 (8.4 – 40.1)	41	February 19, 2019
	Fertilization (IC50): 10.21 µg/L Cu	18.0 (8.9 – 36.5)	36	May 1, 2019
P. promelas	Survival (LC50): 4.0 g/L NaCl	4.7 (3.7 – 6.1)	12	February 19, 2019
	Biomass (IC50): 4.0 g/L NaCl	4..5 (3.4 – 6.1)	15	
	Survival (LC50): 4.2 g/L NaCl	4.7 (3.7 – 6.1)	13	April 23, 2019
	Biomass (IC50): 3.5 g/L NaCl	4..5 (3.4 – 6.1)	15	
C. dubia	Survival (LC50): 2.0 g/L NaCl	2.0 (1.8 – 2.2)	5	March 5, 2019
	Biomass (IC50): 1.8 g/L NaCl	1.5 (1.0 – 2.1)	18	
	Survival (LC50): 2.0 g/L NaCl	2.0 (1.8 – 2.2)	4	May 14, 2019
	Biomass (IC50): 1.2 g/L NaCl	1.6 (1.1 – 2.3)	20	

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effective Concentration

5.0 REFERENCES

USEPA. 2002. Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. EPA-821-R-02-014.

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Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4 Tidepool Scientific Software, McKinleyville, CA. 275 pp.

WDOE. 2016. Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria. Washington State Department of Ecology. Water Quality Program. Publication number: WQ-R-95-80, Revised June 2016.

APPENDIX A – *Atherinops affinis* Toxicity Test Data

Topsmelt Test Summary Sheet

Client: WDOE

Start Date & Time: Feb 19, 2019 @ 1510h

Work Order No.: 191279a

Test Species: *Atherinops affinis*

Sample Information:

Sample ID: DW-3 (Rangefinder)
Sample Date: 29-Jan-19
Date Received: 30-Jan-19
Sample Volume: 5x 20L

Dilution Water:

Type: Natural Seawater
Source: Vancouver Aquarium
Vancouver, BC

Test Organism Information:

Batch No.: 021919
Source: Aquatic Biosystems, CO
Age: 9 days

Copper Reference Toxicant Results:

Reference Toxicant ID: AAC38
Stock Solution ID: 19Cu01
Date Initiated: 19-Feb-19
7-d EC50 (95% CL): 100.1 (89.9 - 111.4) µg/L Cu
7-d IC50 (95% CL): 101.1 (86.4 - 112.0) µg/L Cu

EC50 Reference Toxicant Mean (Acceptable Range) : 91.3 (60.4 - 138.0) µg/L Cu CV (%): 21
IC50 Reference Toxicant Mean (Acceptable Range) : 96.0 (65.0 - 141.6) µg/L Cu CV (%): 20

Test Results:

	Survival	Dry Biomass	Dry Weight
NOEC	0.8	0.8	0.8
LOEC	5.1	5.1	5.1
LC25 mg/L diesel (95% CL)	N/A		
LC50 mg/L diesel (95% CL)	2.4 (1.7 - 3.3)		
IC25 mg/L diesel (95% CL)		1.3 (0.5 - 1.8)	2.1 (n/a - 2.9)
IC50 mg/L diesel (95% CL)		2.3 (1.4 - 3.2)	>5.1

Reviewed by: [signature]

Date reviewed: Dec-19, 2019

Chronic Marine Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3 (Range finder)
Work Order #: 191279

Start Date & Time: Feb 19/19 @ 1510h
Stop Date & Time: Feb 26/19 @ 1430h
Test Species: *Atherinops affinis*

(% v/v) Nominal	Days													
Concentration	0	1		2		3		4		5		6		7
Control	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	20.0	19.0	19.0	19.0	19.0	19.5	19.0	19.5	19.0	~~24.5~~ @ 19.0	19.0	19.0
DO (mg/L)	7.2	7.3	7.3	6.6	6.8	6.3	6.9	5.8	7.5	6.2	7.3	5.9	6.9	5.7
pH	7.9	7.8	7.9	7.7	7.8	7.6	7.8	7.5	7.6	7.6	7.7	7.5	7.7	7.5
Salinity (ppt)	29	29		29		29		30		30		29		29
Initials	MG	MG		MG		MG		A		A		MG		CA

	Days													
Concentration	0	1		2		3		4		5		6		7
Site Control	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.5	19.0	19.6	19.0	19.0	19.0	19.0
DO (mg/L)	6.8	7.3	7.4	6.5	7.1	6.4	6.9	5.9	~~7.8~~ 7.3	6.1	7.2	6.0	7.2	6.6
pH	7.9	7.8	8.0	7.8	7.9	7.7	8.1	7.9	7.8	7.6	7.7	7.8	7.9	8.0
Salinity (ppt)	30	30		30		MG ~~30~~ 28		30		30		30 ~~29~~ MG		30
Initials	CA	MG		MG		MG		A		A		MG		CA

	Days													
Concentration	0	1		2		3		4		5		6		7
0.1	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.5	20.0	19.6	19.0	19.0	19.0	19.0
DO (mg/L)	6.8	7.3	7.2	6.7	6.9	6.3	6.9	5.9	7.2	6.0	7.2	5.8	6.9	5.9
pH	7.9	7.8	7.9	7.7	7.8	7.6	7.8	7.6	7.6	7.6	7.7	7.5	7.7	7.5
Salinity (ppt)	29	29		29		29		30		30		29		29
Initials	CA	MG		MG		MG		A		A		MG		CA

	Days													
Concentration	0	1		2		3		4		5		6		7
0.39	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.5	20.0	19.6	19.0	19.0	19.0	19.0
DO (mg/L)	6.8	7.1	7.2	6.7	6.9	6.3	6.9	6.0	7.2	6.1	7.2	5.9	6.9	6.2
pH	7.9	7.8	7.9	7.7	7.9	7.6	7.8	7.5	7.7	7.6	7.7	7.5	7.7	7.6
Salinity (ppt)	29	29		29		29		30		30		29		29
Initials	CA	MG		MG		MG		A		A		MG		CA

Analysts: MG, AWD, W, RC

Reviewed by: [signature]

Date reviewed: July 17, 2019

Sample Description: DW-3: clear, yellow, odourless, some particulates
MM-11: clear, light yellow, odourless, no particulates

Comments:

Chronic Marine Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: Dw-3 (Rangefinder)
Work Order #: 191279

Start Date & Time: Feb 19/19 @ 1510h
Stop Date & Time: Feb 26/19 @ 1430h
Test Species: *Atherinops affinis*

(% v/v) Concentration 1.6 Nominal	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.8	20.0	19.6	19.0	19.0	19.0	19.0
DO (mg/L)	6.8	7.1	7.2	6.6	6.9	6.4	6.9	5.9	7.2	6.0	7.2	5.9	6.9	6.1
pH	7.9	7.8	7.9	7.7	7.9	7.7	7.8	7.5	7.7	7.6	7.7	7.6	7.7	7.6
Salinity (ppt)	29	29		29		29		30		30		29		29
Initials	CT	MG		MG		MG		AL		AF		MG		CT

Concentration 6.3	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.8	20.0	19.5	19.0	19.0	19.0	19.0
DO (mg/L)	6.8	7.0	7.2	6.5	7.0	6.3	6.9	6.1	7.2	6.1	7.3	5.8	6.9	5.8
pH	7.9	7.8	7.9	7.7	7.9	7.7	7.8	7.6	7.7	7.9	7.7	7.6	7.8	7.6
Salinity (ppt)	29	29		29		29		30		30		29		29
Initials	CT	MG		MG		MG		AL		AF		MG		CT

Concentration 25	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.5	20.0	19.5	19.0	19.0	19.0	19.0
DO (mg/L)	6.8	7.0	7.3	6.4	7.0	6.2	6.9	6.2	7.2	6.1	7.3	5.8	6.9	6.5
pH	7.9	7.9	7.9	7.8	7.9	7.8	7.9	7.6	7.7	7.7	7.7	7.8	7.9	7.7
Salinity (ppt)	29	30		30		29		30		30		29		30
Initials	CT	MG		MG		MG		AL		AF		MG		CT

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.8	19.0	19.5	19.0	19.0	19.0	19.0
DO (mg/L)	7.3	7.1	7.6	6.4	7.4	6.0	7.2	6.2	7.7	6.0	7.4	5.6	6.8	6.4
pH	7.9	7.9	7.9	7.9	7.9	8.0	7.9	7.8	7.8	7.8	7.8	8.0	8.0	8.0
Salinity (ppt)	28	31		31		30		30		30		30		30
Initials	CT	MG		MG		MG		AL		AF		MG		CT

Analysts: MG, AWD, CJ, RC

Reviewed by: [signature]

Date reviewed: July 17, 2019

Sample Description:

Comments:

Chronic Marine Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3 (Range finder)
Work Order #: 191279

Start Date & Time: Feb 19/19 @ ~~1450h~~ 1910h MM
Stop Date & Time: Feb 26/19 @ ~~1400h~~ 1430h MU
Test Species: *Atherinops affinis*

(% v/v) Concentration Salt Adj. Ctrl	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.5	19.0	19.6	19.0	19.0	19.0	19.0
DO (mg/L)	7.1	7.2	7.2	6.6	7.0	6.4	7.2	6.0	7.2	6.3	7.3	6.4	7.1	6.5
pH	7.9	7.9	8.0	7.8	8.0	7.7	7.9	7.6	7.9	7.7	7.9	7.7	7.9	7.6
Salinity (ppt)	29	29		29		29		30		30		30		30
Initials	MG	MG		MG		MG		[illegible]		[illegible]		MG		[illegible]

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Salinity (ppt)														
Initials														

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Salinity (ppt)														
Initials														

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Salinity (ppt)														
Initials														

Analysts: MG, AWD, CJ, RC

Reviewed by: [illegible]
Date reviewed: July 17, 2019

Sample Description:

Comments:

7-d Topsmelt Toxicity Test
Daily Survival

Client: WDOE
Sample ID: DW-3 (Range finder)
Work Order #: 191279

Start Date & Time: Feb 19/19 @ 1510h
Stop Date & Time: Feb 26/19 @ 1430h
Test Species: *Atherinops affinis*

Concentration Nominal % (v/v)	Rep	Day of Test - No. of Survivors							Comments
		1	2	3	4	5	6	7	
control	A	5	5	5	5	5	5	5	
	B	5	5	5	5	5	5	5	
	C	5	5	5	5	5	5	5	
	D								
	E								
site ctrl	A	5	5	5	5	4	4	4	
	B	5	5	5	5	5	4	4	
	C	5	5	5	5	5	5	5	
	D								
	E								
0.10	A	5	5	5	5	5	5	5	
	B	5	5	5	5	5	5	5	
	C	5	5	5	5	5	4	4	
	D								
	E								
0.39	A	5	5	5	5	5	4	4	
	B	5	5	5	5	5	5	5	
	C	5	5	5	5	5	5	5	
	D								
	E								
1.6	A	5	5	5	5	5	5	5	
	B	5	5	5	4	4	4	4	
	C	5	5	5	5	5	5	5	
	D								
	E								
6.3	A	5	5	5	5	5	5	5	
	B	5	5	5	5	5	5	5	
	C	5	5	5	5	5	5	5	
	D								
	E								
25	A	5	4	4	4	4	4	4	
	B	5	5	5	5	5	5	5	
	C	5	5	5	5	5	5	5	
	D								
	E								
100.	A	5	4	1	1	1	1	1	
	B	5	5	0	—	—	—	—	
	C	5	4	3	2	2	2	2	
	D								
	E								
Tech Initials		MG	MG	MG	MM	A	MG	MG	

Comments: -remaining organisms appear normal

Reviewed by: [signature]

Date reviewed: July 17, 2019

7-d Topsmelt Toxicity Test
Daily Survival

Client: WDOE
Sample ID: DW-3 (Range finder)
Work Order #: 191279

Start Date & Time: Feb19/19 @ ~~1400h~~ 1510h MH
Stop Date & Time: Feb26/19 @ ~~1400h~~ 1430h MH
Test Species: *Atherinops affinis*

Concentration % (v/v)	Rep	Day of Test - No. of Survivors 1	2	3	4	5	6	7	Comments
Salt Adj. ctrl	A	5	5	5	5	5	5	5	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
	D	↓	↓	↓	↓	↓	↓	↓	
	E	↓	↓	↓	↓	↓	↓	↓	
	A								
	B								
	C								
	D								
	E								
	A								
	B								
	C								
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	D								
	E								
	A								
	B								
	C								
	D								
	E								
	A								
	B								
	C								
	D								
	E								
Tech Initials		MG	MG	MG	Um	[illegible]	MG	MG	

Comments:

Reviewed by:

Date reviewed: July 17, 2019

Topsmelt Toxicity Test Data Sheet

Dry Weight Data

Client: WDOT

Work Order #: 191279

Sample ID: (Rangefinder) DW-3

Start Date & Time: Feb 19/19 @ 1510h

Termination Date & Time: Feb 26/19 @ 1430h

% (v/v) Nominal	Rep	RF Pan No. red	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	A	1	5	MD	1005.44	1011.47	5	DG /CA
	B	2	5		1022.51	1028.31	5	/CA
	C	3	5		1016.50	1022.38	5	/CA
	D	4			1023.78	—		
	E	5			1007.24	—		
~~Salt Adj.~~ MD Control (site)	A	6	4		1026.12	1030.30	4	/CA
	B	7	4		1018.47	1022.87	4	/CA
	C	8	5		1003.51	1010.51	5	/CA
	D	9			1026.74	—		
	E	10			1018.23	—		
0.1	A	11	5		1036.19	1042.56	5	/CA
	B	12	5		1017.93	1023.26	5	/CA
	C	13	4		1028.24	1032.82	4	/CA
	D	14			1023.75	—		
	E	15			1021.54	—		
0.39	A	16	4		1028.71	1033.97	4	/CA
	B	17	5		1008.66	1014.75	5	/CA
	C	18	5		1019.13	1025.24	5	/CA
	D	19			1020.17	—		
	E	20			1016.51	—		
1.6	A	21	5		1029.50	1034.77	5	/CA
	B	22	4		1027.35	1032.89	4	/CA
	C	23	5		1029.90	1036.42	5	/CA
	D	24			1023.91	—		
	E	25			1017.25	—		
6.3	A	26	5		1024.96	1032.18	5	/CA
	B	27	5		1033.09	1039.09	5	/CA
	C	28	5		1031.22	1036.78	5	/CA
	D	29			1025.80	—		
	E	30			1012.64	—		J

Comments: 10% reweigh: ①pan # 2 weight 1028.30 ②pan # 12 weight 1023.29
③pan # 26 weight 1032.19

Reviewed by: [signature]

Date Reviewed: July 17, 2019

RF 2/2

Topsmelt Toxicity Test Data Sheet

Dry Weight Data

Client: WDoE

Work Order # : 191279

Sample ID: Rangefinder (Dw-3)

Start Date & Time: Feb 19/19 @ 1510h

Termination Date & Time: Feb 26/19 @ 1430h

% (v/v) Natural	Rep	RF Pan No. Red	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
~~Control~~ CS 25	A	CS 1 31	4	NLT	1021.23	1027.21	4	DG 1/4
	B	2 32	5		1024.52	1029.89	5	1/4
	C	3 33	5		1035.84	1040.42	5	1/4
	D	4 34			1028.55	—		
	E	5 35			1020.50	—		
~~Salt Adj.~~ ~~Control~~ CS 100	A	CS 6 36	1		1019.29	1019.86	1	1/4
	B	7 37	0		1005.70	—	—	
	C	8 38	2		1016.34	1017.68	2	1/4
	D	9 39			1010.38	—		
	E	10 40			1013.95	—		
	A	11						
	B	12						
	C	13						
	D	14						
	E	15						
	A	16						
	B	17						
	C	18						
	D	19						
	E	20						
	A	21						
	B	22						
	C	23						
	D	24						
	E	25						
	A	26						
	B	27						
	C	28						
	D	29						
	E	30						

Comments:

Reviewed by:

Date Reviewed: July 17, 2019

Topsmelt Toxicity Test Data Sheet

Dry Weight Data

Client: WDOE

Work Order # : 191279

Sample ID: DW-3 (Rangefinder) RTBlock

Start Date & Time: Feb 19/19 @ 1510h ~~1450h~~ am

Termination Date & Time: Feb 26/19 @ 1430h ~~1400h~~ am

% (v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Salt Adj. Control	A	1 26	5	MG	1034.74	1039.88	5	CA / CA
	B	2 27	5	↓	1026.92	1033.40	5	↓ ↓
	C	3 28	5		1007.01	1013.83	5	
	D	4 29	5		1021.46	1027.52	5	
	E	5 30	5	↓	1017.82	1024.45	5	↓ ↓
	A	6						
	B	7						
	C	8						
	D	9						
	E	10						
	A	11						
	B	12						
	C	13						
	D	14						
	E	15						
	A	16						
	B	17						
	C	18						
	D	19						
	E	20						
	A	21						
	B	22						
	C	23						
	D	24						
	E	25						
	A	26						
	B	27						
	C	28						
	D	29						
	E	30						

Comments:

Reviewed by: [signature]

Date Reviewed: July 17, 2019

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**			
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**			
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology				

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
02-3344-4127	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	✓	IC5	0.4651	n/a	1.333		1
			✓	IC10	0.7864	n/a	1.258		
			✓	IC15	0.932	0.2029	1.423		
			✓	IC20	1.087	0.3168	1.591		
			✓	IC25	1.254	0.4612	1.801		
				IC40	1.841	0.9731	2.566		
				IC50	2.315	1.393	3.21		
08-7851-4664	Mean Dry Weight-mg	Linear Interpolation (ICPIN)		IC5	0.8057	n/a	1.302		1
				IC10	1.072	n/a	1.614		
				IC15	1.377	n/a	1.967		
				IC20	1.727	n/a	2.368		
				IC25	2.128	n/a	2.855		
				IC40	3.724	1.332	5.027		
				IC50	>5.07	n/a	n/a		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits Lower	TAC Limits Upper	Overlap	Decision
02-3344-4127	Mean Dry Biomass-mg	Control Resp	1.181	0.85	>>	Yes	Passes Criteria

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	SC	5	1.245	1.079	1.411	1.028	1.364	0.05979	0.1337	10.74%	0.00%
0.15	N	3	1.181	1.123	1.239	1.16	1.206	0.01348	0.02334	1.98%	5.18%
0.151		3	1.085	0.6387	1.532	0.916	1.274	0.1038	0.1798	16.57%	12.84%
0.16		3	1.164	0.923	1.405	1.052	1.222	0.05601	0.09701	8.33%	6.52%
0.18		3	1.155	0.8286	1.482	1.054	1.304	0.07595	0.1315	11.39%	7.22%
0.27		3	1.252	0.8247	1.679	1.112	1.444	0.09931	0.172	13.74%	-0.55%
0.29	XC	3	1.039	0.2594	1.818	0.836	1.4	0.1811	0.3137	30.20%	16.59%
0.79		3	1.062	0.7133	1.411	0.916	1.196	0.08105	0.1404	13.22%	14.71%
5.07		3	0.1273	-0.2068	0.4614	0	0.268	0.07765	0.1345	105.62%	89.77%

Mean Dry Weight-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	SC	5	1.245	1.079	1.411	1.028	1.364	0.05979	0.1337	10.74%	0.00%
0.15	N	3	1.181	1.123	1.239	1.16	1.206	0.01348	0.02334	1.98%	5.18%
0.151		3	1.162	0.9008	1.423	1.066	1.274	0.06063	0.105	9.04%	6.71%
0.16		3	1.252	1.115	1.388	1.218	1.315	0.03169	0.05489	4.38%	-0.52%
0.18		3	1.248	0.8191	1.676	1.054	1.385	0.09962	0.1725	13.83%	-0.20%
0.27		3	1.252	0.8247	1.679	1.112	1.444	0.09931	0.172	13.74%	-0.55%
0.29	XC	3	1.182	0.707	1.656	1.045	1.4	0.1103	0.1911	16.17%	5.10%
0.79		3	1.162	0.4182	1.905	0.916	1.495	0.1728	0.2993	25.76%	6.71%
5.07		2	0.62	-0.01516	1.255	0.57	0.67	0.04999	0.07069	11.40%	50.21%

SC = salt adjusted control
N = lab control
XC = site control

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	1.028	1.296	1.364	1.212	1.326
0.15	N	1.206	1.16	1.176		
0.151		1.274	1.066	0.916		
0.16		1.052	1.218	1.222		
0.18		1.054	1.108	1.304		
0.27		1.444	1.2	1.112		
0.29	XC	0.836	0.88	1.4		
0.79		1.196	1.074	0.916		
5.07		0.114	0	0.268		

Mean Dry Weight-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	1.028	1.296	1.364	1.212	1.326
0.15	N	1.206	1.16	1.176		
0.151		1.274	1.066	1.145		
0.16		1.315	1.218	1.222		
0.18		1.054	1.385	1.304		
0.27		1.444	1.2	1.112		
0.29	XC	1.045	1.1	1.4		
0.79		1.495	1.074	0.916		
5.07		0.57		0.67		

SC = salt adjusted control
N = lab control
XC = site control

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-7028-7252	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 13:41	**Analysis:**	Trimmed Spearman-Kärber	**Status Level:**	1
Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology		

Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL
Control Threshold	0	20.00%	0.3747	0.07319	2.37	1.692	3.32

7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-mg/L	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0.15	N	3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	15/15	1	0.0%
0.151		3	0.9333	0.8000	1.0000	0.1155	12.37%	6.67%	14/15	0.95	5.0%
0.16		3	0.9333	0.8000	1.0000	0.1155	12.37%	6.67%	14/15	0.95	5.0%
0.18		3	0.9333	0.8000	1.0000	0.1155	12.37%	6.67%	14/15	0.95	5.0%
0.27		3	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	15/15	0.95	5.0%
0.79		3	0.9333	0.8000	1.0000	0.1155	12.37%	6.67%	14/15	0.9333	6.67%
5.07		3	0.2000	0.0000	0.4000	0.2000	100.00%	80.0%	3/15	0.2	80.0%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.0000	1.0000	1.0000
0.151		1.0000	1.0000	0.8000
0.16		0.8000	1.0000	1.0000
0.18		1.0000	0.8000	1.0000
0.27		1.0000	1.0000	1.0000
0.79		0.8000	1.0000	1.0000
5.07		0.2000	0.0000	0.4000

7d Survival Rate Binomials

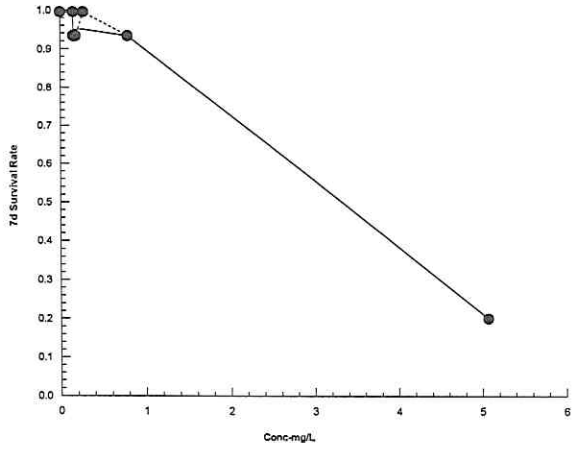
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	5/5	5/5	5/5
0.151		5/5	5/5	4/5
0.16		4/5	5/5	5/5
0.18		5/5	4/5	5/5
0.27		5/5	5/5	5/5
0.79		4/5	5/5	5/5
5.07		1/5	0/5	2/5

N= Lab control

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-7028-7252	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 13:41	**Analysis:**	Trimmed Spearman-Kärber	**Status Level:**	1

Graphics



Analyst: KSL QA: Dec-17/19

CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-3344-4127	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	17 Dec-19 17:24	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2081880	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	1.181	0.85	>>	Yes	Passes Criteria

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	0.4651	n/a	1.333
IC10	0.7864	n/a	1.258
IC15	0.932	0.2029	1.423
IC20	1.087	0.3168	1.591
IC25	1.254	0.4612	1.801
IC40	1.841	0.9731	2.566
IC50	2.315	1.393	3.21

Mean Dry Biomass-mg Summary

			Calculated Variate						Isotonic Variate	
Conc-mg/L	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**Mean**	**%Effect**
0.15	N	3	1.181	1.16	1.206	0.02334	1.98%	0.0%	1.181	0.0%
0.151		3	1.085	0.916	1.274	0.1798	16.57%	8.07%	1.164	1.4%
0.16		3	1.164	1.052	1.222	0.09701	8.34%	1.41%	1.164	1.4%
0.18		3	1.155	1.054	1.304	0.1315	11.39%	2.15%	1.164	1.4%
0.27		3	1.252	1.112	1.444	0.172	13.74%	-6.04%	1.164	1.4%
0.79		3	1.062	0.916	1.196	0.1404	13.22%	10.05%	1.062	10.05%
5.07		3	0.1273	0	0.268	0.1345	105.60%	89.22%	0.1273	89.22%

Mean Dry Biomass-mg Detail

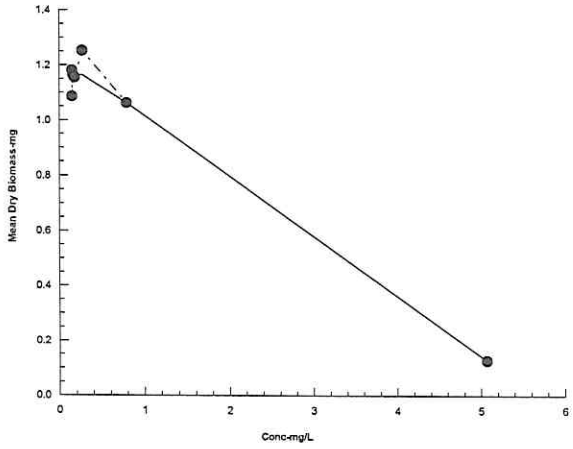
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.206	1.16	1.176
0.151		1.274	1.066	0.916
0.16		1.052	1.218	1.222
0.18		1.054	1.108	1.304
0.27		1.444	1.2	1.112
0.79		1.196	1.074	0.916
5.07		0.114	0	0.268

N= lab control

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-3344-4127	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	17 Dec-19 17:24	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: _____ QA: _____

Dec 19/19

CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-7851-4664	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	17 Dec-19 17:25	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2141035	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	0.8057	n/a	1.302
IC10	1.072	n/a	1.614
IC15	1.377	n/a	1.967
IC20	1.727	n/a	2.368
IC25	2.128	n/a	2.855
IC40	3.724	1.332	5.027
IC50	>5.07	n/a	n/a

Mean Dry Weight-mg Summary

			Calculated Variate						Isotonic Variate	
Conc-mg/L	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0.15	N	3	1.181	1.16	1.206	0.02334	1.98%	0.0%	1.219	0.0%
0.151		3	1.162	1.066	1.274	0.105	9.04%	1.61%	1.219	0.0%
0.16		3	1.252	1.218	1.315	0.05489	4.39%	-6.01%	1.219	0.0%
0.18		3	1.248	1.054	1.385	0.1725	13.83%	-5.68%	1.219	0.0%
0.27		3	1.252	1.112	1.444	0.172	13.74%	-6.04%	1.219	0.0%
0.79		3	1.162	0.916	1.495	0.2993	25.76%	1.61%	1.162	4.68%
5.07		2	0.62	0.57	0.67	0.07069	11.40%	47.49%	0.62	49.13%

Mean Dry Weight-mg Detail

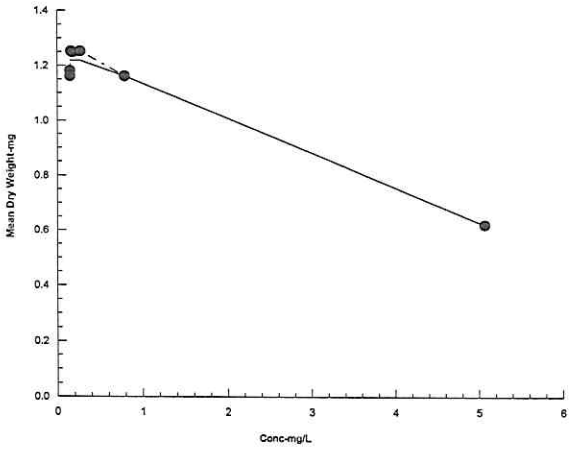
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.206	1.16	1.176
0.151		1.274	1.066	1.145
0.16		1.315	1.218	1.222
0.18		1.054	1.385	1.304
0.27		1.444	1.2	1.112
0.79		1.495	1.074	0.916
5.07		0.57	0.67	

N= Lab control

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-7851-4664	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	17 Dec-19 17:25	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: KSL QA: Dec-19/19

CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	07-5682-5805	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:05	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	0.79	5.07	2.001		23.45%

Dunnett Multiple Comparison Test

Control vs	Conc-mg/L	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	0.151	0.7179	2.532	0.28	4	CDF	0.5857	Non-Significant Effect
	0.16	0.7179	2.532	0.28	4	CDF	0.5857	Non-Significant Effect
	0.18	0.7179	2.532	0.28	4	CDF	0.5857	Non-Significant Effect
	0.27	0	2.532	0.28	4	CDF	0.8571	Non-Significant Effect
	0.79	0.7179	2.532	0.28	4	CDF	0.5857	Non-Significant Effect
	5.07*	8.026	2.532	0.28	4	CDF	4.4E-06	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.81551	0.302585	6	16.5	1.3E-05	Significant Effect
Error	0.256705	0.018336	14			
Total	2.07221		20			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:0.1%)
Variances	Levene Equality of Variance Test	2.932	7.436	0.0456	Equal Variances
Variances	Mod Levene Equality of Variance Test	0.7858	15.52	0.6076	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8703	0.8118	0.0097	Normal Distribution

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15	N	3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.151		3	0.9333	0.6465	1.0000	1.0000	0.8000	1.0000	0.0667	12.37%	6.67%
0.16		3	0.9333	0.6465	1.0000	1.0000	0.8000	1.0000	0.0667	12.37%	6.67%
0.18		3	0.9333	0.6465	1.0000	1.0000	0.8000	1.0000	0.0667	12.37%	6.67%
0.27		3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.79		3	0.9333	0.6465	1.0000	1.0000	0.8000	1.0000	0.0667	12.37%	6.67%
5.07		3	0.2000	0.0000	0.6968	0.2000	0.0000	0.4000	0.1155	100.00%	80.00%

Angular (Corrected) Transformed Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15	N	3	1.345	1.345	1.346	1.345	1.345	1.345	0	0.00%	0.00%
0.151		3	1.266	0.9244	1.607	1.345	1.107	1.345	0.07938	10.86%	5.90%
0.16		3	1.266	0.9244	1.607	1.345	1.107	1.345	0.07938	10.86%	5.90%
0.18		3	1.266	0.9244	1.607	1.345	1.107	1.345	0.07938	10.86%	5.90%
0.27		3	1.345	1.345	1.346	1.345	1.345	1.345	0	0.00%	0.00%
0.79		3	1.266	0.9244	1.607	1.345	1.107	1.345	0.07938	10.86%	5.90%
5.07		3	0.458	-0.1125	1.028	0.4636	0.2255	0.6847	0.1326	50.15%	65.96%

N= lab control

Dec-17/19

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	07-5682-5805	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:05	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.0000	1.0000	1.0000
0.151		1.0000	1.0000	0.8000
0.16		0.8000	1.0000	1.0000
0.18		1.0000	0.8000	1.0000
0.27		1.0000	1.0000	1.0000
0.79		0.8000	1.0000	1.0000
5.07		0.2000	0.0000	0.4000

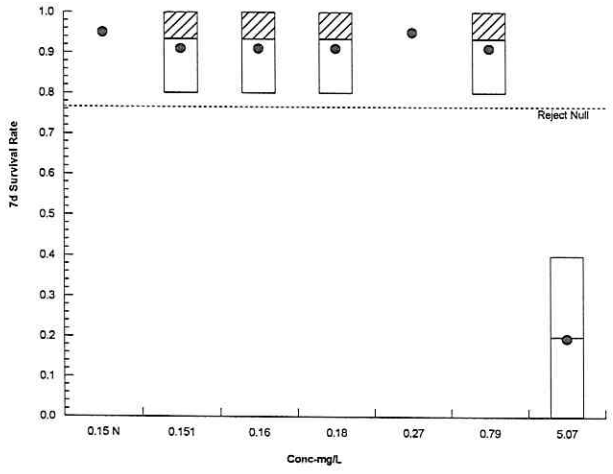
Angular (Corrected) Transformed Detail

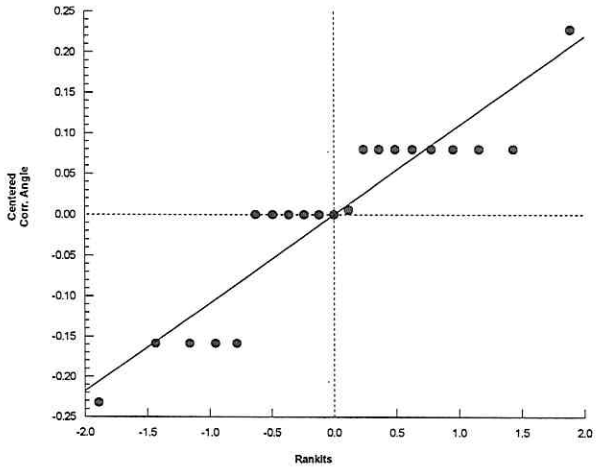
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.345	1.345	1.345
0.151		1.345	1.345	1.107
0.16		1.107	1.345	1.345
0.18		1.345	1.107	1.345
0.27		1.345	1.345	1.345
0.79		1.107	1.345	1.345
5.07		0.4636	0.2255	0.6847

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	5/5	5/5	5/5
0.151		5/5	5/5	4/5
0.16		4/5	5/5	5/5
0.18		5/5	4/5	5/5
0.27		5/5	5/5	5/5
0.79		4/5	5/5	5/5
5.07		1/5	0/5	2/5

Graphics





N=lab control

CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	15-0029-9202	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 13:59	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	0.79	5.07	2.001		33.93%

Bonferroni Adj t Test

Control	vs	Conc-mg/L	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.151	0.1456	2.746	0.358	4	CDF	1.0000	Non-Significant Effect
		0.16	-0.5441	2.746	0.358	4	CDF	1.0000	Non-Significant Effect
		0.18	-0.5135	2.746	0.358	4	CDF	1.0000	Non-Significant Effect
		0.27	-0.5467	2.746	0.358	4	CDF	1.0000	Non-Significant Effect
		0.79	0.1456	2.746	0.358	4	CDF	1.0000	Non-Significant Effect
		5.07*	3.843	2.746	0.401	3	CDF	0.0061	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.656295	0.109382	6	4.283	0.0134	Significant Effect
Error	0.332018	0.0255398	13			
Total	0.988313		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	9.993	16.81	0.1250	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.971	0.866	0.7761	Normal Distribution

Mean Dry Weight-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15	N	3	1.181	1.123	1.239	1.176	1.16	1.206	0.01348	1.98%	0.00%
0.151		3	1.162	0.9008	1.423	1.145	1.066	1.274	0.06063	9.04%	1.61%
0.16		3	1.252	1.115	1.388	1.222	1.218	1.315	0.03169	4.38%	-6.01%
0.18		3	1.248	0.8191	1.676	1.304	1.054	1.385	0.09962	13.83%	-5.68%
0.27		3	1.252	0.8247	1.679	1.2	1.112	1.444	0.09931	13.74%	-6.04%
0.79		3	1.162	0.4182	1.905	1.074	0.916	1.495	0.1728	25.76%	1.61%
5.07		2	0.62	-0.01516	1.255	0.62	0.57	0.67	0.04999	11.40%	47.49%

Mean Dry Weight-mg Detail

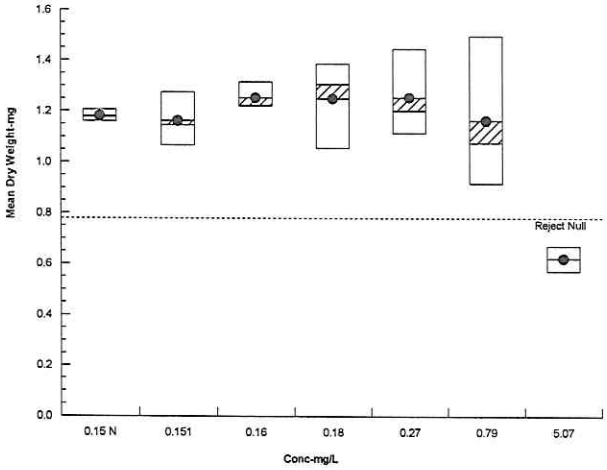
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.206	1.16	1.176
0.151		1.274	1.066	1.145
0.16		1.315	1.218	1.222
0.18		1.054	1.385	1.304
0.27		1.444	1.2	1.112
0.79		1.495	1.074	0.916
5.07		0.57	0.67	

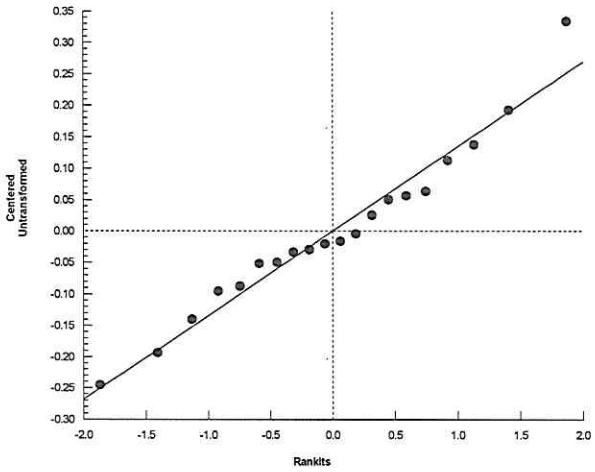
N= lab control

Pacific Topsmelt 7-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	15-0029-9202	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 13:59	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1

Graphics





Analyst: _____ QA: Dec-17/19

CETIS Analytical Report

Test Code/ID: 191279a / 13-1178-4533

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	14-6247-1442	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 13:59	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	00-9075-6029	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 15:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	26 Feb-19 14:30	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 9d
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 15h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	0.79	5.07	2.001		23.58%

Dunnett Multiple Comparison Test

Control vs	Conc-mg/L	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	0.151	0.8669	2.532	0.279	4	CDF	0.5175	Non-Significant Effect
	0.16	0.1516	2.532	0.279	4	CDF	0.8125	Non-Significant Effect
	0.18	0.2303	2.532	0.279	4	CDF	0.7861	Non-Significant Effect
	0.27	-0.6488	2.532	0.279	4	CDF	0.9659	Non-Significant Effect
	0.79	1.079	2.532	0.279	4	CDF	0.4218	Non-Significant Effect
	5.07*	9.579	2.532	0.279	4	CDF	1.3E-06	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.75926	0.459876	6	25.35	9.3E-07	Significant Effect
Error	0.253937	0.0181384	14			
Total	3.01319		20			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	5.142	16.81	0.5257	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9442	0.871	0.2641	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15	N	3	1.181	1.123	1.239	1.176	1.16	1.206	0.01348	1.98%	0.00%
0.151		3	1.085	0.6387	1.532	1.066	0.916	1.274	0.1038	16.57%	8.07%
0.16		3	1.164	0.923	1.405	1.218	1.052	1.222	0.05601	8.33%	1.41%
0.18		3	1.155	0.8286	1.482	1.108	1.054	1.304	0.07595	11.39%	2.15%
0.27		3	1.252	0.8247	1.679	1.2	1.112	1.444	0.09931	13.74%	-6.04%
0.79		3	1.062	0.7133	1.411	1.074	0.916	1.196	0.08105	13.22%	10.05%
5.07		3	0.1273	-0.2068	0.4614	0.114	0	0.268	0.07765	105.62%	89.22%

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15	N	1.206	1.16	1.176
0.151		1.274	1.066	0.916
0.16		1.052	1.218	1.222
0.18		1.054	1.108	1.304
0.27		1.444	1.2	1.112
0.79		1.196	1.074	0.916
5.07		0.114	0	0.268

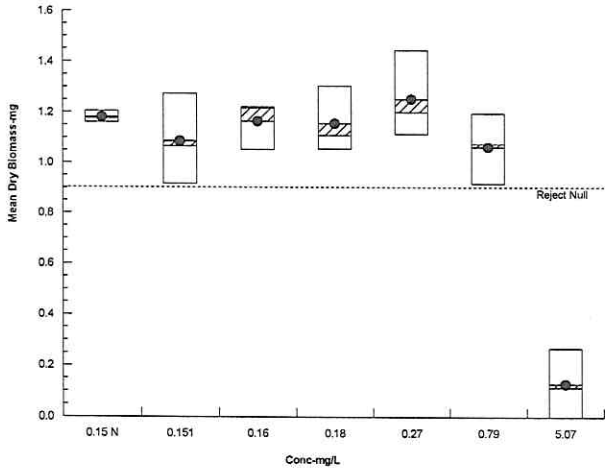
N = lab control

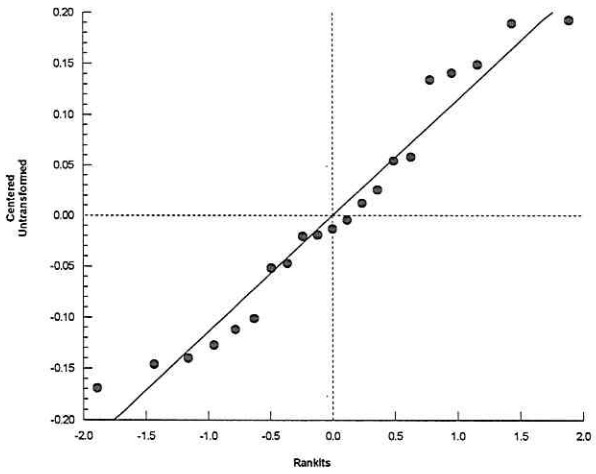
Analyst: MT QA: Dec 17/19

Pacific Topsmelt 7-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	14-6247-1442	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 13:59	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

Graphics





Analyst: _____ QA: Dec 17/19

Topsmelt Test Summary Sheet

Client: WDOE

Start Date & Time: April 23, 2019 @ 1230h

Work Order No.: 191279

Test Species: *Atherinops affinis*

Sample Information:

Sample ID: DW-3 (Definitive)
Sample Date: 29-Jan-19
Date Received: 30-Jan-19
Sample Volume: 5x 20L

Dilution Water:

Type: Natural Seawater
Source: Vancouver Aquarium
Vancouver, BC

Test Organism Information:

Batch No.: 042319
Source: Aquatic Biosystems, CO
Age: 12 days

Copper Reference Toxicant Results:

Reference Toxicant ID: AAC41
Stock Solution ID: 19Cu01
Date Initiated: 23-Apr-19
7-d EC50 (95% CL): 104.0 (88.3 - 122.5) µg/L Cu
7-d IC50 (95% CL): 95.1 (70.6 - 112.5) µg/L Cu

EC50 Reference Toxicant Mean (Acceptable Range) : 95.9 (68.6 - 133.9) µg/L Cu CV (%): 17
IC50 Reference Toxicant Mean (Acceptable Range) : 91.3 (66.1 - 126.1) µg/L Cu CV (%): 16

Test Results:

	Survival	Dry Biomass	Dry Weight
NOEC	3.14	2.12	2.12
LOEC	>3.14	3.14	3.14
LC25 mg/L diesel (95% CL)	3.0 (2.3 - n/a)		
LC50 mg/L diesel (95% CL)	>3.14		
IC25 mg/L diesel (95% CL)		2.0 (1.4 - 2.6)	2.4 (1.7 - 3.0)
IC50 mg/L diesel (95% CL)		3.1 (2.4 - 4.0)	>3.14

n/a= not available

Reviewed by: [signature]

Date reviewed: Jan-16, 2020

Chronic Marine Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3
Work Order #: 191279

Start Date & Time: Apr 23/19 @1030h
Stop Date & Time: Apr 30/19 @~~1345~~ 1320h
Test Species: *Atherinops affinis* MG

(% v/v) Concentration	Days													
	0	1		2		3		4		5		6		7
Control	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.0	19.5	20.0	20.0	20.0	20.0	19.5	20.0	19.0	20.0	19.0	19.0	20.0	19.5
DO (mg/L)	7.4	6.5	7.1	6.6	7.4	5.7	7.3	5.2	7.5	5.6	7.4	5.6	7.4	5.9
pH	7.7	7.6	7.6	7.4	7.6	7.4	7.7	7.6	7.7	7.8	7.7	7.5	7.8	7.5
Salinity (ppt)	29	30		30		30		30		30		29		30
Initials	CT	CT		CT		CT		CT		CT		CT		CT

Concentration	Days													
	0	1		2		3		4		5		6		7
Salt Adj. Control	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.0	19.0	19.0	20.0	19.0	20.0	19.5	20.0	19.0	20.0	19.0	19.0	19.0	19.5
DO (mg/L)	6.7	6.4	7.8	6.3	7.4	5.7	7.3	5.3	7.4	5.7	7.4	5.0	7.5	5.3
pH	7.9	7.8	7.7	7.6	7.8	7.6	7.9	7.8	7.9	7.9	7.9	7.7	7.9	7.7
Salinity (ppt)	31	31		31		31		30		30		31		31
Initials	CT	CT		CT		CT		CT		CT		CT		CT

Concentration	Days													
	0	1		2		3		4		5		6		7
Site Control	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.0	19.0	20.0	20.0	20.5	20.0	19.5	20.0	19.0	20.0	19.0	19.0	19.0	20.0
DO (mg/L)	7.85	6.3	7.4	6.3	7.3	5.7	7.7	5.2	7.5	5.7	7.4	5.3	7.7	5.8
pH	8.0	8.0	8.0	7.9	7.9	7.9	7.9	7.7	7.6	7.8	7.7	8.0	8.1	8.1
Salinity (ppt)	29	~~30~~ 29		29		30		30		30		31		31
Initials	CT	CT		CT		CT		CT		CT		CT		CT

Concentration	Days													
	0	1		2		3		4		5		6		7
12.5	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.0	19.5	19.0	20.0	20.0	20.0	19.5	20.0	19.0	20.0	19.0	20.0	20.0	20.5
DO (mg/L)	7.3	6.6	7.6	6.1	7.4	5.75	7.3	5.2	7.4	5.8	7.5	5.8	7.4	6.1
pH	7.7	7.6	7.6	7.5	7.7	7.5	7.7	7.7	7.7	7.8	7.8	7.6	7.8	7.8
Salinity (ppt)	29	30		30		30		30		30		30		30
Initials	CT	CT		CT		CT		CT		CT		CT		CT

Analysts: CS, AWD

Reviewed by: [signature]

Date reviewed: July 17, 2019

Sample Description: DW-3: clear, yellow, odourless, some particulates
MW-11 (Site Control): clear, light yellow, odourless, no particulates

Comments:

Chronic Marine Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3
Work Order #: 191279

Start Date & Time: Apr 23/19 @ 1230h
Stop Date & Time: Apr 30/19 @ 1320h
Test Species: *Atherinops affinis*

(% v/v) Concentration 25	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.0	19.5	19.0	20.0	20.0	20.5	20.0	20.0	19.0	20.0	19.0	20.0	20.0	20.5
DO (mg/L)	7.2	6.4	~~6.0~~ 7.1	6.2	7.5	5.6	7.3	5.2	7.4	5.5	7.5	5.5	~~7.85~~ 7.8	5.9
pH	7.8	7.6	7.7	7.5	7.8	7.6	7.7	7.7	7.7	7.8	7.7	7.7	7.8	7.7
Salinity (ppt)	29	30		30		30		30		30		30		30
Initials	AT	AT		AT		AT		A		A		AT		AT

Concentration 50	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.0	20.0	19.0	20.0	20.0	20.5	20.0	20.0	19.0	20.0	19.0	20.0	20.0	20.5
DO (mg/L)	7.4	6.8	~~6.0~~ 7.1	6.2	7.95	5.7	7.4	5.1	7.4	5.7	7.5	5.6	7.6	6.0
pH	7.8	7.7	7.8	7.6	7.9	7.7	7.7	7.7	7.6	7.8	7.7	7.8	7.9	7.9
Salinity (ppt)	29	29		30		30		30		30		30		30
Initials	AT	AT		AT		AT		A		A		AT		AT

Concentration 75	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.0	~~7.8~~ 20.0	19.0	20.0	20.0	20.5	19.5	20.0	19.0	20.0	19.0	20.0	~~20.85~~ 20.5	20.5
DO (mg/L)	7.1	6.7	~~6.0~~ 7.1	6.3	7.6	5.8	7.5	5.2	7.4	5.7	7.5	5.6	7.5	6.2
pH	7.8	7.8	7.8	7.7	7.9	7.8	7.7	7.8	7.6	7.9	7.7	7.8	7.9	7.9
Salinity (ppt)	29	29		30		30		30		30		~~30~~ 31		31
Initials	AT	AT		AT		AT		A		A		AT		AT

OMS

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	19.5	19.5	19.5	20.0	20.0	20.5	19.0	20.0	19.0	20.0	19.0	20.0	20.0	20.5
DO (mg/L)	8.4	6.7	8.0	6.3	7.6	5.8	7.8	5.2	7.4	5.6	7.5	6.0	7.6	6.3
pH	7.8	7.8	7.8	7.8	7.9	7.8	7.7	7.8	7.8	7.9	7.7	7.9	7.9	7.9
Salinity (ppt)	29	29		30		30		30		30		31		31
Initials	AT	AT		AT		AT		A		A		AT		AT

Analysts: CS, AWD

Reviewed by: [signature]

Date reviewed: July 17, 2019

Sample Description:

Comments:

7-d Topsmelt Toxicity Test
Daily Survival

Client: WDOE
Sample ID: Dup-3
Work Order #: 19279

Start Date & Time: Apr 23/19 @ 1230h
Stop Date & Time: Apr 30/19 @ 1320h
Test Species: *Atherinops affinis*

Concentration % (v/v)	Rep	Day of Test - No. of Survivors 1	2	3	4	5	6	7	Comments
Control	A	5	5	5	5	5	5	5	
	B	↓	↓	↓	↓	5	↓	↓	
	C					5			
	D					5			
	E					5	↓	↓	
Salt adj.	A					4	4	4	
Control	B					5	5	5	
	C		↓	↓	↓	5	5	5	
	D		4	4	4	4	4	4	
	E		5	5	5	5	5	5	
Site Control	A		↓	↓	↓	5	5	5	
	B					5	↓	↓	
	C					5			
	D					5			
	E					5	↓	↓	
12.5	A				↓	5	5	5	
	B					5	5	5	
	C				4	4	4	4	
	D				5	5	5	5	
	E				5	4	4	4	
25	A			↓	↓	5	5	5	
	B					5	↓	↓	
	C					5			
	D					5			
	E					5	↓	↓	
50	A					4	4	4	
	B					5	5	5	
	C					5	5	5	
	D					5	5	5	
	E					4	4	4	
75	A					4	4	4	
	B					5	5	5	
	C					4	4	4	
	D					5	5	5	
	E			↓	↓	5	5	5	
100	A			4	4	4	3	3	
	B			4	3	3	3	3	
	C			5	5	5	5	5	
	D			3	3	3	3	3	
	E	↓	↓	4	4	4	4	4	
Tech Initials									

Comments: ~~Organism~~ 1 organism died due to technician error
- remaining organisms appear normal

Reviewed by: [signature]

Date reviewed: July 17, 2019

Topsmelt Toxicity Test Data Sheet
Dry Weight Data

Client: WDOE
Work Order # : 191279
Sample ID: Dw-3

Start Date & Time: Apr 23/19 @ 1230h
Termination Date & Time: Apr 30/19 @ 1320h

AARed

% (v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	A	1	5	Ct	1049.82	1060.36	5	Ct/Ct
	B	2	5	Ct	1072.62	1083.92	5	Ct/Ct
	C	3	5	Ct	~~984.85~~ 984.76	990.72	5	Ct/Ct
	D	4	5	Ct	984.97	993.62	5	Ct/Ct
	E	5	5	Ct	1048.66	1058.01	5	Ct/Ct
Salt Adj. Control	A	6	4	Ct	1071.53	1079.54	4	Ct/Ct
	B	7	5	Ct	1052.93	1061.54	5	Ct/Ct
	C	8	5	Ct	1064.84	1073.45	5	Ct/Ct
	D	9	4	Ct	1043.07	1049.76	4	Ct/Ct
	E	10	5	Ct	1064.16	1072.62	5	Ct/Ct
~~12.5~~ site control	A	11	5	Ct	1091.91	1101.08	5	Ct/Ct
	B	12	5	Ct	1064.50	1076.80	5	Ct/Ct
	C	13	5	Ct	1049.34	1059.94	5	Ct/Ct
	D	14	5	Ct	1042.41	1051.94	5	Ct/Ct
	E	15	5	Ct	1044.92	1054.24	5	Ct/Ct
~~25~~ 12.5	A	16	5	Ct	1062.63	1071.82	5	Ct/Ct
	B	17	5	Ct	~~1058~~ 1057.02	1067.87	5	Ct/Ct
	C	18	4	Ct	1053.96	1062.16	4	Ct/Ct
	D	19	5	Ct	1075.82	1084.00	5	Ct/Ct
	E	20	4	Ct	1048.40	1054.77	4	Ct/Ct
~~50~~ 25	A	21	5	Ct	1060.26	1068.97	5	Ct/Ct
	B	22	5	Ct	1043.92	1052.75	5	Ct/Ct
	C	23	5	Ct	1033.55	1045.75	5	Ct/Ct
	D	24	5	Ct	1043.28	1051.76	5	Ct/Ct
	E	25	5	Ct	1045.72	1055.67	5	Ct/Ct
50	A	26	4	Ct	1062.50	1067.64	4	Ct/Ct
	B	27	5	Ct	1065.37	1075.11	5	Ct/Ct
	C	28	5	Ct	1071.88	1081.34	5	Ct/Ct
	D	29	5	Ct	1042.72	1053.26	5	Ct/Ct
	E	30	4	Ct	1033.05	1039.49	4	Ct/Ct

Comments: 10% re-weigh : pan 1) # 2 weight 1083.99 2) # 5 weight 1058.12
3) # 11 weight 1101.15 4) # 25 weight 1055.60

Reviewed by: [signature] Date Reviewed: July 17, 2019

Topsmelt Toxicity Test Data Sheet

Dry Weight Data

Client: WDOE

Work Order # : 191279

Sample ID: DW-3 AA Red

Start Date & Time: Apr 23/19

Termination Date & Time: Apr 30/19

% (v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
75	A	31	4	CA	1059.19	1064.06	4	CHA
	B	32	5	CA	1053.39	1059.69	5	CHA
	C	33	4	CA	1057.78	1065.54	4	CHA
	D	34	5	CA	1059.62	1067.49	5	CHA
	E	35	5	CA	1031.62	1037.23	5	CHA
100	A	36	3	CA	1098.81	1101.94	3	CHA
	B	37	3	CA	1081.21	~~12~~ 1084.18	3	CHA
	C	38	5	CA	1075~~6~~.00	1082.80	5	CHA
	D	39	3	CA	1044.74	1047.80	3	CHA
	E	40	4	CA	1044.64	1051.21	4	CHA
	A							
	B							
	C							
	D							
	E							
	A							
	B							
	C							
	D							
	E							
	A							
	B							
	C							
	D							
	E							
	A							
	B							
	C							
	D							
	E							

Comments:

Reviewed by: CW

Date Reviewed: July 17, 2019

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**			
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**			
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology				

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
12-3914-5165	7d Survival Rate	Steel Many-One Rank Sum Test		3.14	>3.14	n/a		16.0%	1
07-1613-2626	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test		2.12	3.14	2.58		30.1%	1
13-4199-4736	Mean Dry Weight-mg	Dunnett Multiple Comparison Test		2.12	3.14	2.58		26.4%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
01-5682-8765	7d Survival Rate	Linear Interpolation (ICPIN)		EC5	0.7664	0.04748	2.863		1
				EC10	2.21	0.3861	2.49		
				EC15	2.445	1.609	2.962		
				EC20	2.697	2.104	n/a		
				EC25	2.968	2.331	n/a		
				EC40	>3.14	n/a	n/a		
				EC50	>3.14	n/a	n/a		
16-1829-3962	Mean Dry Biomass-mg	NLR: 3P Log-Logistic		IC5	0.9821	n/a	1.567		1
				IC10	1.311	n/a	1.912		
				IC15	1.567	0.4562	2.179		
				IC20	1.793	1.018	2.393		
				IC25	2.004	1.364	2.578		
				IC40	2.619	2.085	3.209		
				IC50	3.063	2.359	3.978		
18-3332-0016	Mean Dry Weight-mg	NLR: 3P Log-Logistic		IC5	0.984	n/a	1.67		1
				IC10	1.405	n/a	2.138		
				IC15	1.751	0.7986	2.473		
				IC20	2.067	1.321	2.738		
				IC25	2.37	1.726	3.001		
				IC40	3.297	2.292	4.511		
				IC50	3.999	2.378	6.725		

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
01-5682-8765	7d Survival Rate	Control Resp	1	0.8	>>	Yes	Passes Criteria
16-1829-3962	Mean Dry Biomass-mg	Control Resp	1.832	0.85	>>	Yes	Passes Criteria
07-1613-2626	Mean Dry Biomass-mg	PMSD	0.3013	<<	0.5	No	Passes Criteria

Pacific Topsmelt 7-d Survival and Growth Test — Nautilus Environmental

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	SC	5	0.9200	0.7840	1.0000	0.8000	1.0000	0.0490	0.1095	11.91%	0.00%
0.16	N	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-8.70%
0.2	XC	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-8.70%
0.37		5	0.9200	0.7840	1.0000	0.8000	1.0000	0.0490	0.1095	11.91%	0.00%
0.62		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-8.70%
1.29		5	0.9200	0.7840	1.0000	0.8000	1.0000	0.0490	0.1095	11.91%	0.00%
2.12		5	0.9200	0.7840	1.0000	0.8000	1.0000	0.0490	0.1095	11.91%	0.00%
3.14		5	0.7200	0.4979	0.9421	0.6000	1.0000	0.0800	0.1789	24.85%	21.74%

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	SC	5	1.615	1.413	1.817	1.338	1.722	0.0727	0.1626	10.06%	0.00%
0.16	N	5	1.832	1.32	2.344	1.192	2.26	0.1845	0.4126	22.52%	-13.42%
0.2	XC	5	2.037	1.712	2.362	1.834	2.46	0.1171	0.2618	12.85%	-26.10%
0.37		5	1.712	1.305	2.118	1.274	2.17	0.1464	0.3273	19.12%	-5.97%
0.62		5	1.927	1.544	2.31	1.696	2.44	0.138	0.3085	16.01%	-19.29%
1.29		5	1.653	1.072	2.234	1.028	2.108	0.2092	0.4677	28.30%	-2.33%
2.12		5	1.296	0.969	1.624	0.974	1.574	0.1179	0.2637	20.34%	19.74%
3.14		5	0.9012	0.4066	1.396	0.594	1.36	0.1781	0.3983	44.20%	44.20%

Mean Dry Weight-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	SC	5	1.762	1.593	1.931	1.673	2.003	0.06081	0.136	7.72%	0.00%
0.16	N	5	1.832	1.32	2.344	1.192	2.26	0.1845	0.4126	22.52%	-3.96%
0.2	XC	5	2.037	1.712	2.362	1.834	2.46	0.1171	0.2618	12.85%	-15.58%
0.37		5	1.857	1.544	2.17	1.592	2.17	0.1128	0.2522	13.58%	-5.40%
0.62		5	1.927	1.544	2.31	1.696	2.44	0.138	0.3085	16.01%	-9.34%
1.29		5	1.769	1.365	2.172	1.285	2.108	0.1452	0.3247	18.36%	-0.36%
2.12		5	1.423	1.006	1.839	1.122	1.94	0.1499	0.3352	23.56%	19.27%
3.14		5	1.211	0.859	1.563	0.99	1.642	0.1268	0.2836	23.42%	31.27%

N = lab control
SC = salt adjusted control
XC = site control (MW-11)

Pacific Topsmelt 7-d Survival and Growth Test **Nautilus Environmental**

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	0.8000	1.0000	1.0000	0.8000	1.0000
0.16	N	1.0000	1.0000	1.0000	1.0000	1.0000
0.2	XC	1.0000	1.0000	1.0000	1.0000	1.0000
0.37		1.0000	1.0000	0.8000	1.0000	0.8000
0.62		1.0000	1.0000	1.0000	1.0000	1.0000
1.29		0.8000	1.0000	1.0000	1.0000	0.8000
2.12		0.8000	1.0000	0.8000	1.0000	1.0000
3.14		0.6000	0.6000	1.0000	0.6000	0.8000

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	1.602	1.722	1.722	1.338	1.692
0.16	N	2.108	2.26	1.192	1.73	1.87
0.2	XC	1.834	2.46	2.12	1.906	1.864
0.37		1.838	2.17	1.64	1.636	1.274
0.62		1.742	1.766	2.44	1.696	1.99
1.29		1.028	1.948	1.892	2.108	1.288
2.12		0.974	1.26	1.552	1.574	1.122
3.14		0.626	0.594	1.36	0.612	1.314

Mean Dry Weight-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	2.003	1.722	1.722	1.673	1.692
0.16	N	2.108	2.26	1.192	1.73	1.87
0.2	XC	1.834	2.46	2.12	1.906	1.864
0.37		1.838	2.17	2.05	1.636	1.592
0.62		1.742	1.766	2.44	1.696	1.99
1.29		1.285	1.948	1.892	2.108	1.61
2.12		1.218	1.26	1.94	1.574	1.122
3.14		1.043	0.99	1.36	1.02	1.642

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	4/5	5/5	5/5	4/5	5/5
0.16	N	5/5	5/5	5/5	5/5	5/5
0.2	XC	5/5	5/5	5/5	5/5	5/5
0.37		5/5	5/5	4/5	5/5	4/5
0.62		5/5	5/5	5/5	5/5	5/5
1.29		4/5	5/5	5/5	5/5	4/5
2.12		4/5	5/5	4/5	5/5	5/5
3.14		3/5	3/5	5/5	3/5	4/5

N= lab control
SC= salt adjusted control
XC= site Control (MW-11)

CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-5682-8765	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	14 Jan-20 16:48	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	180712	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	1	0.8	>>	Yes	Passes Criteria

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	0.7664	0.04748	2.863
EC10	2.21	0.3861	2.49
EC15	2.445	1.609	2.962
EC20	2.697	2.104	n/a
EC25	2.968	2.331	n/a
EC40	>3.14	n/a	n/a
EC50	>3.14	n/a	n/a

7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-mg/L	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0.16	N	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	25/25	1	0.0%
0.37		5	0.9200	0.8000	1.0000	0.1095	11.91%	8.0%	23/25	0.96	4.0%
0.62		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	25/25	0.96	4.0%
1.29		5	0.9200	0.8000	1.0000	0.1095	11.91%	8.0%	23/25	0.92	8.0%
2.12		5	0.9200	0.8000	1.0000	0.1095	11.91%	8.0%	23/25	0.92	8.0%
3.14		5	0.7200	0.6000	1.0000	0.1789	24.85%	28.0%	18/25	0.72	28.0%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	1.0000	1.0000	1.0000	1.0000	1.0000
0.37		1.0000	1.0000	0.8000	1.0000	0.8000
0.62		1.0000	1.0000	1.0000	1.0000	1.0000
1.29		0.8000	1.0000	1.0000	1.0000	0.8000
2.12		0.8000	1.0000	0.8000	1.0000	1.0000
3.14		0.6000	0.6000	1.0000	0.6000	0.8000

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	5/5	5/5	5/5	5/5	5/5
0.37		5/5	5/5	4/5	5/5	4/5
0.62		5/5	5/5	5/5	5/5	5/5
1.29		4/5	5/5	5/5	5/5	4/5
2.12		4/5	5/5	4/5	5/5	5/5
3.14		3/5	3/5	5/5	3/5	4/5

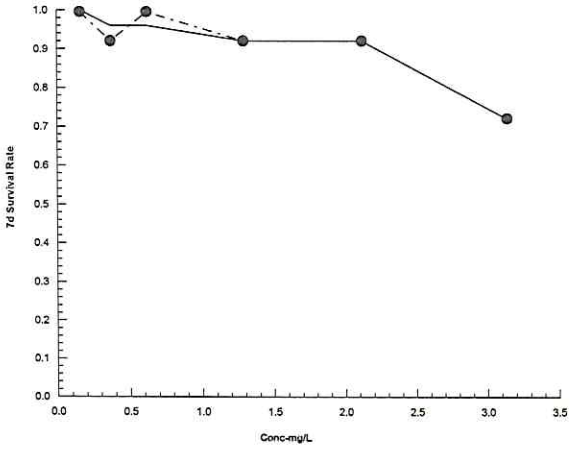
N= Lab Control

Analyst: KSV QA: JM 1/16/20

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-5682-8765	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	14 Jan-20 16:48	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: KJC QA: JMM 1/16/20

CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-1829-3962	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	14 Jan-20 16:49	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology		

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
8	32.06	-57.19	-53.91	0.4745	Yes	0.3524	3.009	0.7878	Non-Significant Lack of Fit

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	0.9821	n/a	1.567
IC10	1.311	n/a	1.912
IC15	1.567	0.4562	2.179
IC20	1.793	1.018	2.393
IC25	2.004	1.364	2.578
IC40	2.619	2.085	3.209
IC50	3.063	2.359	3.978

Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	1.832	0.85	>>	Yes	Passes Criteria

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	1.831	0.1024	1.621	2.041	17.89	<1.0E-37	Significant Parameter
γ	2.589	1.13	0.2697	4.908	2.29	0.0300	Significant Parameter
δ	3.063	0.384	2.275	3.851	7.976	<1.0E-37	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	75.97	25.32	3	199.8	<1.0E-37	Significant
Lack of Fit	0.1444	0.04812	3	0.3524	0.7878	Non-Significant
Pure Error	3.278	0.1366	24			
Residual	3.422	0.1267	27			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance Test	1.598	11.07	0.9015	Equal Variances
	Mod Levene Equality of Variance	0.2746	2.773	0.9211	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9688	0.9303	0.5071	Normal Distribution
	Anderson-Darling A2 Normality Te	0.3541	2.492	0.4668	Normal Distribution

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-1829-3962	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	14 Jan-20 16:49	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1

Mean Dry Biomass-mg Summary

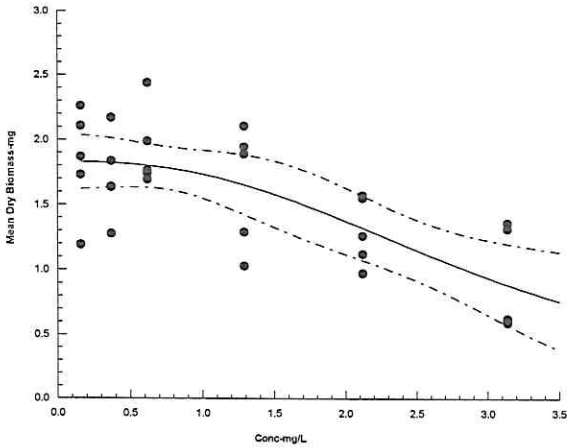
Conc-mg/L	Code	Count	Calculated Variate Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.16	N	5	1.832	1.192	2.26	0.1845	0.4126	22.52%	0.0%
0.37		5	1.712	1.274	2.17	0.1464	0.3273	19.12%	6.57%
0.62		5	1.927	1.696	2.44	0.138	0.3085	16.01%	-5.17%
1.29		5	1.653	1.028	2.108	0.2092	0.4677	28.30%	9.78%
2.12		5	1.296	0.974	1.574	0.1179	0.2637	20.34%	29.24%
3.14		5	0.9012	0.594	1.36	0.1781	0.3983	44.20%	50.81%

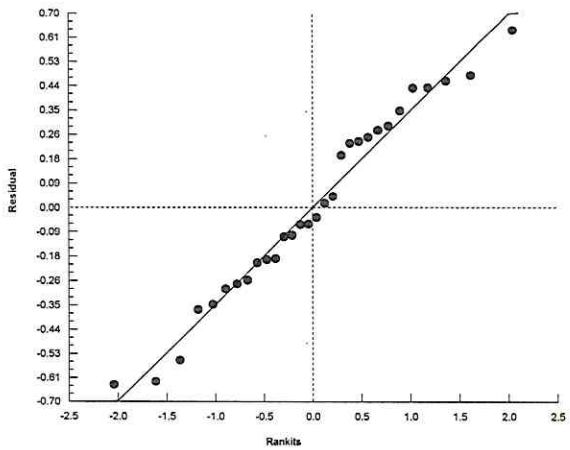
Mean Dry Biomass-mg Detail

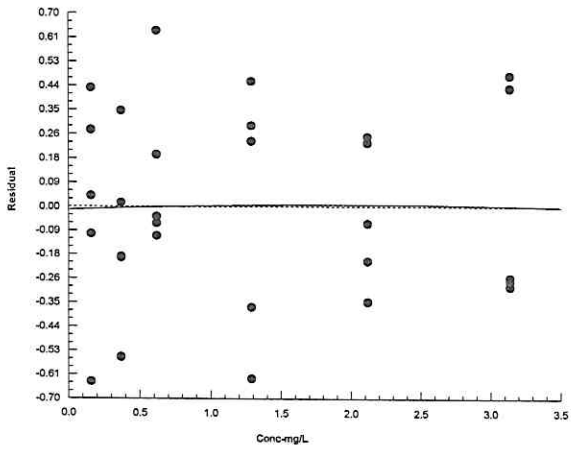
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	2.108	2.26	1.192	1.73	1.87
0.37		1.838	2.17	1.64	1.636	1.274
0.62		1.742	1.766	2.44	1.696	1.99
1.29		1.028	1.948	1.892	2.108	1.288
2.12		0.974	1.26	1.552	1.574	1.122
3.14		0.626	0.594	1.36	0.612	1.314

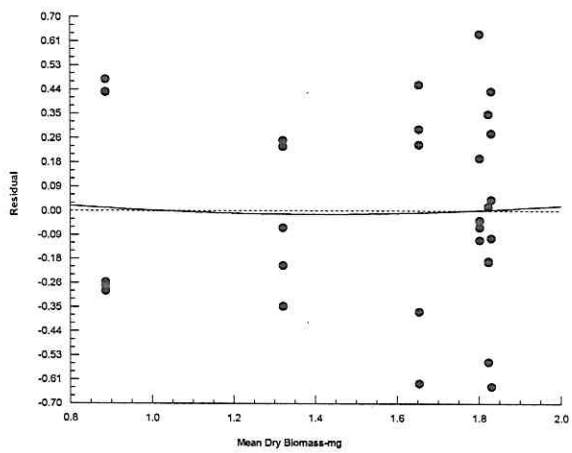
N = lab control

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]









CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-3332-0016	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	15 Jan-20 12:46	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology		

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
14	36.22	-65.52	-62.23	0.3883	Yes	0.2675	3.009	0.8482	Non-Significant Lack of Fit

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	0.984	n/a	1.67
IC10	1.405	n/a	2.138
IC15	1.751	0.7986	2.473
IC20	2.067	1.321	2.738
IC25	2.37	1.726	3.001
IC40	3.297	2.292	4.511
IC50	3.999	2.378	6.725

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	1.889	0.09771	1.688	2.089	19.33	<1.0E-37	Significant Parameter
γ	2.1	1.108	-0.1744	4.374	1.895	0.0689	Non-Significant Parameter
δ	3.999	0.8705	2.213	5.785	4.594	9.1E-05	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	85.6	28.53	3	297.2	<1.0E-37	Significant
Lack of Fit	0.08388	0.02796	3	0.2675	0.8482	Non-Significant
Pure Error	2.509	0.1045	24			
Residual	2.593	0.09602	27			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance Test	1.037	11.07	0.9595	Equal Variances
	Mod Levene Equality of Variance	0.1365	2.773	0.9816	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9787	0.9303	0.7888	Normal Distribution
	Anderson-Darling A2 Normality Te	0.3562	2.492	0.4618	Normal Distribution

Mean Dry Weight-mg Summary

			Calculated Variate						
Conc-mg/L	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.16	N	5	1.832	1.192	2.26	0.1845	0.4126	22.52%	0.0%
0.37		5	1.857	1.592	2.17	0.1128	0.2522	13.58%	-1.38%
0.62		5	1.927	1.696	2.44	0.138	0.3085	16.01%	-5.17%
1.29		5	1.769	1.285	2.108	0.1452	0.3247	18.36%	3.46%
2.12		5	1.423	1.122	1.94	0.1499	0.3352	23.56%	22.34%
3.14		5	1.211	0.99	1.642	0.1268	0.2836	23.42%	33.89%

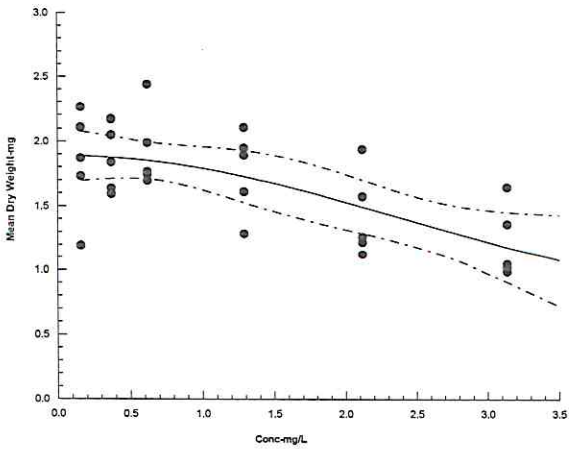
Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

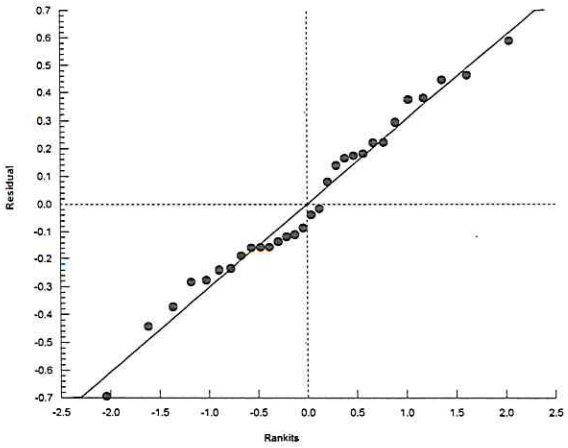
Analysis ID:	18-3332-0016	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	15 Jan-20 12:46	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1

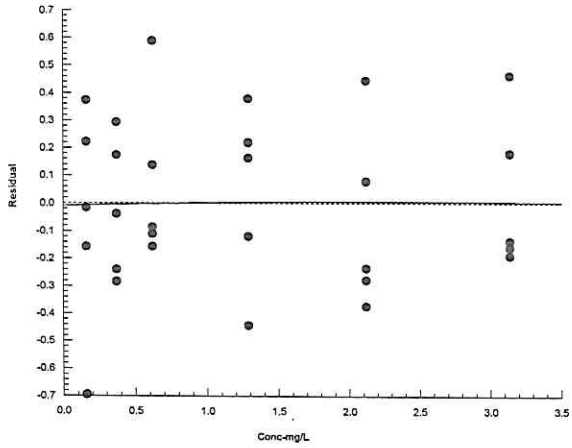
Mean Dry Weight-mg Detail

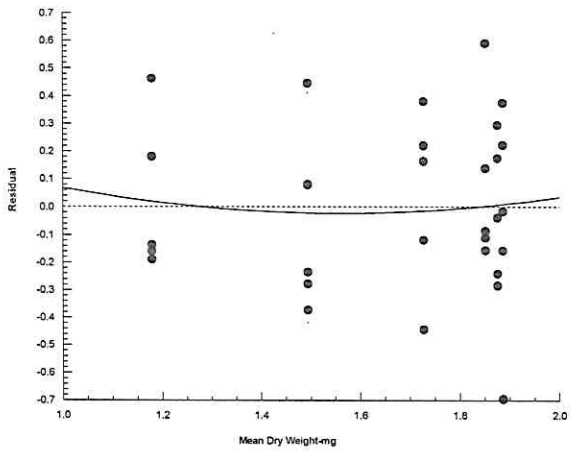
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	2.108	2.26	1.192	1.73	1.87
0.37		1.838	2.17	2.05	1.636	1.592
0.62		1.742	1.766	2.44	1.696	1.99
1.29		1.285	1.948	1.892	2.108	1.61
2.12		1.218	1.26	1.94	1.574	1.122
3.14		1.043	0.99	1.36	1.02	1.642

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]









CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-7592-9747	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	15 Jan-20 12:47	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Salt Control passed 7d survival rate	10.75%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Salt Control	1.633	1.86	0.109	8	CDF	0.0706	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.92	0.8	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0226832	0.0226832	1	2.667	0.1411	Non-Significant Effect
Error	0.0680495	0.0085062	8			
Total	0.0907326		9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	96	11.26	9.9E-06	Unequal Variances
Variances	Mod Levene Equality of Variance Test	3	13.75	0.1340	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8142	0.7411	0.0215	Normal Distribution

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	5	0.9200	0.7840	1.0000	1.0000	0.8000	1.0000	0.0490	11.91%	0.00%
0.16	N	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-8.70%

Angular (Corrected) Transformed Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	5	1.25	1.088	1.412	1.345	1.107	1.345	0.05833	10.43%	0.00%
0.16	N	5	1.345	1.345	1.346	1.345	1.345	1.345	0	0.00%	-7.62%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	0.8000	1.0000	1.0000	0.8000	1.0000
0.16	N	1.0000	1.0000	1.0000	1.0000	1.0000

Angular (Corrected) Transformed Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	1.107	1.345	1.345	1.107	1.345
0.16	N	1.345	1.345	1.345	1.345	1.345

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	4/5	5/5	5/5	4/5	5/5
0.16	N	5/5	5/5	5/5	5/5	5/5

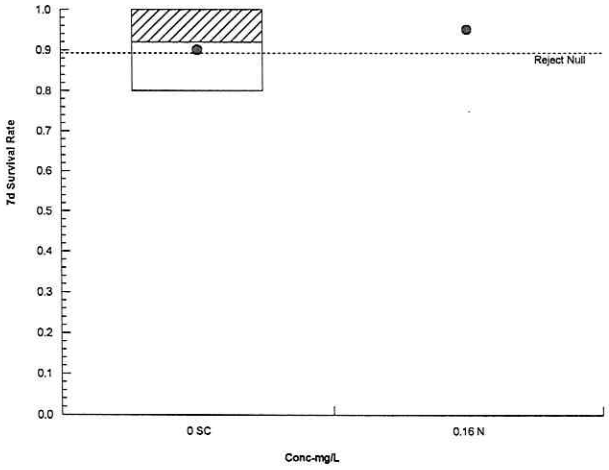
N=lab Control, SC= salt adjusted control

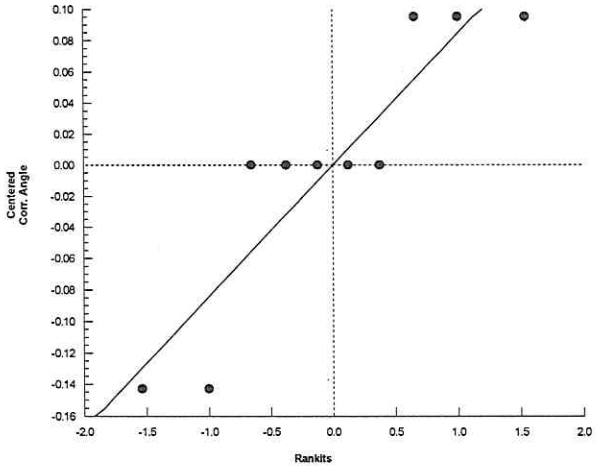
Analyst: KJL QA: dm 1/16/20

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-7592-9747	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	15 Jan-20 12:47	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-5445-1064	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4		
Analyzed:	15 Jan-20 12:47	**Analysis:**	Nonparametric-Two Sample	**Status Level:**	1		
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**			
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**			
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology				

Data Transform	Alt Hyp	Comparison Result
Angular (Corrected)	C > T	Site Control passed 7d survival rate

Wilcoxon Rank Sum Two-Sample Test

Control	vs	Control II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Site Control	27.5	n/a	1	8	Exact	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	1	65540	<1.0E-37	Significant Effect
Error	0	0	8			
Total	0		9			

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.16	N	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.2	XC	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.16	N	5	1.345	1.345	1.346	1.345	1.345	1.345	0	0.00%	0.00%
0.2	XC	5	1.345	1.345	1.346	1.345	1.345	1.345	0	0.00%	0.00%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	1.0000	1.0000	1.0000	1.0000	1.0000
0.2	XC	1.0000	1.0000	1.0000	1.0000	1.0000

Angular (Corrected) Transformed Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	1.345	1.345	1.345	1.345	1.345
0.2	XC	1.345	1.345	1.345	1.345	1.345

7d Survival Rate Binomials

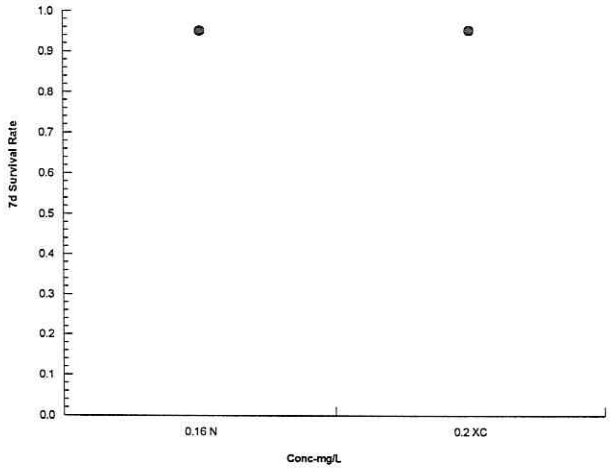
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	5/5	5/5	5/5	5/5	5/5
0.2	XC	5/5	5/5	5/5	5/5	5/5

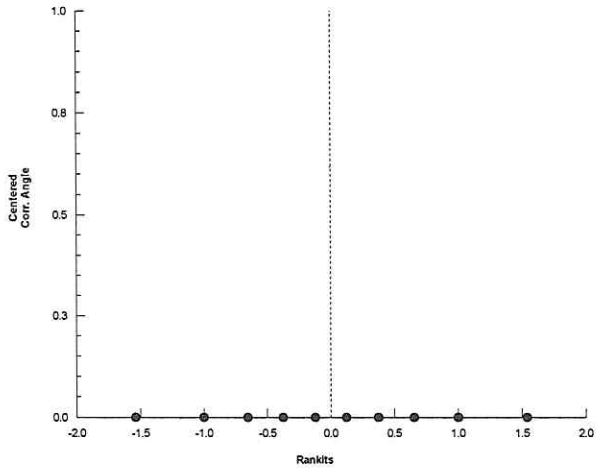
N= lab control
XC= site control (MW-11)

Pacific Topsmelt 7-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	10-5445-1064	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	15 Jan-20 12:47	**Analysis:**	Nonparametric-Two Sample	**Status Level:**	1

Graphics





CETIS Analytical Report

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-9641-2332	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4		
Analyzed:	15 Jan-20 12:47	**Analysis:**	Parametric-Two Sample	**Status Level:**	1		
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**			
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**			
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology				

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	Site Control passed mean dry biomass-mg	22.18%

Equal Variance t Two-Sample Test

Control vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	Site Control	-0.9372	1.86	0.406	8	CDF	0.8120	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.104847	0.104847	1	0.8783	0.3761	Non-Significant Effect
Error	0.954969	0.119371	8			
Total	1.05982		9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.484	23.15	0.3998	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9386	0.7411	0.5381	Normal Distribution

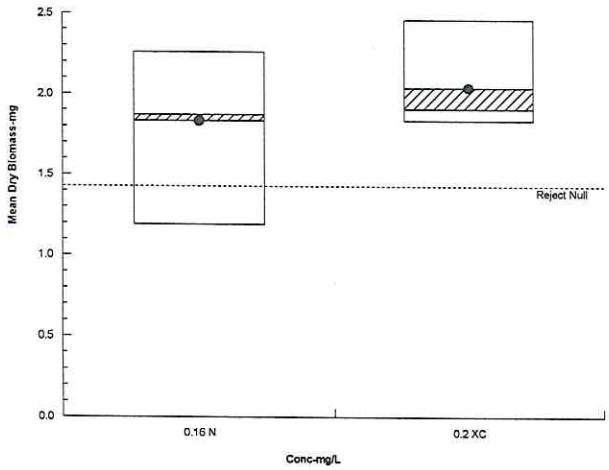
Mean Dry Biomass-mg Summary

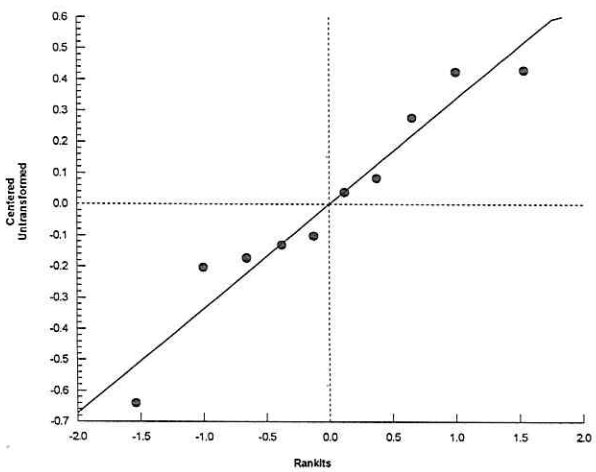
Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.16	N	5	1.832	1.32	2.344	1.87	1.192	2.26	0.1845	22.52%	0.00%
0.2	XC	5	2.037	1.712	2.362	1.906	1.834	2.46	0.1171	12.85%	-11.18%

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.16	N	2.108	2.26	1.192	1.73	1.87
0.2	XC	1.834	2.46	2.12	1.906	1.864

Graphics





N= lab control
XC= site control (MW-11)

Analyst: [signature] QA: [signature] 1/16/20

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-9151-4622	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4		
Analyzed:	15 Jan-20 12:47	**Analysis:**	Parametric-Two Sample	**Status Level:**	1		
Batch ID:	19-0277-6459	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	23 Apr-19 12:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	30 Apr-19 13:20	**Species:**	Atherinops affinis	**Brine:**			
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	12d
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**			
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	35d 13h	**Client:**	WA State Dept of Ecology				

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	Salt Control passed mean dry biomass-mg	20.13%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Salt Control	1.093	1.86	0.369	8	CDF	0.1531	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	1.615	0.85	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.117508	0.117508	1	1.195	0.3061	Non-Significant Effect
Error	0.786545	0.0983181	8			
Total	0.904052		9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	6.44	23.15	0.0987	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9311	0.7411	0.4586	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	5	1.615	1.413	1.817	1.692	1.338	1.722	0.0727	10.06%	0.00%
0.16	N	5	1.832	1.32	2.344	1.87	1.192	2.26	0.1845	22.52%	-13.42%

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	SC	1.602	1.722	1.722	1.338	1.692
0.16	N	2.108	2.26	1.192	1.73	1.87

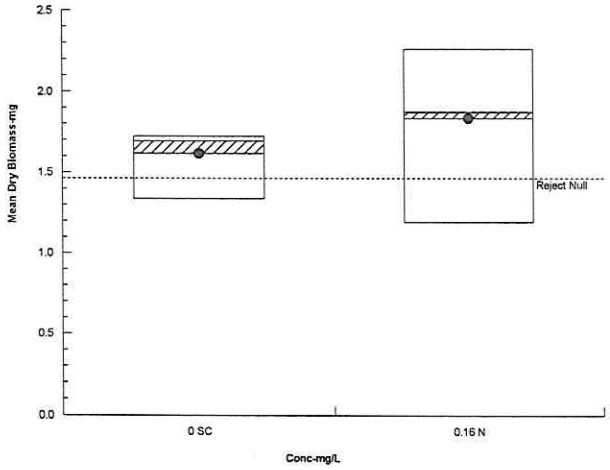
N = ~~Neg~~ KJL lab control

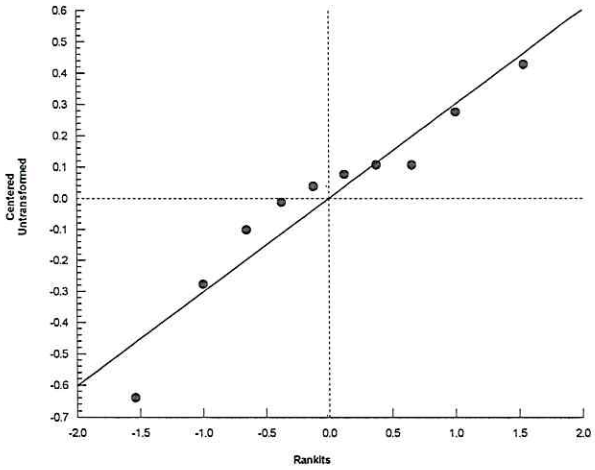
SC = Salt adjusted control

Pacific Topsmelt 7-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-9151-4622	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	15 Jan-20 12:47	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: KSV QA: JM 1/16/20

APPENDIX B – *Strongylocentrotus purpuratus* Toxicity Test Data

Echinoderm Fertilization Test Summary Sheet

Client: WDOE

Start Date/Time: February 19, 2019 @1745h

Work Order No.: 191280

Test Species: S. purpuratus

Sample Information:

Sample ID: DW-3 (range finder)
Sample Date: January 29, 2019
Date Received: January 30, 2019
Sample Volume: 5 x 20L

Dilution Water:

Type: Natural Seawater
Source: Vancouver Aquarium

Test Organism Information:

Batch No.: 021919
Source: Enthalpy, San Diego, CA
Sperm:Egg Ratio: 200:1
Exposure Period: 20 min : 20 min

Reference Toxicant Results:

Reference Toxicant ID: SpWS06
Stock Solution ID: 18Cu06
Date Initiated: February 19, 2019
IC50 (95% CL): 16.4 (15.2-18.6) ug/L Cu

Reference Toxicant Mean ± 2 SD: 13.4 (8.4-40.1) ug/L Cu
Reference Toxicant CV (%): 41

Test Results: The fertilization rate ~~is~~ IC25 is estimated to be >100% (v/v)
The fertilization rate IC50 is estimated to be >100% (v/v)

Reviewed by: JM

Date reviewed: July 8/19

Echinoderm Fertilization WQ Data Sheet

Client : WDOE **Analysts:** YHL

Sample ID: DW-3 (orange finder) **Test Date & Time:** February 19, 2019 @ 1745h

WO No: 191280 **Test Species:** S. purpuratus

Initial Water Quality

	100% sample
Temp (°C)	5.5
DO (mg/L)	9.6
pH	7.6
Salinity	0.2

Brine/Salt Adjusted Water Quality

	100% sample
Temp (°C)	13.0
DO (mg/L)	8.3
pH	7.7
Salinity	29

	Water Quality			
Concentration % (v/v)	Temp. (°C)	DO (mg/L)	pH	Salinity (ppt)
Seawater Control	13.0	8.2	7.6	29
Salt Control	13.0	8.3	7.8	29
Site Control (MW-1)	13.0	8.3	7.8	31
0.1	13.0	8.2	7.6	29
0.39	13.0	8.3	7.6	29
1.6	13.0	8.3	7.6	29
6.3	13.0	8.3	7.6	29
25	13.0	8.3	7.7	29
100	13.0	8.3	7.7	29
Analyst Initials	YHL	YHL	YHL	YHL

Thermometer: CER#3 **DO meter:** 3 (probe) 13 **pH meter:** 3 (probe) 13 **Salinity:** 3 (probe) 13

Sample Description: DW-3 - clear, yellow, some particulates, no odour.
MW-1 - clear, light yellow, no particulates, no odour.

Echinoderm Source: Enthalpy, San Diego, CA **Date Received:** February 19, 2019

Seawater Source: Vancouver Aquarium **Date Collected:** February 15, 2019

Comments:

Reviewed: JCH **Date Reviewed:** July 8/19

Echinoderm Fertilization Toxicity Test Data Sheet
Fertilized Egg Counts

Client: WDOE | Start Date/Time: February 19, 2019 @ 1745h

~~Work Order #:~~ Sample ID: DW-3 (rangefinder) | Test species: S. purpuratus

~~Sample ID:~~ WO#: 191280 | Test set up by: YM

Test Duration: 20 min: 20 min

Concentration (% v/v)	Rep	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Initials
Seawater Control	A	89	11		YM
	B	89	11		↓
	C	81	19		
	D	85	15		
Salt Control	A	95	5		
	B	92	8		
	C	90	10		
	D	88	12		
Site Control	A	94	6		
	B	90	10		
	C	88	12		
	D	91	9		
0.1	A	84	16		
	B	98	2		
	C	85	15		
	D	82	18		
0.39	A	98	2		
	B	95	5		
	C	91	9		
	D	92	8		
1.6	A	94	6		
	B	90	10		
	C	90	10		
	D	91	9		
6.3	A	89	11		
	B	90	10		
	C	91	9		
	D	86	14		
25	A	95	5		
	B	87	13		
	C	88	12		
	D	90	10		↓

Comments:

Reviewed by: JCh   Date Reviewed: July 8/19

Echinoderm Fertilization Toxicity Test Data Sheet
Fertilized Egg Counts

Client: WDOE
Sample ID: ~~Work Order #:~~ OW-3 (rag finder)
~~Sample ID:~~ WO# 191280

Start Date/Time: February 19, 2019 @ 1745h
Test species: S. purpuratus
Test set up by: YMC
Test Duration: 20 min; 20 min

Concentration (% v/v)	Rep	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Initials
100	A	91	9		YMC
	B	84	16		↓
	C	85	15		
	D	84	16		↓
	A				
	B				
	C				
	D				
EGS Control	A	0	100		YMC
	B	0	100		↓
	C	0	100		
	D	0	100		
Effluent Control	A	0	100		
	B	0	100		
	C	0	100		
	D	0	100		↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JGH Date Reviewed: July 8/19

CETIS Summary Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Batch ID:	19-5334-0495	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam		
Start Date:	19 Feb-19 17:45	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	19 Feb-19 18:25	**Species:**	Strongylocentrotus purpuratus	**Brine:**			
Test Length:	40m	**Taxon:**	Echinoidea	**Source:**	San Diego Lab	**Age:**	
Sample ID:	04-0118-8251	**Code:**	191282	**Project:**			
Sample Date:	29 Jan-19	**Material:**	Ground Water	**Source:**	WDOE		
Receipt Date:	30 Jan-19	**CAS (PC):**		**Station:**	NWTPH-Dx		
Sample Age:	21d 18h	**Client:**	WDOE				

SIngle Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
09-1544-4894	Fertilization Rate	Equal Variance t Two-Sample Test	0.9640	Salt Control passed fertilization rate	1
19-1223-1912	Fertilization Rate	Equal Variance t Two-Sample Test	0.9605	Site Control passed fertilization rate	1

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
03-5399-0733	Fertilization Rate	Dunnett Multiple Comparison Test		100	>100	n/a	1	11.1%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
02-8166-1841	Fertilization Rate	Linear Interpolation (ICPIN)		IC1	34.06	n/a	n/a	2.936	1
				IC5	>100	n/a	n/a	<1	
				IC10	>100	n/a	n/a	<1	
				IC15	>100	n/a	n/a	<1	
				IC20	>100	n/a	n/a	<1	
				IC25	>100	n/a	n/a	<1	
				IC40	>100	n/a	n/a	<1	
				IC50	>100	n/a	n/a	<1	

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
02-8166-1841	Fertilization Rate	Control Resp	0.86	0.7	>>	Yes	Passes Criteria
03-5399-0733	Fertilization Rate	Control Resp	0.86	0.7	>>	Yes	Passes Criteria
09-1544-4894	Fertilization Rate	Control Resp	0.9125	0.7	>>	Yes	Passes Criteria
	Fertilization Rate	Control Resp	0.86	0.7	>>	Yes	Passes Criteria
19-1223-1912	Fertilization Rate	Control Resp	0.9075	0.7	>>	Yes	Passes Criteria
	Fertilization Rate	Control Resp	0.86	0.7	>>	Yes	Passes Criteria

Fertilization Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	SC	4	0.9125	0.8650	0.9600	0.8800	0.9500	0.0149	0.0299	3.27%	0.00%
0	N	4	0.8600	0.7991	0.9209	0.8100	0.8900	0.0192	0.0383	4.45%	5.75%
0	XC	4	0.9075	0.8677	0.9473	0.8800	0.9400	0.0125	0.0250	2.75%	0.55%
0.1		4	0.8725	0.7567	0.9883	0.8200	0.9800	0.0364	0.0727	8.34%	4.38%
0.39		4	0.9400	0.8897	0.9903	0.9100	0.9800	0.0158	0.0316	3.36%	-3.01%
1.6		4	0.9125	0.8824	0.9426	0.9000	0.9400	0.0095	0.0189	2.07%	0.00%
6.3		4	0.8900	0.8556	0.9244	0.8600	0.9100	0.0108	0.0216	2.43%	2.47%
25		4	0.9000	0.8434	0.9566	0.8700	0.9500	0.0178	0.0356	3.95%	1.37%
100		4	0.8600	0.8064	0.9136	0.8400	0.9100	0.0168	0.0337	3.91%	5.75%

Analyst: KJL QA: Aug. 12/19

Echinoid Sperm Cell Fertilization Test — Nautilus Environmental

Fertilization Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	0.9500	0.9200	0.9000	0.8800
0	N	0.8900	0.8900	0.8100	0.8500
0	XC	0.9400	0.9000	0.8800	0.9100
0.1		0.8400	0.9800	0.8500	0.8200
0.39		0.9800	0.9500	0.9100	0.9200
1.6		0.9400	0.9000	0.9000	0.9100
6.3		0.8900	0.9000	0.9100	0.8600
25		0.9500	0.8700	0.8800	0.9000
100		0.9100	0.8400	0.8500	0.8400

Fertilization Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	95/100	92/100	90/100	88/100
0	N	89/100	89/100	81/100	85/100
0	XC	94/100	90/100	88/100	91/100
0.1		84/100	98/100	85/100	82/100
0.39		98/100	95/100	91/100	92/100
1.6		94/100	90/100	90/100	91/100
6.3		89/100	90/100	91/100	86/100
25		95/100	87/100	88/100	90/100
100		91/100	84/100	85/100	84/100

CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	02-8166-1841	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	19-5334-0495	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	19 Feb-19 17:45	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	19 Feb-19 18:25	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m (20 min 20 min)	**Taxon:**	Echinoidea	**Source:**	San Diego Lab **Age:**
Sample ID:	04-0118-8251	**Code:**	191282	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Ground Water	**Source:**	WDOE
Receipt Date:	30 Jan-19	**CAS (PC):**		**Station:**	NWTPH-Dx
Sample Age:	21d 18h	**Client:**	WDOE		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1549091	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.86	0.7	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	34.06	n/a	n/a	2.936	n/a	n/a
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

Fertilization Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0	N	4	0.8600	0.8100	0.8900	0.0383	4.45%	0.0%	344/400	0.8963	0.0%
0.1		4	0.8725	0.8200	0.9800	0.0727	8.34%	-1.45%	349/400	0.8963	0.0%
0.39		4	0.9400	0.9100	0.9800	0.0316	3.36%	-9.3%	376/400	0.8963	0.0%
1.6		4	0.9125	0.9000	0.9400	0.0189	2.07%	-6.11%	365/400	0.8963	0.0%
6.3		4	0.8900	0.8600	0.9100	0.0216	2.43%	-3.49%	356/400	0.895	0.14%
25		4	0.9000	0.8700	0.9500	0.0356	3.95%	-4.65%	360/400	0.895	0.14%
100		4	0.8600	0.8400	0.9100	0.0337	3.92%	0.0%	344/400	0.86	4.05%

Fertilization Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8900	0.8900	0.8100	0.8500
0.1		0.8400	0.9800	0.8500	0.8200
0.39		0.9800	0.9500	0.9100	0.9200
1.6		0.9400	0.9000	0.9000	0.9100
6.3		0.8900	0.9000	0.9100	0.8600
25		0.9500	0.8700	0.8800	0.9000
100		0.9100	0.8400	0.8500	0.8400

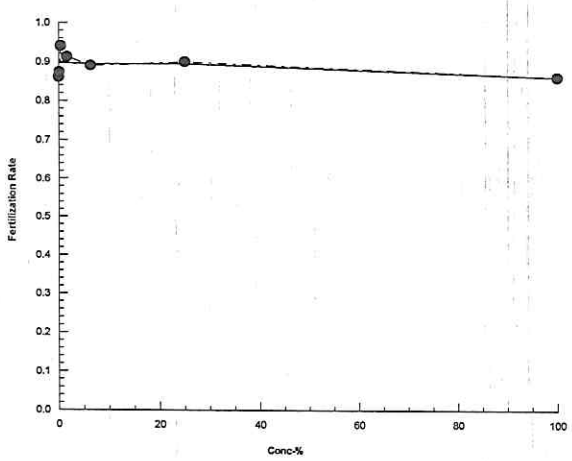
Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	02-8166-1841	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Fertilization Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	89/100	89/100	81/100	85/100
0.1		84/100	98/100	85/100	82/100
0.39		98/100	95/100	91/100	92/100
1.6		94/100	90/100	90/100	91/100
6.3		89/100	90/100	91/100	86/100
25		95/100	87/100	88/100	90/100
100		91/100	84/100	85/100	84/100

Graphics



Analyst: _____ QA: _____ 8/19

CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	09-1544-4894	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:03	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	19-5334-0495	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	19 Feb-19 17:45	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	19 Feb-19 18:25	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m	**Taxon:**	Echinoidea	**Source:**	San Diego Lab **Age:**
Sample ID:	04-0118-8251	**Code:**	191282	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Ground Water	**Source:**	WDOE
Receipt Date:	30 Jan-19	**CAS (PC):**		**Station:**	NWTPH-Dx
Sample Age:	21d 18h	**Client:**	WDOE		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Salt Control passed fertilization rate	6.30%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Salt Control	-2.181	1.943	0.075	6	CDF	0.9640	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.9125	0.7	>>	Yes	Passes Criteria
Control Resp	0.86	0.7	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0142041	0.0142041	1	4.757	0.0720	Non-Significant Effect
Error	0.0179167	0.0029861	6			
Total	0.0321208		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.02	47.47	0.9873	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9502	0.6451	0.7136	Normal Distribution

Fertilization Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	4	0.9125	0.8650	0.9600	0.9100	0.8800	0.9500	0.0149	3.27%	0.00%
0	N	4	0.8600	0.7991	0.9209	0.8700	0.8100	0.8900	0.0192	4.45%	5.75%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	SC	4	1.274	1.186	1.361	1.267	1.217	1.345	0.02746	4.31%	0.00%
0	N	4	1.19	1.103	1.276	1.203	1.12	1.233	0.02719	4.57%	6.62%

Fertilization Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	0.9500	0.9200	0.9000	0.8800
0	N	0.8900	0.8900	0.8100	0.8500

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	1.345	1.284	1.249	1.217
0	N	1.233	1.233	1.12	1.173

Fertilization Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	SC	95/100	92/100	90/100	88/100
0	N	89/100	89/100	81/100	85/100

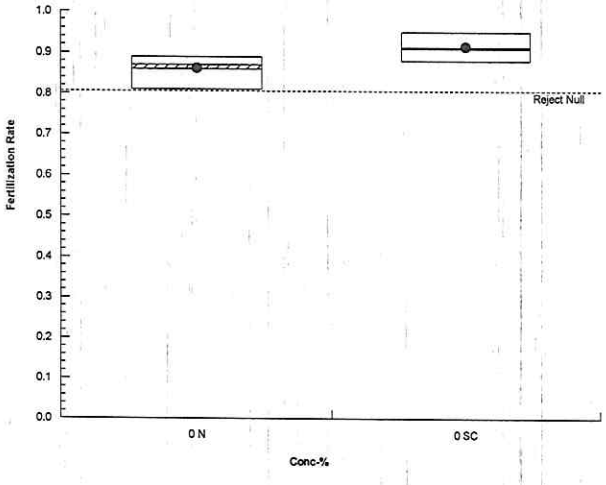
Analyst: _____ QA: _____ 7/8/19

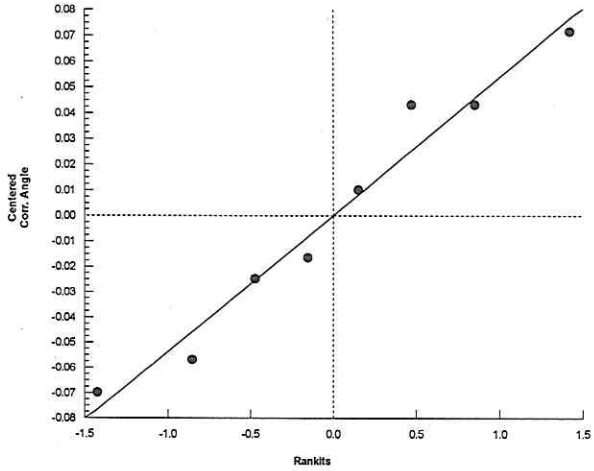
Echinoid Sperm Cell Fertilization Test

Nautilus Environmental

Analysis ID:	09-1544-4894	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:03	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: MW QA: 8/19

CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	19-1223-1912	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:03	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	19-5334-0495	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	19 Feb-19 17:45	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	19 Feb-19 18:25	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m	**Taxon:**	Echinoidea	**Source:**	San Diego Lab **Age:**
Sample ID:	04-0118-8251	**Code:**	191282	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Ground Water	**Source:**	WDOE
Receipt Date:	30 Jan-19	**CAS (PC):**		**Station:**	NWTPH-Dx
Sample Age:	21d 18h	**Client:**	WDOE		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Site Control passed fertilization rate	5.68%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Site Control	-2.114	1.943	0.068	6	CDF	0.9605	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.9075	0.7	>>	Yes	Passes Criteria
Control Resp	0.86	0.7	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0110413	0.0110413	1	4.47	0.0789	Non-Significant Effect
Error	0.014821	0.0024702	6			
Total	0.0258624		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.49	47.47	0.7510	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9407	0.6451	0.6178	Normal Distribution

Fertilization Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.8600	0.7991	0.9209	0.8700	0.8100	0.8900	0.0192	4.45%	0.00%
0	XC	4	0.9075	0.8677	0.9473	0.9050	0.8800	0.9400	0.0125	2.75%	-5.52%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.19	1.103	1.276	1.203	1.12	1.233	0.02719	4.57%	0.00%
0	XC	4	1.264	1.193	1.335	1.258	1.217	1.323	0.02227	3.52%	-6.25%

Fertilization Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8900	0.8900	0.8100	0.8500
0	XC	0.9400	0.9000	0.8800	0.9100

Angular (Corrected) Transformed Detail

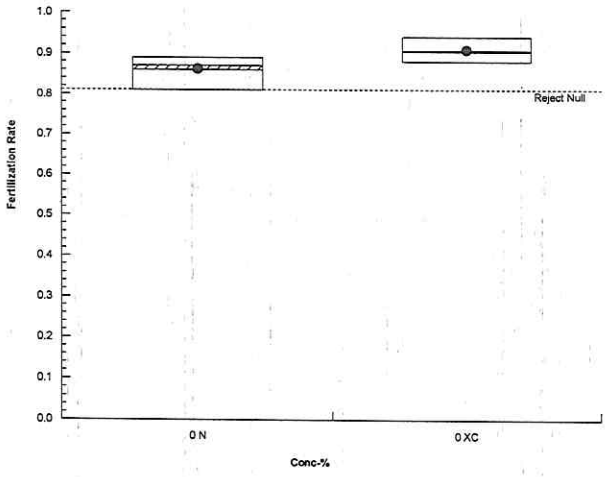
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.233	1.233	1.12	1.173
0	XC	1.323	1.249	1.217	1.266

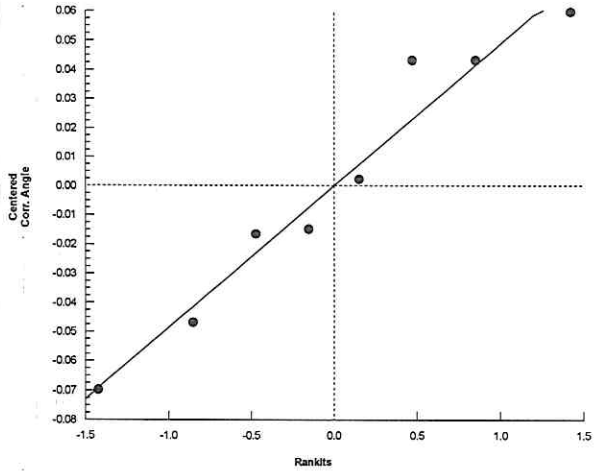
Fertilization Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	89/100	89/100	81/100	85/100
0	XC	94/100	90/100	88/100	91/100

Analyst: YL QA: JGL July 8/19

Graphics





Analyst: MW QA: July 8/19

CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	03-5399-0733	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	12 Aug-19 12:01	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	19-5334-0495	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	19 Feb-19 17:45	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	19 Feb-19 18:25	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m (20 & 20)	**Taxon:**	Echinoidea	**Source:**	San Diego Lab **Age:**
Sample ID:	04-0118-8251	**Code:**	191282	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Ground Water	**Source:**	WDOE
Receipt Date:	30 Jan-19	**CAS (PC):**		**Station:**	NWTPH-Dx
Sample Age:	21d 18h	**Client:**	WDOE		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	>100	n/a	1	11.07%

Dunnett Multiple Comparison Test

Control vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	0.1	-0.6632	2.448	0.125	6	CDF	0.9679	Non-Significant Effect
	0.39	-2.768	2.448	0.125	6	CDF	1.0000	Non-Significant Effect
	1.6	-1.61	2.448	0.125	6	CDF	0.9981	Non-Significant Effect
	6.3	-0.865	2.448	0.125	6	CDF	0.9813	Non-Significant Effect
	25	-1.247	2.448	0.125	6	CDF	0.9939	Non-Significant Effect
	100	0.002783	2.448	0.125	6	CDF	0.8564	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.86	0.7	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0595077	0.009918	6	1.898	0.1286	Non-Significant Effect
Error	0.10974	0.0052257	21			
Total	0.169247		27			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	8.272	16.81	0.2188	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9027	0.8975	0.0132	Normal Distribution

Fertilization Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.8600	0.7991	0.9209	0.8700	0.8100	0.8900	0.0192	4.45%	0.00%
0.1		4	0.8725	0.7567	0.9883	0.8450	0.8200	0.9800	0.0364	8.34%	-1.45%
0.39		4	0.9400	0.8897	0.9903	0.9350	0.9100	0.9800	0.0158	3.36%	-9.30%
1.6		4	0.9125	0.8824	0.9426	0.9050	0.9000	0.9400	0.0095	2.07%	-6.10%
6.3		4	0.8900	0.8556	0.9244	0.8950	0.8600	0.9100	0.0108	2.43%	-3.49%
25		4	0.9000	0.8434	0.9566	0.8900	0.8700	0.9500	0.0178	3.95%	-4.65%
100		4	0.8600	0.8064	0.9136	0.8450	0.8400	0.9100	0.0168	3.91%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.19	1.103	1.276	1.203	1.12	1.233	0.02719	4.57%	0.00%
0.1		4	1.223	1.004	1.443	1.166	1.133	1.429	0.06899	11.28%	-2.85%
0.39		4	1.331	1.214	1.448	1.315	1.266	1.429	0.03675	5.52%	-11.89%
1.6		4	1.272	1.216	1.328	1.258	1.249	1.323	0.01761	2.77%	-6.92%
6.3		4	1.234	1.18	1.288	1.241	1.187	1.266	0.01693	2.74%	-3.72%
25		4	1.253	1.151	1.356	1.233	1.202	1.345	0.03219	5.14%	-5.36%
100		4	1.189	1.107	1.271	1.166	1.159	1.266	0.02576	4.33%	0.01%

Analyst: KL QA: Aug 12/19

Echinoid Sperm Cell Fertilization Test | **Nautilus Environmental**

Analysis ID: 03-5399-0733 **Endpoint:** Fertilization Rate **CETIS Version:** CETISv1.9.4
Analyzed: 12 Aug-19 12:01 **Analysis:** Parametric-Control vs Treatments **Status Level:** 1

Fertilization Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8900	0.8900	0.8100	0.8500
0.1		0.8400	0.9800	0.8500	0.8200
0.39		0.9800	0.9500	0.9100	0.9200
1.6		0.9400	0.9000	0.9000	0.9100
6.3		0.8900	0.9000	0.9100	0.8600
25		0.9500	0.8700	0.8800	0.9000
100		0.9100	0.8400	0.8500	0.8400

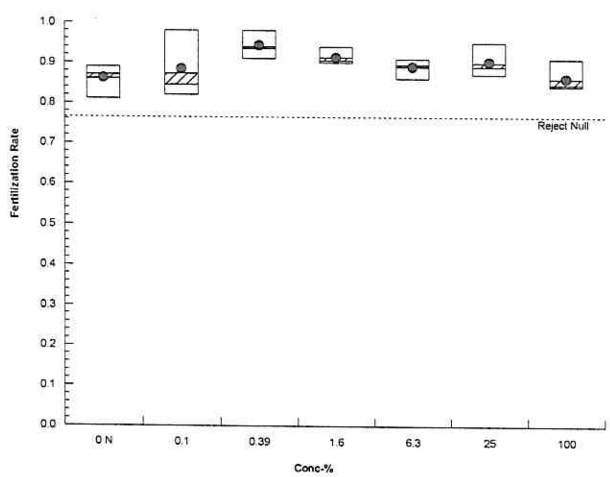
Angular (Corrected) Transformed Detail

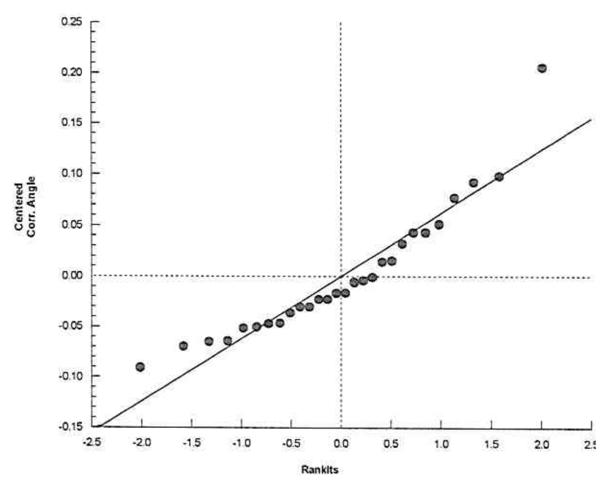
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.233	1.233	1.12	1.173
0.1		1.159	1.429	1.173	1.133
0.39		1.429	1.345	1.266	1.284
1.6		1.323	1.249	1.249	1.266
6.3		1.233	1.249	1.266	1.187
25		1.345	1.202	1.217	1.249
100		1.266	1.159	1.173	1.159

Fertilization Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	89/100	89/100	81/100	85/100
0.1		84/100	98/100	85/100	82/100
0.39		98/100	95/100	91/100	92/100
1.6		94/100	90/100	90/100	91/100
6.3		89/100	90/100	91/100	86/100
25		95/100	87/100	88/100	90/100
100		91/100	84/100	85/100	84/100

Graphics





Echinoderm Fertilization Test Summary Sheet

Client: WDOE

Start Date/Time: May 1, 2019 @ 1630h

Work Order No.: 1918280

Test Species: S. purpuratus

Sample Information:

Sample ID: DW-3
Sample Date: January 29 2019
Date Received: January 30, 2019
Sample Volume: 5 x 20L

Dilution Water:

Type: Natural Seawater
Source: Vancouver Aquarium

Test Organism Information:

Batch No.: 050119
Source: Enthalpy, San Diego, CA
Sperm:Egg Ratio: 200:1
Exposure Period: 20 min : 20 min

Reference Toxicant Results:

Reference Toxicant ID: SpWS07
Stock Solution ID: 19Cu01 (100 mg/L Cu)
Date Initiated: May 1, 2019
IC50 (95% CL): 10.2 (8.1 - 14.2) ug/L Cu

Reference Toxicant Mean ± 2 SD: 18.0 (8.9 - 36.5) ug/L Cu
Reference Toxicant CV (%): 36

Test Results:

Sample ID:	Fertilization Rate ± SD (%)
Seawater Control	78.2 ± 3.5
Salt Control	76.2 ± 6.2
MW-11 (site control)	78.2 ± 5.2
DW-3	79.2 ± 4.8

** Sample was not significantly different relative to the Seawater Control or Site Controls

Reviewed by: JCh

Date reviewed: July 8/19

Echinoderm Fertilization WQ Data Sheet

Client : WDOE **Analysts:** YK

Sample ID: DW-3 **Test Date & Time:** May 1, 2019 @ 1630h

WO No: 191280 **Test Species:** S. purpuratus

Initial Water Quality

	100% sample
Temp (°C)	12.5
DO (mg/L)	8.9
pH	7.6
Salinity	0.2

Brine/Salt Adjusted Water Quality

	100% sample
Temp (°C)	13.0
DO (mg/L)	8.3
pH	7.8
Salinity	30

	Water Quality			
Concentration ~~% (v/v)~~	Temp. (°C)	DO (mg/L)	pH	Salinity (ppt)
Seawater control	13.0	8.2	7.8	29
Salt control	13.0	8.3	8.0	30
Site Control - MW-1	13.0	8.3	8.0	30
DW-3 (100% v/v)	13.0	8.3	7.8	30
Analyst Initials	YK	YK	YK	YK

Thermometer: CER#3 **DO meter:** 3 (probe) 13 **pH meter:** 3 (probe) 13 **Salinity:** 3 (probe) 13

Sample Description: DW-3 - clear, yellow, some particulates, no odour.
MW-1 (Site control) - clear, light yellow, no odour, no particulates

Echinoderm Source: Enthalpy, San Diego, CA **Date Received:** May 1, 2019

Seawater Source: Vancouver Aquarium **Date Collected:** April 26, 2019

Comments:

Reviewed: JGh **Date Reviewed:** July 8/19

Echinoderm Fertilization Toxicity Test Data Sheet
Fertilized Egg Counts

Client: WDOE
Work Order #: 19128O
Sample ID: DW-3

Start Date/Time: May 1, 2019 @ 1630h
Test species: S. purpuratus
Test set up by: YMK
Test Duration: 20 min; 20 min

Sample ID	Rep	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Initials
Seawater Control	A	77	23		YMK
	B	74	26		
	C	82	18		
	D	80	20		
Salt Control	A	75	25		
	B	82	18		
	C	80	20		
	D	68	32		
Site Control - MW-11	A	71	29		
	B	83	17		
	C	81	19		
	D	78	22		
100% (v/v)	A	81	19		
	B	77	23		
	C	85	15		
	D	74	26		↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JGL Date Reviewed: July 8/19

CETIS Summary Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Batch ID:	02-3159-5361	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam		
Start Date:	01 May-19 16:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater		
Ending Date:	01 May-19 17:10	**Species:**	Strongylocentrotus purpuratus	**Brine:**			
Test Length:	40m (20 min. 20 min)	**Taxon:**	Echinoidea	**Source:**	San Diego Lab	**Age:**	

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Control SW	09-4780-6032	01 May-19	01 May-19	16h	WDOE	
Salt Control	18-7858-9023	01 May-19	01 May-19	16h		
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	92d 16h	WA State Dept of Ecolog	
DW-3	16-5145-0355	29 Jan-19	30 Jan-19 08:46	92d 16h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Control SW	Control SW	WDOE	Control	
Salt Control	Control water	WDOE	Salt Control	
MW-11	Diesel	WDOE	MW-11	
DW-3	Diesel	WDOE	DW-3	

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.5347	Control SW passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.5347	Salt Control passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.5347	MW-11 passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.5347	DW-3 passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.7586	Control SW passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.7586	Salt Control passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.7586	MW-11 passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.7586	DW-3 passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.8465	Control SW passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.8465	Salt Control passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.8465	MW-11 passed fertilization rate	1
14-4363-1114	Fertilization Rate	Dunnett Multiple Comparison Test	0.8465	DW-3 passed fertilization rate	1

Test Acceptability

				TAC Limits			
Analysis ID	**Endpoint**	**Attribute**	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
14-4363-1114	Fertilization Rate	Control Resp	0.7825	0.7	>>	Yes	Passes Criteria

Fertilization Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control SW	N	4	0.7825	0.7268	0.8382	0.7400	0.8200	0.0175	0.0350	4.47%	0.00%
Salt Control	SC	4	0.7625	0.6632	0.8618	0.6800	0.8200	0.0312	0.0624	8.18%	2.56%
MW-11	XC	4	0.7825	0.6989	0.8661	0.7100	0.8300	0.0263	0.0525	6.71%	0.00%
DW-3		4	0.7925	0.7163	0.8687	0.7400	0.8500	0.0239	0.0479	6.04%	-1.28%

Fertilization Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	0.7700	0.7400	0.8200	0.8000
Salt Control	SC	0.7500	0.8200	0.8000	0.6800
MW-11	XC	0.7100	0.8300	0.8100	0.7800
DW-3		0.8100	0.7700	0.8500	0.7400

Fertilization Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	77/100	74/100	82/100	80/100
Salt Control	SC	75/100	82/100	80/100	68/100
MW-11	XC	71/100	83/100	81/100	78/100
DW-3		81/100	77/100	85/100	74/100

Analyst: _____ QA: July 8/19

CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	14-4363-1114	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:15	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	02-3159-5361	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	01 May-19 16:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	01 May-19 17:10	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m (20 min 20 min)	**Taxon:**	Echinoidea	**Source:**	San Diego Lab

Age:

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Control SW	09-4780-6032	01 May-19	01 May-19	16h	WDOE	
Salt Control	18-7858-9023	01 May-19	01 May-19	16h		
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	92d 16h	WA State Dept of Ecolog	
DW-3	16-5145-0355	29 Jan-19	30 Jan-19 08:46	92d 16h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Control SW	Control SW	WDOE	Control	
Salt Control	Control water	WDOE	Salt Control	
MW-11	Diesel	WDOE	MW-11	
DW-3	Diesel	WDOE	DW-3	

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Salt Control passed fertilization rate	10.80%
		MW-11 passed fertilization rate	10.80%
		DW-3 passed fertilization rate	10.80%

Dunnett Multiple Comparison Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Salt Control	0.5253	2.287	0.098	6	CDF	0.5347	Non-Significant Effect
		MW-11	-0.02433	2.287	0.098	6	CDF	0.7586	Non-Significant Effect
		DW-3	-0.3111	2.287	0.098	6	CDF	0.8465	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.7825	0.7	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0026505	0.0008835	3	0.2429	0.8648	Non-Significant Effect
Error	0.0436502	0.0036375	12			
Total	0.0463006		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	0.7372	11.34	0.8644	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9461	0.8408	0.4309	Normal Distribution

Fertilization Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control SW	N	4	0.7825	0.7268	0.8382	0.7850	0.7400	0.8200	0.0175	4.47%	0.00%
Salt Control		4	0.7625	0.6632	0.8618	0.7750	0.6800	0.8200	0.0312	8.18%	2.56%
MW-11		4	0.7825	0.6989	0.8661	0.7950	0.7100	0.8300	0.0263	6.71%	0.00%
DW-3		4	0.7925	0.7163	0.8687	0.7900	0.7400	0.8500	0.0239	6.04%	-1.28%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control SW	N	4	1.087	1.019	1.154	1.089	1.036	1.133	0.02119	3.90%	0.00%
Salt Control		4	1.064	0.9487	1.18	1.077	0.9695	1.133	0.03626	6.82%	2.06%
MW-11		4	1.088	0.988	1.187	1.101	1.002	1.146	0.0313	5.76%	-0.10%
DW-3		4	1.1	1.005	1.195	1.095	1.036	1.173	0.0299	5.44%	-1.22%

Analyst: YYL QA: July 8/19

Echinoid Sperm Cell Fertilization Test

Nautilus Environmental

Analysis ID:	14-4363-1114	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:15	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

Fertilization Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	0.7700	0.7400	0.8200	0.8000
Salt Control		0.7500	0.8200	0.8000	0.6800
MW-11		0.7100	0.8300	0.8100	0.7800
DW-3		0.8100	0.7700	0.8500	0.7400

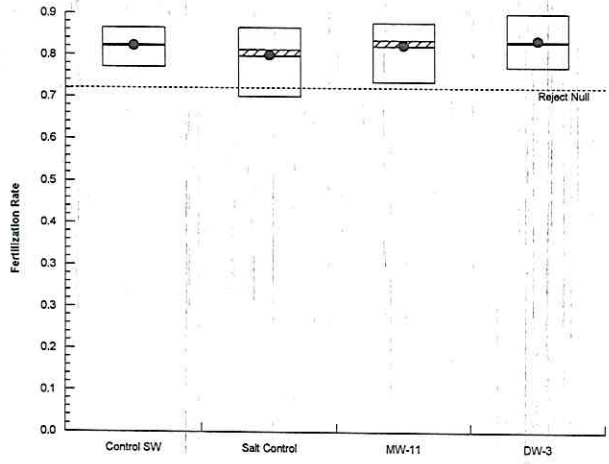
Angular (Corrected) Transformed Detail

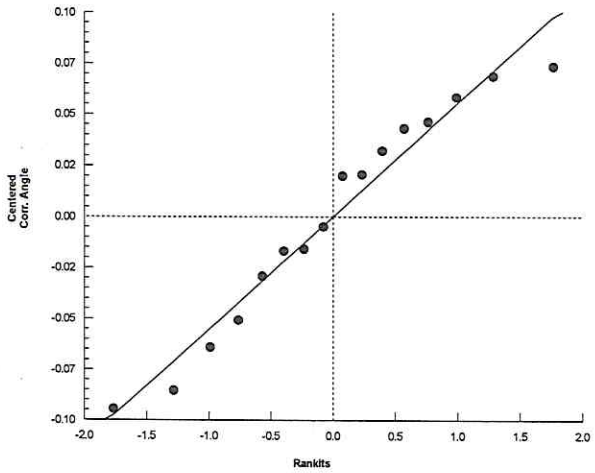
Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	1.071	1.036	1.133	1.107
Salt Control		1.047	1.133	1.107	0.9695
MW-11		1.002	1.146	1.12	1.083
DW-3		1.12	1.071	1.173	1.036

Fertilization Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	77/100	74/100	82/100	80/100
DW-3		81/100	77/100	85/100	74/100

Graphics





CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	11-4262-9726	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:15	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	02-3159-5361	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	01 May-19 16:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	01 May-19 17:10	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m (20 minutes)	**Taxon:**	Echinoidea	**Source:**	San Diego Lab

Age:

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Control SW	09-4780-6032	01 May-19	01 May-19	16h	WDOE	
Salt Control	18-7858-9023	01 May-19	01 May-19	16h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Control SW	Control SW	WDOE	Control	
Salt Control	Control water	WDOE	Salt Control	

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Salt Control passed fertilization rate	8.94%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Salt Control	0.5334	1.943	0.082	6	CDF	0.3065	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	0.7825	0.7	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0010038	0.0010038	1	0.2845	0.6129	Non-Significant Effect
Error	0.021167	0.0035278	6			
Total	0.0221708		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.93	47.47	0.4009	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9514	0.6451	0.7258	Normal Distribution

Fertilization Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control SW	N	4	0.7825	0.7268	0.8382	0.7850	0.7400	0.8200	0.0175	4.47%	0.00%
Salt Control	SC	4	0.7625	0.6632	0.8618	0.7750	0.6800	0.8200	0.0312	8.18%	2.56%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control SW	N	4	1.087	1.019	1.154	1.089	1.036	1.133	0.02119	3.90%	0.00%
Salt Control	SC	4	1.064	0.9487	1.18	1.077	0.9695	1.133	0.03626	6.82%	2.06%

Fertilization Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	0.7700	0.7400	0.8200	0.8000
Salt Control	SC	0.7500	0.8200	0.8000	0.6800

Angular (Corrected) Transformed Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	1.071	1.036	1.133	1.107
Salt Control	SC	1.047	1.133	1.107	0.9695

Analyst: _____ QA: July 8/19

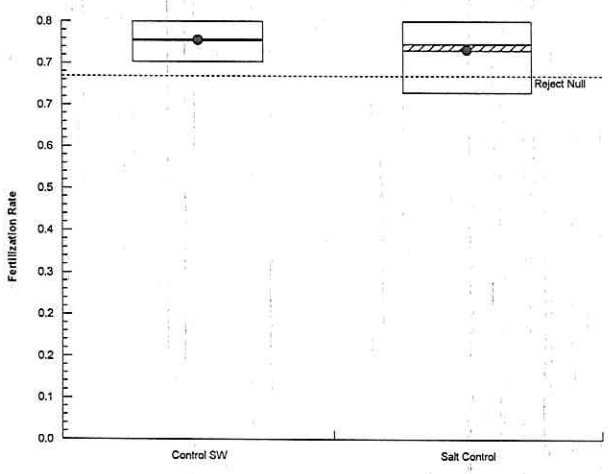
Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

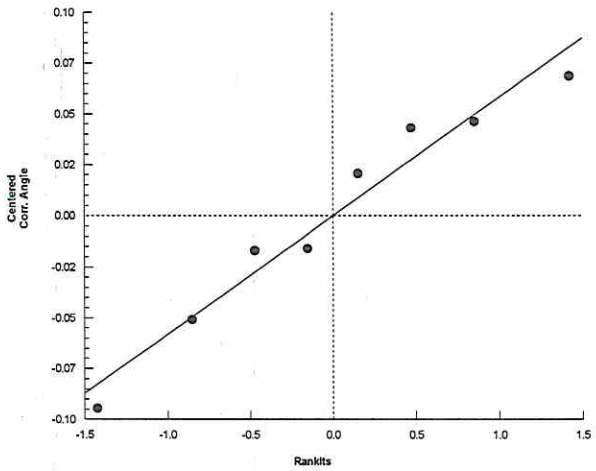
Analysis ID:	11-4262-9726	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:15	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Fertilization Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
Control SW	N	77/100	74/100	82/100	80/100
Salt Control	SC	75/100	82/100	80/100	68/100

Graphics





Analyst: _____ QA: _____ 7/8/19

CETIS Analytical Report

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	05-0589-8278	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:17	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	02-3159-5361	**Test Type:**	Fertilization	**Analyst:**	Yvonne Lam
Start Date:	01 May-19 16:30	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Natural seawater
Ending Date:	01 May-19 17:10	**Species:**	Strongylocentrotus purpuratus	**Brine:**	
Test Length:	40m (20min 20sp)	**Taxon:**	Echinoidea	**Source:**	San Diego Lab **Age:**

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	92d 16h	WA State Dept of Ecolog	
DW-3	16-5145-0355	29 Jan-19	30 Jan-19 08:46	92d 16h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
MW-11	Diesel	WDOE	MW-11	
DW-3	Diesel	WDOE	DW-3	

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	DW-3 passed fertilization rate	9.11%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		DW-3	-0.2825	1.943	0.084	6	CDF	0.6065	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0002991	0.0002991	1	0.07983	0.7870	Non-Significant Effect
Error	0.0224832	0.0037472	6			
Total	0.0227823		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.096	47.47	0.9419	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9598	0.6451	0.8079	Normal Distribution

Fertilization Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
MW-11	XC	4	0.7825	0.6989	0.8661	0.7950	0.7100	0.8300	0.0263	6.71%	0.00%
DW-3		4	0.7925	0.7163	0.8687	0.7900	0.7400	0.8500	0.0239	6.04%	-1.28%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
MW-11	XC	4	1.088	0.988	1.187	1.101	1.002	1.146	0.0313	5.76%	0.00%
DW-3		4	1.1	1.005	1.195	1.095	1.036	1.173	0.0299	5.44%	-1.12%

Fertilization Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
MW-11	XC	0.7100	0.8300	0.8100	0.7800
DW-3		0.8100	0.7700	0.8500	0.7400

Angular (Corrected) Transformed Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
MW-11	XC	1.002	1.146	1.12	1.083
DW-3		1.12	1.071	1.173	1.036

Fertilization Rate Binomials

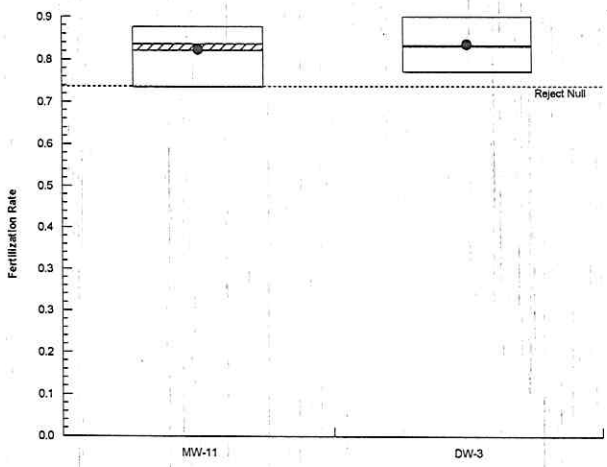
Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
MW-11	XC	71/100	83/100	81/100	78/100
DW-3		81/100	77/100	85/100	74/100

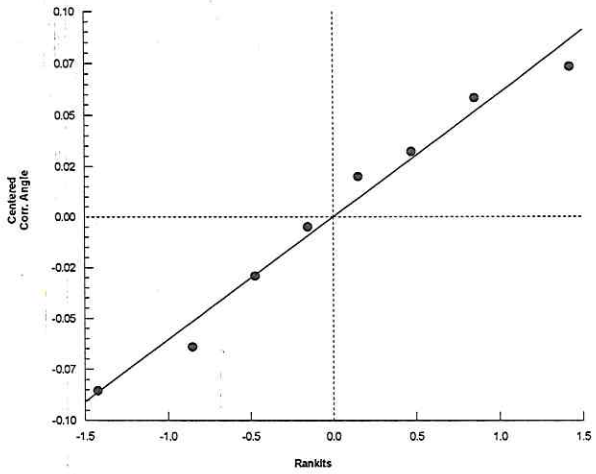
Analyst: _____ QA: July 8/19

Echinoid Sperm Cell Fertilization Test — **Nautilus Environmental**

Analysis ID:	05-0589-8278	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	05 Jul-19 13:17	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: _____ QA: _____ 8/19

APPENDIX C – *Pimephales promelas* Toxicity Test Data

Fathead Minnow Test Summary Sheet

Client: WDOE

Start Date & Time: Feb 19/19 @ 1615h

Work Order No.: 19128la

Test Species: *Pimephales promelas*

Sample Information:

Sample ID: DW-3 (range finder)
Sample Date: Jan 29/19
Date Received: Jan 30/19
Sample Volume: 5 x 20L

Dilution Water:

Type: Moderately - hard water
Hardness (mg/L $CaCO_3$): 100
Alkalinity (mg/L $CaCO_3$): 74

Test Organism Information:

Batch No.: 021919
Source: Aquatic BioSystems, CO
Loading Density: 10 fish / 250 mL

NaCl Reference Toxicant Results:

Reference Toxicant ID: PP 138
Stock Solution ID: NaCl
Date Initiated: Feb 19/19
7-d EC50 (95% CL): 4.0 (3.4-4.7) g/L NaCl
7-d IC50 (95% CL): 4.0 (3.5-4.7) g/L NaCl

Survival:

Reference Toxicant Mean ± 2 SD: 4.7 (3.7-6.1) g/L NaCl CV (%): 12

Biomass

Reference Toxicant Mean ± 2 SD: 4.5 (3.4-6.2) g/L NaCl CV (%): 15

Test Results:

	Survival	Biomass
NOEC % (v/v)	6.2	1.0
LOEC % (v/v)	>6.2	6.2
EC25 % (v/v) (95% CL)	>6.2	
EC50 % (v/v) (95% CL)	>6.2	2.6 (n/a - 5.4)
IC25 % (v/v) (95% CL)		~~3.9 (n/a - 7.5)~~
IC50 % (v/v) (95% CL)		>6.2

Reviewed by:

Date reviewed: Dec. 19, 2019

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3 (Rangefinder)
Work Order #: 191281

Start Date & Time: Feb 19/19 @ 1615h
Stop Date & Time: Feb 26/19 @ 1545h
CER #: 11
Test Species: *Pimephales promelas*

% (v/v) Nominal Concentration	Days													
control	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
DO (mg/L) 7.7	6.2 MW	6.8	7.8	4.8	8.2	4.4	7.7	5.1	8.0	6.0	8.0	5.2	7.6	4.5
pH	8.0	7.6	8.0	7.5	8.0	7.5	7.9	7.2	7.7	7.4	7.6	7.3	7.9	7.1
Cond. (µS/cm)	323	321		322		322		332		329		325		337
Initials	CA	MG		MG		MG		M		M		MG		CA

Concentration	Days													
site control	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
DO (mg/L) 7.8	7.8 MW	7.0	7.9	5.4	8.0	4.5	7.9	5.4	8.7	5.9	8.0	5.5	7.8	5.8
pH	7.7	7.8	7.5	7.9	7.7	7.8 MG	7.9	7.7	7.6	7.5	7.6	7.4	7.6 MW	7.6
Cond. (µS/cm)	324	320		323		325		324		330		327		331
Initials	CA	MG		MG		MG		M		M		MG		CA

@ 7.7

Concentration	Days													
0.10	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
DO (mg/L) 7.7	6.4 MW	6.7	7.8	4.9	8.2	4.5	7.7	4.2	8.1	5.8	8.0	5.0	7.6	5.1
pH	8.0	7.6	8.0	7.5	8.0	7.5	7.9	7.3	7.7	7.4	7.6	7.2	7.9	7.4
Cond. (µS/cm)	320	321		322		323		329		330		327		7.4 338
Initials	CA	MG		MG		MG		M		M		MG		CA

Concentration	Days													
0.39	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
DO (mg/L) 7.7	6.3 MW	6.7	7.7	5.0	8.3	4.4	7.7	4.3	8.1	5.9	8.1	5.1	7.6	5.2
pH	8.0	7.6	8.0	7.5	8.0	7.5	7.9	7.3	7.7	7.4	7.6	7.3	7.9	7.4
Cond. (µS/cm)	320	321		321		322		331		330		326		333
Initials	CA	MG		MG		MG		M		M		MG		CA

Thermometer: 11 **DO meter/probe:** 4 / 4 **pH meter/probe:** 4 / 4 **Conductivity meter/probe:** 4 / 4

	Control			
Hardness*	100			
Alkalinity*	74			

* mg/L as $CaCO_3$

Analysts: MG, CS, AW D

Reviewed by:

Date reviewed: July 17, 2019

Sample Description: DW-3 : clear, yellow, some particulates, odourless
MW-11 : clear, light yellow, no particulates, odourless

Comments:

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3 (Range finder)
Work Order #: 19128 1

Start Date & Time: Feb 19/19 @ 1615h
Stop Date & Time: Feb 26/19 @ 1545h
CER #:
Test Species: *Pimephales promelas*

% (v/v) Nominal Concentration 1.6	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.5	24.0	24.0	24.0
DO (mg/L) 7.8	~~6.4~~	6.6	7.8	5.0	8.2	4.6	7.7	4.1	8.1	5.8	8.0	5.5	7.6	5.0
pH	8.0 [MV]	7.6	8.0	7.5	8.0	7.5	7.9	7.2	7.7	7.3	7.6	7.3	7.9	7.4
Cond. (µS/cm)	320	320		321		321		330		330		325		334
Initials	CA	MG		MG		MG		AL		A		MG		CA

Concentration 6.3	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.5	24.0	24.0	24.0
DO (mg/L) 7.8	~~6.5~~ [MV]	5.5	7.7	5.0	8.2	4.5	7.7	5.2	8.1	5.9	8.0	5.4	7.7	5.0
pH	7.9	7.5	8.0	7.5	8.0	7.6	7.9	7.2	7.7	7.2	7.7	7.4	7.9	7.3
Cond. (µS/cm)	320	319		320		320		329		330		323		331
Initials	CA	MG		MG		MG		AL		A		MG		CA

Concentration 25	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.5	24.0	24.0	24.0
DO (mg/L) 7.8	~~7.6~~ [MV]	5.3	7.8	5.2	7.9	4.7	7.8	4.4	8.0	5.8	8.0	5.5	7.7	5.0
pH	7.7	7.5	7.8	7.5	7.8	7.7	7.9	7.2	7.7	7.3	7.7	7.4	7.8	7.3
Cond. (µS/cm)	315	313		312		313		321		~~338~~ 322		316		324
Initials	CA	MG		MG		MG		AL		A		MG		CA

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	~~24.0~~	24.5		24.0	24.0
DO (mg/L) 8.2	~~7.9~~ [MV]	6.9	7.8	5.6	7.8	5.0	8.0	5.5	8.5	5.7	8.0	5.4	7.8	4.3
pH	7.2	7.4	7.4	7.4	7.3	7.7	7.6	7.3	7.3	~~7.7~~	7.5	7.5	7.6	7.3
Cond. (µS/cm)	300	291		290		288		290		~~292~~		288		297
Initials	CA	MG		MG		MG		AL		A		MG		CA

Thermometer: 4 **DO meter/probe:** 4 / 4 **pH meter/probe:** 4 / 4 **Conductivity meter/probe:** 4 / 4

	Control			
Hardness*	100			
Alkalinity*	74			

* mg/L as CaCO3

Analysts: MG, CS, AWD

Reviewed by:

Date reviewed: July 17, 2019

Sample Description: same as page 1

Comments:

7-d Fathead Minnow Toxicity Test
Daily Survival

Client: WDOE
Sample ID: Dw-3 (Range finder)
Work Order #: 191281

Start Date & Time: Feb 19/19 @ 1615h
Stop Date & Time: Feb 26/19 @ 1545h
Test Species: *Pimephales promelas*

Concentration % (v/v) Nominal	Rep	Day of Test - No. of Survivors							Comments
		1	2	3	4	5	6	7	
Control	A	10	10	10	10	10	10	10	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	10	10	10	
	D								
Site Control	A	10	10	10	9	9	9	9	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	10	10	10	
	D								
0.10	A	10	10	10	10	10	10	9	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	9	9	9	
	D								
0.39	A	10	10	10	10	10	10	10	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	10	10	10	
	D								
1.6	A	10	10	10	10	10	10	10	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	10	10	10	
	D								
6.3	A	10	10	10	10	10	10	10	
	B	10	10	10	10	10	10	DNM ~~10~~ 8	
	C	10	10	10	10	10	10	DNM 8 10	
	D								
25	A	~~10~~ DNM	10	10	10	10	9	9	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	10	10	10	
	D								
100	A	10	10	10	10	10	10	10	
	B	10	10	10	10	10	7	7	
	C	10	10	10	9	9	9	9	
	D								
Tech Initials		MLT	ML	MM	MM	A	MLT	MD	

Comments: ~16.5cm solution depth
-remaining organisms appear normal

Reviewed by: [signature]

Date reviewed: July 17, 2019

Fathead Minnow Toxicity Test Data Sheet

Dry Weight Data

Client: WDOE

Start Date & Time: Feb 19/19 1615h

Sample ID: DW-3 (Range finder)

Termination Date & Time: Feb 26/19 1545h

Work Order No.: 19128 1

Balance ID: Bal- 1

PP Green

Nominal Concentration % (v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
control	A	1	10	MG	1021.62	1030.04	10	SSK/ CT
	B	2	10		1048.69	1055.51	10	/ CT
	C	3	10		1011.22	1016.81	10	/ CT
site ctrl	A	4	9		1032.18	1038.93	9	/ CT
	B	5	10		1043.95	1051.96	10	/ CT
	C	6	10		1030.81	~~1039~~ CC 1040.01	10	/ CT
0.10	A	7	9		1033.57	1039.15	9	/ CT
	B	8	10		1034.12	1040.76	10	/ CT
	C	9	9		1042.54	1049.13	9	/ CT
0.39	A	10	10		1019.33	1027.07	10	/ CT
	B	11	10		1078.68	1085.86 CS	10	/ CT
	C	12	10		1051.74	1059.42	10	/ CT
1.6	A	13	10		1025.54	1033.45	10	/ CT
	B	14	10		1035.30	1042.83	10	/ CT
	C	15	10		1019.33	1026.38	10	/ CT
6.3	A	16	10		1058.68	1066.36	10	/ CT
	B	17	8		1019.68	1024.11	8	/ CT
	C	18	10		1062.92	1070.73	10	/ CT
25	A	19	9		998.43	1004.96	9	/ CT
	B	20	10		1050.32	1057.47	10	/ CT
	C	21	10		1038.03	1045.06	10	/ CT
100	A	22	10		1032.73	1037.54	10	/ CT
	B	23	7		1046.46	1048.~~80~~ CS 75	7	/ CT
	C	24	9	↓	1037.55	1041.06	9	↓ / CT

Comments: 10% reweigh (mg): #4 = 1038.80 #20 - 1057.31
#12 = 1059.35

Reviewed by:

Date Reviewed: July 17, 2019

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water		
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**			
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	<24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**			
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology				

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
03-6347-4466	7d Survival Rate	Linear Interpolation (ICPIN)		EC5	1.885	n/a	n/a		1
				EC10	5.118	n/a	n/a		
				EC15	>6.23	n/a	n/a		
				EC20	>6.23	n/a	n/a		
				EC25	>6.23	n/a	n/a		
				EC40	>6.23	n/a	n/a		
				EC50	>6.23	n/a	n/a		
20-6823-9408	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)		IC5	1.051	n/a	1.659		1
				IC10	1.36	n/a	2.157		
				IC15	1.716	n/a	2.823		
				IC20	2.124	n/a	3.914		
				IC25	2.595	n/a	5.414		
				IC40	4.475	0.8971	n/a		
				IC50	>6.23	n/a	n/a		
09-0897-9947	Mean Dry Weight-mg	Linear Interpolation (ICPIN)		IC5	1.231	n/a	1.506		1
				IC10	1.591	n/a	2.036		
				IC15	2.009	n/a	2.813		
				IC20	2.494	0.1173	3.794		
				IC25	3.057	0.3557	4.9		
				IC40	5.353	1.787	n/a		
				IC50	>6.23	n/a	n/a		

Analyst: KJL QA: Dec-19/19

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0.15		3	0.9333	0.7899	1.0000	0.9000	1.0000	0.0333	0.0577	6.19%	0.00%
0.151		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-7.14%
0.16	N	3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-7.14%
0.19		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-7.14%
0.2	XC	3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	-3.57%
0.32		3	0.9333	0.6465	1.0000	0.8000	1.0000	0.0667	0.1155	12.37%	0.00%
1		3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	-3.57%
6.23		3	0.8667	0.4872	1.0000	0.7000	1.0000	0.0882	0.1528	17.63%	7.14%

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0.15		3	0.627	0.4784	0.7756	0.558	0.664	0.03453	0.0598	9.54%	0.00%
0.151		3	0.7533	0.6769	0.8297	0.718	0.774	0.01775	0.03075	4.08%	-20.15%
0.16	N	3	0.6943	0.3418	1.047	0.559	0.842	0.08193	0.1419	20.44%	-10.74%
0.19		3	0.7497	0.6426	0.8567	0.705	0.791	0.02488	0.04309	5.75%	-19.56%
0.2	XC	3	0.7987	0.4943	1.103	0.675	0.92	0.07073	0.1225	15.34%	-27.38%
0.32		3	0.664	0.1883	1.14	0.443	0.781	0.1106	0.1915	28.84%	-5.90%
1		3	0.6903	0.6086	0.772	0.653	0.715	0.01899	0.03288	4.76%	-10.10%
6.23		3	0.3537	0.04061	0.6667	0.229	0.481	0.07276	0.126	35.63%	43.59%

Mean Dry Weight-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0.15		3	0.6721	0.5316	0.8125	0.62	0.7322	0.03264	0.05654	8.41%	0.00%
0.151		3	0.7533	0.6769	0.8297	0.718	0.774	0.01775	0.03075	4.08%	-12.09%
0.16	N	3	0.6943	0.3418	1.047	0.559	0.842	0.08193	0.1419	20.44%	-3.31%
0.19		3	0.7497	0.6426	0.8567	0.705	0.791	0.02488	0.04309	5.75%	-11.54%
0.2	XC	3	0.8237	0.607	1.04	0.75	0.92	0.05036	0.08723	10.59%	-22.56%
0.32		3	0.7009	0.3839	1.018	0.5537	0.781	0.07368	0.1276	18.21%	-4.29%
1		3	0.7145	0.6865	0.7426	0.703	0.7256	0.006516	0.01129	1.58%	-6.32%
6.23		3	0.3994	0.2072	0.5916	0.3271	0.481	0.04466	0.07736	19.37%	40.57%

N= lab control
XC= site control

Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.9000	1.0000	0.9000
0.151		1.0000	1.0000	1.0000
0.16	N	1.0000	1.0000	1.0000
0.19		1.0000	1.0000	1.0000
0.2	XC	0.9000	1.0000	1.0000
0.32		1.0000	0.8000	1.0000
1		0.9000	1.0000	1.0000
6.23		1.0000	0.7000	0.9000

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.558	0.664	0.659
0.151		0.774	0.718	0.768
0.16	N	0.842	0.682	0.559
0.19		0.791	0.753	0.705
0.2	XC	0.675	0.801	0.92
0.32		0.768	0.443	0.781
1		0.653	0.715	0.703
6.23		0.481	0.229	0.351

Mean Dry Weight-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.62	0.664	0.7322
0.151		0.774	0.718	0.768
0.16	N	0.842	0.682	0.559
0.19		0.791	0.753	0.705
0.2	XC	0.75	0.801	0.92
0.32		0.768	0.5537	0.781
1		0.7256	0.715	0.703
6.23		0.481	0.3271	0.39

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		9/10	10/10	9/10
0.151		10/10	10/10	10/10
0.16	N	10/10	10/10	10/10
0.19		10/10	10/10	10/10
0.2	XC	9/10	10/10	10/10
0.32		10/10	8/10	10/10
1		9/10	10/10	10/10
6.23		10/10	7/10	9/10

N = lab Control

XC = Site Control

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-0367-2582	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4		
Analyzed:	16 Dec-19 14:27	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1		
Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water		
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**			
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	<24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**			
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology				

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	515536	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	1	n/a	n/a
EC10	3.324	n/a	n/a
EC15	>6.23	n/a	n/a
EC20	>6.23	n/a	n/a
EC25	>6.23	n/a	n/a
EC40	>6.23	n/a	n/a
EC50	>6.23	n/a	n/a

7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-mg/L	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0.15		3	0.9333	0.9000	1.0000	0.0577	6.19%	0.0%	28/30	0.9833	0.0%
0.151		3	1.0000	1.0000	1.0000	0.0000	0.00%	-7.14%	30/30	0.9833	0.0%
0.16	N	3	1.0000	1.0000	1.0000	0.0000	0.00%	-7.14%	30/30	0.9833	0.0%
0.19		3	1.0000	1.0000	1.0000	0.0000	0.00%	-7.14%	30/30	0.9833	0.0%
0.32		3	0.9333	0.8000	1.0000	0.1155	12.37%	0.0%	28/30	0.95	3.39%
1		3	0.9667	0.9000	1.0000	0.0577	5.97%	-3.57%	29/30	0.95	3.39%
6.23		3	0.8667	0.7000	1.0000	0.1528	17.63%	7.14%	26/30	0.8667	11.86%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.9000	1.0000	0.9000
0.151		1.0000	1.0000	1.0000
0.16	N	1.0000	1.0000	1.0000
0.19		1.0000	1.0000	1.0000
0.32		1.0000	0.8000	1.0000
1		0.9000	1.0000	1.0000
6.23		1.0000	0.7000	0.9000

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		9/10	10/10	9/10
0.151		10/10	10/10	10/10
0.16	N	10/10	10/10	10/10
0.19		10/10	10/10	10/10
0.32		10/10	8/10	10/10
1		9/10	10/10	10/10
6.23		10/10	7/10	9/10

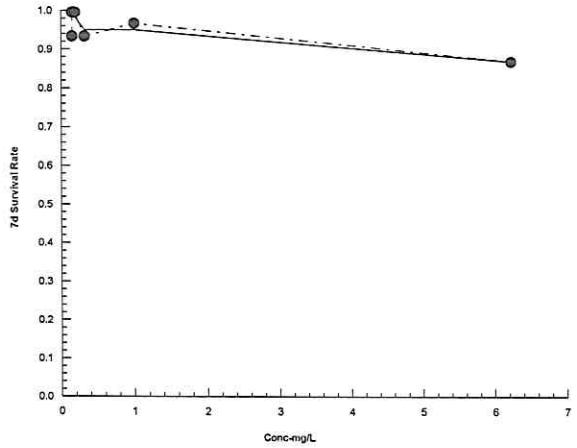
N= lab control

Analyst: [illegible] QA: Dec-19/19

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-0367-2582	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:27	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-6823-9408	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	17 Dec-19 17:26	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1068237	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	1.051	n/a	1.659
IC10	1.36	n/a	2.157
IC15	1.716	n/a	2.823
IC20	2.124	n/a	3.914
IC25	2.595	n/a	5.414
IC40	4.475	0.8971	n/a
IC50	>6.23	n/a	n/a

Mean Dry Biomass-mg Summary

			Calculated Variate						Isotonic Variate	
Conc-mg/L	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0.15		3	0.627	0.558	0.664	0.0598	9.54%	0.0%	0.7061	0.0%
0.151		3	0.7533	0.718	0.774	0.03075	4.08%	-20.15%	0.7061	0.0%
0.16	N	3	0.6943	0.559	0.842	0.1419	20.44%	-10.74%	0.7061	0.0%
0.19		3	0.7497	0.705	0.791	0.04309	5.75%	-19.56%	0.7061	0.0%
0.32		3	0.664	0.443	0.781	0.1915	28.84%	-5.9%	0.6772	4.1%
1		3	0.6903	0.653	0.715	0.03288	4.76%	-10.1%	0.6772	4.1%
6.23		3	0.3537	0.229	0.481	0.126	35.63%	43.59%	0.3537	49.91%

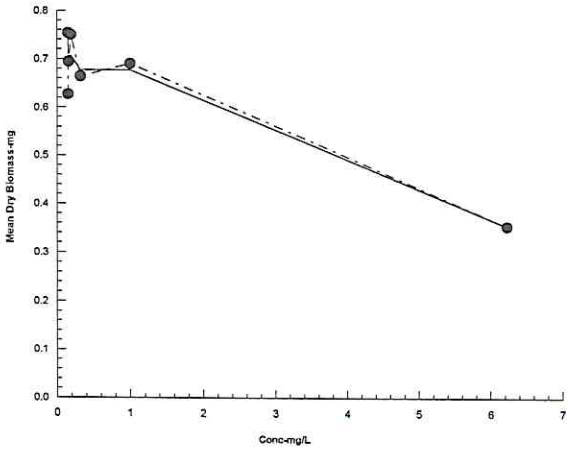
Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.558	0.664	0.659
0.151		0.774	0.718	0.768
0.16	N	0.842	0.682	0.559
0.19		0.791	0.753	0.705
0.32		0.768	0.443	0.781
1		0.653	0.715	0.703
6.23		0.481	0.229	0.351

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

Analysis ID:	20-6823-9408	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	17 Dec-19 17:26	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-6817-8280	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:34	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	626733	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	1.231	n/a	1.588
IC10	1.591	n/a	2.203
IC15	2.009	n/a	2.962
IC20	2.494	0.0176	3.889
IC25	3.057	0.2682	5.022
IC40	5.353	1.411	n/a
IC50	>6.23	n/a	n/a

Mean Dry Weight-mg Summary

			Calculated Variate						Isotonic Variate	
Conc-mg/L	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0.15		3	0.6721	0.62	0.7322	0.05654	8.41%	0.0%	0.7174	0.0%
0.151		3	0.7533	0.718	0.774	0.03075	4.08%	-12.09%	0.7174	0.0%
0.16	N	3	0.6943	0.559	0.842	0.1419	20.44%	-3.31%	0.7174	0.0%
0.19		3	0.7497	0.705	0.791	0.04309	5.75%	-11.54%	0.7174	0.0%
0.32		3	0.7009	0.5537	0.781	0.1276	18.21%	-4.29%	0.7077	1.34%
1		3	0.7145	0.703	0.7256	0.01129	1.58%	-6.32%	0.7077	1.34%
6.23		3	0.3994	0.3271	0.481	0.07736	19.37%	40.57%	0.3994	44.33%

Mean Dry Weight-mg Detail

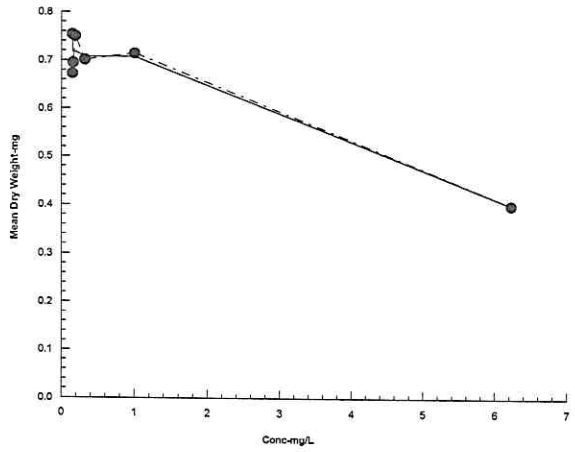
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.62	0.664	0.7322
0.151		0.774	0.718	0.768
0.16	N	0.842	0.682	0.559
0.19		0.791	0.753	0.705
0.32		0.768	0.5537	0.781
1		0.7256	0.715	0.703
6.23		0.481	0.3271	0.39

NE lab control

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-6817-8280	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:34	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: _____ QA: Dec-19/19

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-6335-2881	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:28	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	6.23	>6.23	n/a		15.02%

Dunnett Multiple Comparison Test

Control	vs	Conc-mg/L	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.15	1.15	2.532	0.239	4	CDF	0.3911	Non-Significant Effect
		0.151	0	2.532	0.239	4	CDF	0.8571	Non-Significant Effect
		0.19	0	2.532	0.239	4	CDF	0.8571	Non-Significant Effect
		0.32	1.076	2.532	0.239	4	CDF	0.4234	Non-Significant Effect
		1	0.575	2.532	0.239	4	CDF	0.6495	Non-Significant Effect
		6.23	2.06	2.532	0.239	4	CDF	0.1118	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0984944	0.0164157	6	1.226	0.3503	Non-Significant Effect
Error	0.187438	0.0133884	14			
Total	0.285933		20			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	5.372	4.456	0.0046	Unequal Variances
Variances	Mod Levene Equality of Variance Test	1.243	7.191	0.3871	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9068	0.871	0.0475	Normal Distribution

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15		3	0.9333	0.7899	1.0000	0.9000	0.9000	1.0000	0.0333	6.19%	0.00%
0.151		3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-7.14%
0.16	N	3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-7.14%
0.19		3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-7.14%
0.32		3	0.9333	0.6465	1.0000	1.0000	0.8000	1.0000	0.0667	12.37%	0.00%
1		3	0.9667	0.8232	1.0000	1.0000	0.9000	1.0000	0.0333	5.97%	-3.57%
6.23		3	0.8667	0.4872	1.0000	0.9000	0.7000	1.0000	0.0882	17.63%	7.14%

Angular (Corrected) Transformed Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15		3	1.303	1.07	1.537	1.249	1.249	1.412	0.05432	7.22%	0.00%
0.151		3	1.412	1.411	1.413	1.412	1.412	1.412	0	0.00%	-8.34%
0.16	N	3	1.412	1.411	1.413	1.412	1.412	1.412	0	0.00%	-8.34%
0.19		3	1.412	1.411	1.413	1.412	1.412	1.412	0	0.00%	-8.34%
0.32		3	1.31	0.8731	1.748	1.412	1.107	1.412	0.1016	13.43%	-0.54%
1		3	1.358	1.124	1.591	1.412	1.249	1.412	0.05432	6.93%	-4.17%
6.23		3	1.217	0.6903	1.745	1.249	0.9912	1.412	0.1225	17.43%	6.60%

N: & lab control

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-6335-2881	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:28	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.9000	1.0000	0.9000
0.151		1.0000	1.0000	1.0000
0.16	N	1.0000	1.0000	1.0000
0.19		1.0000	1.0000	1.0000
0.32		1.0000	0.8000	1.0000
1		0.9000	1.0000	1.0000
6.23		1.0000	0.7000	0.9000

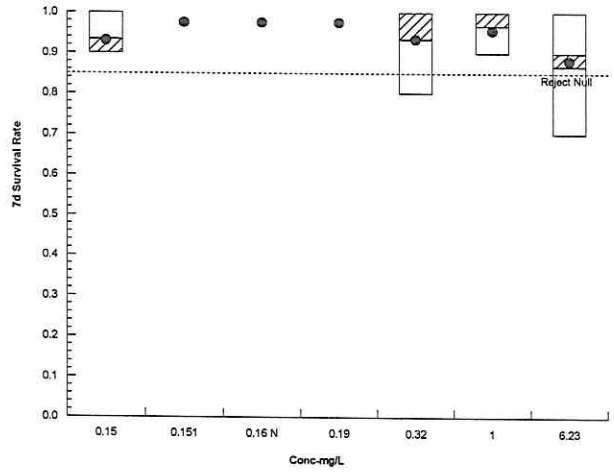
Angular (Corrected) Transformed Detail

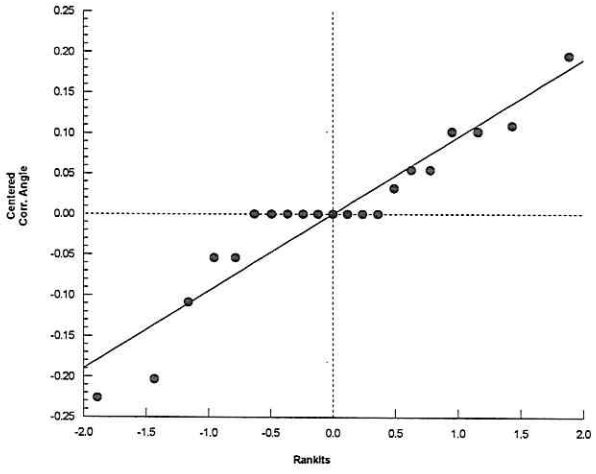
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		1.249	1.412	1.249
0.151		1.412	1.412	1.412
0.16	N	1.412	1.412	1.412
0.19		1.412	1.412	1.412
0.32		1.412	1.107	1.412
1		1.249	1.412	1.412
6.23		1.412	0.9912	1.249

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		9/10	10/10	9/10
0.151		10/10	10/10	10/10
0.16	N	10/10	10/10	10/10
0.19		10/10	10/10	10/10
0.32		10/10	8/10	10/10
1		9/10	10/10	10/10
6.23		10/10	7/10	9/10

Graphics





N= lab control

Dec-19/19

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-3059-3958	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:28	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	1	6.23	2.496		31.86%

Dunnett Multiple Comparison Test

Control	vs	Conc-mg/L	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.15	0.7707	2.532	0.221	4	CDF	0.5616	Non-Significant Effect
		0.151	-0.6752	2.532	0.221	4	CDF	0.9681	Non-Significant Effect
		0.19	-0.6332	2.532	0.221	4	CDF	0.9645	Non-Significant Effect
		0.32	0.3473	2.532	0.221	4	CDF	0.7434	Non-Significant Effect
		1	0.0458	2.532	0.221	4	CDF	0.8445	Non-Significant Effect
		6.23*	3.899	2.532	0.221	4	CDF	0.0039	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.338081	0.0563469	6	4.921	0.0066	Significant Effect
Error	0.1603	0.01145	14			
Total	0.498381		20			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	9.712	16.81	0.1373	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9539	0.871	0.4030	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15		3	0.627	0.4784	0.7756	0.659	0.558	0.664	0.03453	9.54%	0.00%
0.151		3	0.7533	0.6769	0.8297	0.768	0.718	0.774	0.01775	4.08%	-20.15%
0.16	N	3	0.6943	0.3418	1.047	0.682	0.559	0.842	0.08193	20.44%	-10.74%
0.19		3	0.7497	0.6426	0.8567	0.753	0.705	0.791	0.02488	5.75%	-19.56%
0.32		3	0.664	0.1883	1.14	0.768	0.443	0.781	0.1106	28.84%	-5.90%
1		3	0.6903	0.6086	0.772	0.703	0.653	0.715	0.01899	4.76%	-10.10%
6.23		3	0.3537	0.04061	0.6667	0.351	0.229	0.481	0.07276	35.63%	43.59%

Mean Dry Biomass-mg Detail

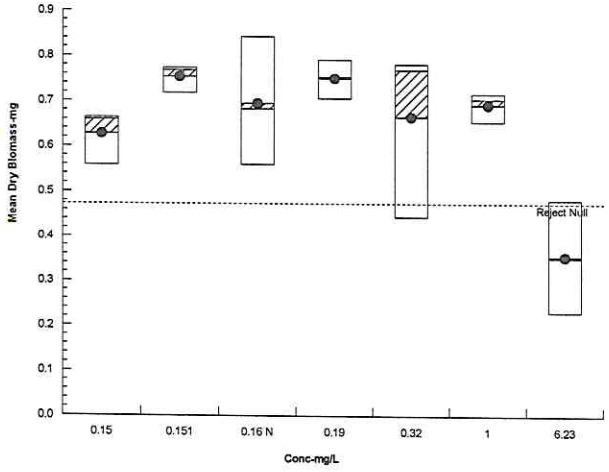
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.558	0.664	0.659
0.151		0.774	0.718	0.768
0.16	N	0.842	0.682	0.559
0.19		0.791	0.753	0.705
0.32		0.768	0.443	0.781
1		0.653	0.715	0.703
6.23		0.481	0.229	0.351

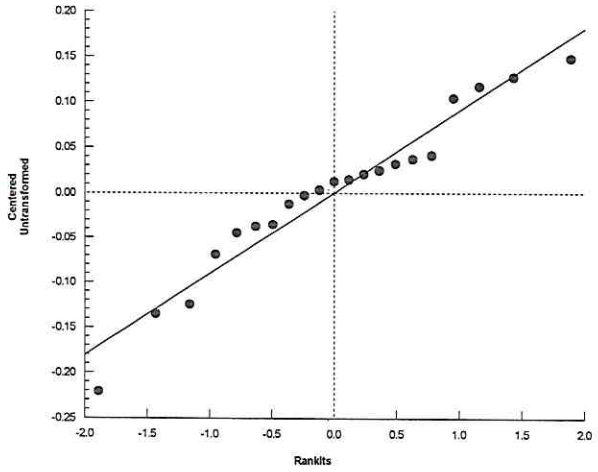
N= lab control

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-3059-3958	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:28	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

Graphics





Analyst: KJ QA: Dec 19/19

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-5739-3261	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:28	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	03-4091-2684	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	19 Feb-19 16:15	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	26 Feb-19 15:45	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	14-5122-1569	**Code:**	567FE241	**Project:**	
Sample Date:	29 Jan-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	30 Jan-19 08:46	**CAS (PC):**		**Station:**	DW-3
Sample Age:	21d 16h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	1	6.23	2.496		24.79%

Dunnett Multiple Comparison Test

Control	vs	Conc-mg/L	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.15	0.3274	2.532	0.172	4	CDF	0.7509	Non-Significant Effect
		0.151	-0.8677	2.532	0.172	4	CDF	0.9806	Non-Significant Effect
		0.19	-0.8137	2.532	0.172	4	CDF	0.9776	Non-Significant Effect
		0.32	-0.0967	2.532	0.172	4	CDF	0.8815	Non-Significant Effect
		1	-0.2969	2.532	0.172	4	CDF	0.9219	Non-Significant Effect
		6.23*	4.338	2.532	0.172	4	CDF	0.0017	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.270155	0.0450259	6	6.494	0.0019	Significant Effect
Error	0.0970641	0.0069332	14			
Total	0.367219		20			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	10.6	16.81	0.1016	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9687	0.871	0.7050	Normal Distribution

Mean Dry Weight-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15		3	0.6721	0.5316	0.8125	0.664	0.62	0.7322	0.03264	8.41%	0.00%
0.151		3	0.7533	0.6769	0.8297	0.768	0.718	0.774	0.01775	4.08%	-12.09%
0.16	N	3	0.6943	0.3418	1.047	0.682	0.559	0.842	0.08193	20.44%	-3.31%
0.19		3	0.7497	0.6426	0.8567	0.753	0.705	0.791	0.02488	5.75%	-11.54%
0.32		3	0.7009	0.3839	1.018	0.768	0.5537	0.781	0.07368	18.21%	-4.29%
1		3	0.7145	0.6865	0.7426	0.715	0.703	0.7256	0.006516	1.58%	-6.32%
6.23		3	0.3994	0.2072	0.5915	0.39	0.3271	0.481	0.04466	19.37%	40.57%

Mean Dry Weight-mg Detail

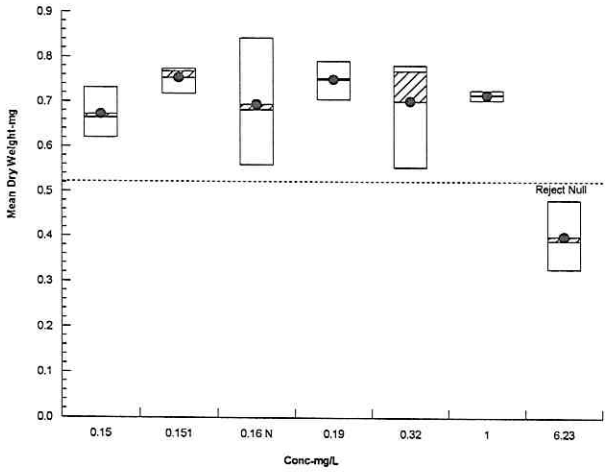
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0.15		0.62	0.664	0.7322
0.151		0.774	0.718	0.768
0.16	N	0.842	0.682	0.559
0.19		0.791	0.753	0.705
0.32		0.768	0.5537	0.781
1		0.7256	0.715	0.703
6.23		0.481	0.3271	0.39

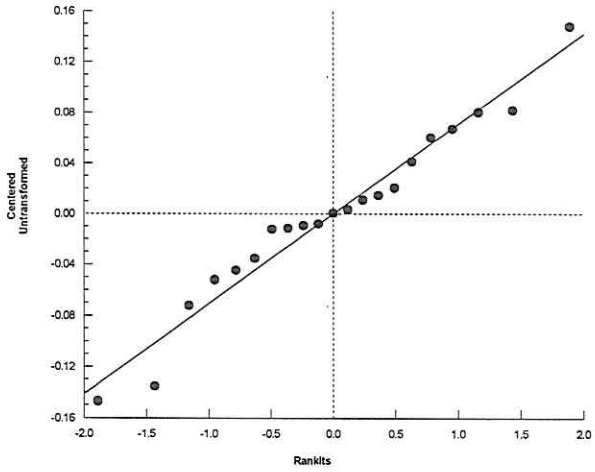
N= lab control

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

Analysis ID:	06-5739-3261	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Dec-19 14:28	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

Graphics





Analyst: VDC QA: Dec-19/19

Fathead Minnow Test Summary Sheet

Client: WDOE

Start Date & Time: Apr 23/19 @1340h

Work Order No.: 191281

Test Species: *Pimephales promelas*

Sample Information:

Sample ID: DW-3 (definitive)
Sample Date: Jan 29/19
Date Received: Jan 30/19
Sample Volume: 5x20L

Dilution Water:

Type: Moderately - hard water
Hardness (mg/L $CaCO_3$): 100
Alkalinity (mg/L $CaCO_3$): 70

Test Organism Information:

Batch No.: 042319
Source: Aquatic BioSystems, CO
Loading Density: 10 fish /250 mL

NaCl Reference Toxicant Results:

Reference Toxicant ID: PP139
Stock Solution ID: NaCl
Date Initiated: Apr 23/19
7-d EC50 (95% CL): 4.2(3.6-4.9) g/L NaCl
7-d IC50 (95% CL): 3.5(3.1-4.2) g/L NaCl

Survival:

Reference Toxicant Mean ± 2 SD: 4.7(3.7-6.1) g/L NaCl CV (%): 13

Biomass

Reference Toxicant Mean ± 2 SD: 4.5(3.4-6.1) g/L NaCl CV (%): 15

Test Results:

	Survival	Biomass
NOEC % (v/v)	3.04	3.04
LOEC % (v/v)	4.33	4.33
EC25 % (v/v) (95% CL)	>4.33	
EC50 % (v/v) (95% CL)	>4.33	
IC25 % (v/v) (95% CL)		4.3(3.8-4.6)
IC50 % (v/v) (95% CL)		>4.33

Reviewed by: [signature]

Date reviewed: Jan. 16, 2020

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3
Work Order #: 19128 1

Start Date & Time: ~~Feb 19/19~~ MG April 23/19 @ 1340h
Stop Date & Time: April 30/19 @ 1435h
CER #: 11
Test Species: *Pimephales promelas*

% (v/v) Concentration: control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0
DO (mg/L)	8.0	6.6	8.1	6.4	8.0	6.2	7.8	6.0	7.9	6.2	7.8	5.5	7.7	5.3
pH	8.0	7.6	8.1	7.6	8.1	7.6	8.0	7.9	7.9	7.6	7.9	7.6	8.0	7.4
Cond. (µS/cm)	330	321		323		326		321		32		329		330
Initials	MG	MG		MG		MG		A		A		MG		MG

Concentration: Site ctrl	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0
DO (mg/L)	8.2	6.8	7.9	6.3	8.1	6.3	8.0	7.9	7.9	6.3	7.9	5.0	8.1	5.4
pH	7.9	7.9	8.0	7.9	8.0	7.7	7.7	7.8	7.7	7.7	7.7	7.7	8.0	~~7.4~~ MG 7.7
Cond. (µS/cm)	332	334		342		345		329		331		342		357
Initials	MG	MG		MG		MG		A		A		MG		MG

Concentration: 12.5	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0
DO (mg/L)	8.1	6.7	7.9	6.3	8.0	6.2	7.8	6.0	7.7	6.2	7.8	5.0	7.7	5.3
pH	7.8	7.6	7.8	7.6	8.0	7.6	8.0	7.5	7.9	7.6	7.9	7.6	7.8	7.4
Cond. (µS/cm)	474	483		489		486		471		465		496		496
Initials	MG	MG		MG		MG		A		A		MG		MG

Concentration: 25	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0
DO (mg/L)	8.1	6.7	7.9	6.3	8.0	6.3	7.9	5.9	7.8	6.2	7.8	4.6	7.8	5.3
pH	7.7	7.7	7.9	7.7	7.8	7.6	7.9	7.6	7.9	7.6	7.9	7.5	7.6	7.4
Cond. (µS/cm)	617	611		612		602		600		602		611		620
Initials	MG	MG		MG		MG		A		A		MG		MG

Thermometer: 4 DO meter/probe: 4 / 4 pH meter/probe: 4 / 4 Conductivity meter/probe: 4 / 4

	Control			
Hardness*	100			
Alkalinity*	70			

* mg/L as CaCO3

Analysts: MG, PWD, CS
Reviewed by: [signature]
Date reviewed: July 17/19

Sample Description: DW-3: clear yellow, odourless, some particulates
MW-11: clear, light yellow, odourless, no particulates
Comments:

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3
Work Order #: 19128 I

Start Date & Time: Apr 23/19 @ 1340h
Stop Date & Time: Apr 30/19 @ 1435h
CER #: 11
Test Species: *Pimephales promelas*

% (v/v) Concentration 50	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0
DO (mg/L)	8.1	6.7	7.8	6.4	8.0	6.4	8.0	5.9	7.7	6.3	7.8	5.2	7.3	5.4
pH	7.4	7.7	7.5	7.7	7.8	7.7	7.7	7.6	7.9	7.6	7.8	7.6	7.4	7.4
Cond. (µS/cm)	897	889		896		894		886		879		903		917
Initials	MG	MG		MG		MG		↑		↑		MG		MG

Concentration 75 ~~100~~ MG	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.5	24.0	24.5	24.0	25.0	24.0
DO (mg/L)	8.2	6.7	7.8	6.4	8.1	6.4	8.1	6.0	7.9	6.2	7.8	5.7	7.9	5.5
pH	7.3	7.7	7.4	7.7	7.5	7.7	7.7	7.7	7.8	7.7	7.8	7.7	7.3	7.5
Cond. (µS/cm)	1185	1164		1201		1194		1186		1190		1188		1148
Initials	MG	MG		MG		MG		↑		↑		MG		MG

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0
DO (mg/L)	8.3	6.8	7.9	6.3	8.0	6.5	8.3	6.0	8.0	6.3	7.9	5.9	8.1	5.7
pH	7.1	7.7	7.3	7.6	7.5	7.7	7.6	7.7	7.7	7.7	7.6	7.7	7.0	7.5
Cond. (µS/cm)	1469	1464		1490		1455		1442		1445		1482		1494
Initials	MG	MG		MG		MG		↑		↑		MG		MG

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 11 **DO meter/probe:** 4 / 4 **pH meter/probe:** 4 / 4 **Conductivity meter/probe:** 4 / 4

	Control			
Hardness*	100			
Alkalinity*	70			

* mg/L as CaCO3

Analysts: MG, AWD, CS
Reviewed by: [signature]
Date reviewed: July 17, 2019

Sample Description:

Comments:

7-d Fathead Minnow Toxicity Test
Daily Survival

Client: WDOE
Sample ID: Dw-3
Work Order #: 191281

Start Date & Time: April 23/19 @ 1340h
Stop Date & Time: April 30/19 @ 1425h
Test Species: *Pimephales promelas*

Concentration % (v/v)	Rep	Day of Test - No. of Survivors							Comments
		1	2	3	4	5	6	7	
control	A	10 JW	10	10	10	10	10	10	
	B	↓	↓	↓	↓	↓	10 MLG	10	
	C						10	10	
	D						10	10	
site ctrl	A						10	10	
	B						9	9	
	C						9	9	
	D						10	10	
12.5	A						10	10	
	B						10	10	
	C						9	9	
	D					↓	10	10	
25	A				↓	10	10	10	
	B				9	9	9	9	
	C				10	10	10	10	
	D				↓	↓	10	10	
50	A				↓	↓	9 JW	7	
	B				↓	↓	9	9	
	C				↓	↓	9	9	
	D				↓	↓	10	10	
75	A				↓	↓	10	9	
	B				↓	↓	10	10	
	C				↓	↓	10	10	
	D		↓		9	9	9	9	
100	A		10		10	10	9	7	
	B		10	↓	10	10	10	10	
	C		9 JW	9	9	9	8	8	
	D	↓	10	10	10	10	9	8	
	A								
	B								
	C								
	D								
Tech Initials		MLG	MLG	MLG	MLG	✓	MLG	JW	

Comments: n: 6.5cm
- remaining organisms appear normal

Reviewed by: [signature]

Date reviewed: July 17, 2019

Fathead Minnow Toxicity Test Data Sheet

Dry Weight Data

Client: WDOE

Start Date & Time: April 23/19 @ 1345h

Sample ID: DW-3

Termination Date & Time: April 30/19 @ 1425h

Work Order No.: PP Blue

Sample ID %(v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
control	A	1	10	JW	1042.14	1048.93	10	CH CA
	B	2	~~JW~~ 10		1047.36	1053.38	10	CH CA
	C	3	10		1060.55	1066.81	10	CH CA
	D	4	10		1009.57	1015.73	10	CH CA
site control	A	5	10		1009.05	1015.95	10	CH CA
	B	6	9		1055.09	1060.77	9	CH CA
	C	7	9		1062.72	1068.70	9	CH CA
	D	8	10		1046.48	1052.62	10	CH CA
12.5	A	9	10		1073.01	1078.84	10	CH CA
	B	10	10		1068.54	1074.58 ~~87~~	10	CH CA
	C	11	9		1079.60	1085.13	9	CH CA
	D	12	10		1061.30	1067.69	10	CH CA
25	A	13	10		1059.75	1066.04	10	CH CA
	B	14	9		1046.75	1051.89	9	CH CA
	C	15	10		1044.72	1050.40 ~~53~~	10	CH CA
	D	16	10		1051.24	1057.50	10	CH CA
50	A	17	7		1055.97	1060.82 ~~88~~	7	CH CA
	B	18	9		1023.35	1028.97 ~~78~~	9	CH CA
	C	19	9		1063.16	1069.94	9	CH CA
	D	20	10		1080.25	1086.97	10	CH CA
75	A	21	9		1070.87	1075.91	9	CH CA
	B	22	10		983.59	989.47	10	CH CA
	C	23	10		993.21	999.35	10	CH CA
	D	24	9	↓	1052.49	1058.68 ~~85~~	9	CH CA

Comments: 10% re-weigh: ① pan: 2 weight: 1053.40 ② pan: 17 weight: 1060.77
③ pan: 26 weight: 1059.43

Reviewed by: [signature]

Date Reviewed: July 17, 2019

Fathead Minnow Toxicity Test Data Sheet

Dry Weight Data

Client: NDOE

Start Date & Time: April 23/19 @ 1340h

Sample ID: DW-3

Termination Date & Time: April 30/19 @ 1435h

Work Order No.: PPBIAC

Sample ID 0/0 (v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
100	A	25	7	JW	1052.99	1057.18	7	CH/CT
	B	26	10	↓	1053.61	1059.57	10	CH/CT
	C	27	8		1055.99	1059.71	8	CH/CT
	D	28	8		1056.39	1060.31	8	CH/CT
	A							
	B							
	C							
	D							
	A							
	B							
	C							
	D							
	A							
	B							
	C							
	D							
	A							
	B							
	C							
	D							
	A							
	B							
	C							
	D							

Comments:

Reviewed by: [signature]

Date Reviewed: July 17, 2019

Client: WDOE

W.O.#: 19128

Hardness and Alkalinity Datasheet

	Alkalinity							Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
MHw (FHm)	Apr 22/19	Apr 22/19	50	3.6	3.7	70		50	50	100	MG

Notes:

Reviewed by: [signature] Date Reviewed: July 17, 2019

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran		
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water		
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**			
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	<24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**			
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology		
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3		
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology				

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓	NOEL	LOEL	TOEL	TU	PMSD	S
09-7701-8224	7d Survival Rate	Dunnett Multiple Comparison Test		3.04	4.33	3.628		12.5%	1
03-5664-9281	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test		3.04	4.33	3.628		18.2%	1
19-2257-6075	Mean Dry Weight-mg	Dunnett Multiple Comparison Test		3.04	4.33	3.628		12.7%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	mg/L	95% LCL	95% UCL	TU	S
15-1142-7854	7d Survival Rate	Linear Interpolation (ICPIN)	✓	EC5	1.243	0.3571	4.283		1
				EC10	3.203	0.3878	5.006		
				EC15	3.924	2.509	n/a		
				EC20	>4.33	n/a	n/a		
				EC25	>4.33	n/a	n/a		
				EC40	>4.33	n/a	n/a		
				EC50	>4.33	n/a	n/a		
18-8963-1070	Mean Dry Biomass-mg	NLR: 3P Log-Logistic		IC5	3.194	n/a	3.997		1
				IC10	3.598	n/a	4.294		
				IC15	3.873	2.495	4.425		
				IC20	4.095	3.512	4.506		
				IC25	4.287	3.844	4.647		
				IC40	4.788	3.677	5.791		
				IC50	5.108	3.273	7.972		
08-3875-3809	Mean Dry Weight-mg	NLR: 3P Log-Logistic		IC5	3.589	n/a	4.489		1
				IC10	4.037	n/a	4.61		
				IC15	4.343	3.707	4.757		
				IC20	4.588	2.813	5.316		
				IC25	4.801	n/a	6.025		
				IC40	5.355	n/a	n/a		
				IC50	5.708	n/a	n/a		

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0.17	N	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0.21	XC	4	0.9500	0.8581	1.0000	0.9000	1.0000	0.0289	0.0577	6.08%	5.00%
0.51		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
0.89		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
1.9		4	0.8750	0.6748	1.0000	0.7000	1.0000	0.0629	0.1258	14.38%	12.50%
3.04		4	0.9500	0.8581	1.0000	0.9000	1.0000	0.0289	0.0577	6.08%	5.00%
4.33		4	0.8250	0.6248	1.0000	0.7000	1.0000	0.0629	0.1258	15.25%	17.50%

Mean Dry Biomass-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0.17	N	4	0.6308	0.5772	0.6843	0.602	0.679	0.01682	0.03364	5.33%	0.00%
0.21	XC	4	0.6175	0.5348	0.7002	0.568	0.69	0.02598	0.05196	8.41%	2.10%
0.51		4	0.5945	0.5371	0.6519	0.553	0.639	0.01804	0.03608	6.07%	5.75%
0.89		4	0.5843	0.4974	0.6711	0.514	0.629	0.0273	0.0546	9.35%	7.37%
1.9		4	0.5995	0.4518	0.7472	0.485	0.678	0.04642	0.09284	15.49%	4.96%
3.04		4	0.5805	0.4969	0.6641	0.504	0.616	0.02628	0.05257	9.06%	7.97%
4.33		4	0.4448	0.2814	0.6081	0.372	0.596	0.05133	0.1027	23.08%	29.49%

Mean Dry Weight-mg Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0.17	N	4	0.6308	0.5772	0.6843	0.602	0.679	0.01682	0.03364	5.33%	0.00%
0.21	XC	4	0.6499	0.5958	0.7039	0.614	0.69	0.01698	0.03397	5.23%	-3.03%
0.51		4	0.6099	0.5727	0.647	0.583	0.639	0.01168	0.02337	3.83%	3.31%
0.89		4	0.5985	0.5452	0.6518	0.568	0.629	0.01675	0.0335	5.60%	5.11%
1.9		4	0.6859	0.6016	0.7703	0.6256	0.7533	0.0265	0.05301	7.73%	-8.75%
3.04		4	0.6116	0.5268	0.6965	0.56	0.6844	0.02666	0.05333	8.72%	3.03%
4.33		4	0.5374	0.4261	0.6486	0.465	0.5986	0.03496	0.06992	13.01%	14.80%

N = lab control
XC = site control (MW-11)

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	1.0000	1.0000	1.0000	1.0000
0.21	XC	1.0000	0.9000	0.9000	1.0000
0.51		1.0000	1.0000	0.9000	1.0000
0.89		1.0000	0.9000	1.0000	1.0000
1.9		0.7000	0.9000	0.9000	1.0000
3.04		0.9000	1.0000	1.0000	0.9000
4.33		0.7000	1.0000	0.8000	0.8000

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	0.679	0.602	0.626	0.616
0.21	XC	0.69	0.568	0.598	0.614
0.51		0.583	0.603	0.553	0.639
0.89		0.629	0.514	0.568	0.626
1.9		0.485	0.563	0.678	0.672
3.04		0.504	0.588	0.614	0.616
4.33		0.419	0.596	0.372	0.392

Mean Dry Weight-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	0.679	0.602	0.626	0.616
0.21	XC	0.69	0.6311	0.6644	0.614
0.51		0.583	0.603	0.6144	0.639
0.89		0.629	0.5711	0.568	0.626
1.9		0.6929	0.6256	0.7533	0.672
3.04		0.56	0.588	0.614	0.6844
4.33		0.5986	0.596	0.465	0.49

7d Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	10/10	10/10	10/10	10/10
0.21	XC	10/10	9/10	9/10	10/10
0.51		10/10	10/10	9/10	10/10
0.89		10/10	9/10	10/10	10/10
1.9		7/10	9/10	9/10	10/10
3.04		9/10	10/10	10/10	9/10
4.33		7/10	10/10	8/10	8/10

N = lab control
XC = site control (MW-11)

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	15-1142-7854	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:05	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1567867	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	1.243	0.3571	4.283
EC10	3.203	0.3878	5.006
EC15	3.924	2.509	n/a
EC20	>4.33	n/a	n/a
EC25	>4.33	n/a	n/a
EC40	>4.33	n/a	n/a
EC50	>4.33	n/a	n/a

7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-mg/L	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0.17	N	4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.51		4	0.9750	0.9000	1.0000	0.0500	5.13%	2.5%	39/40	0.975	2.5%
0.89		4	0.9750	0.9000	1.0000	0.0500	5.13%	2.5%	39/40	0.975	2.5%
1.9		4	0.8750	0.7000	1.0000	0.1258	14.38%	12.5%	35/40	0.9125	8.75%
3.04		4	0.9500	0.9000	1.0000	0.0577	6.08%	5.0%	38/40	0.9125	8.75%
4.33		4	0.8250	0.7000	1.0000	0.1258	15.25%	17.5%	33/40	0.825	17.5%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	1.0000	1.0000	1.0000	1.0000
0.51		1.0000	1.0000	0.9000	1.0000
0.89		1.0000	0.9000	1.0000	1.0000
1.9		0.7000	0.9000	0.9000	1.0000
3.04		0.9000	1.0000	1.0000	0.9000
4.33		0.7000	1.0000	0.8000	0.8000

7d Survival Rate Binomials

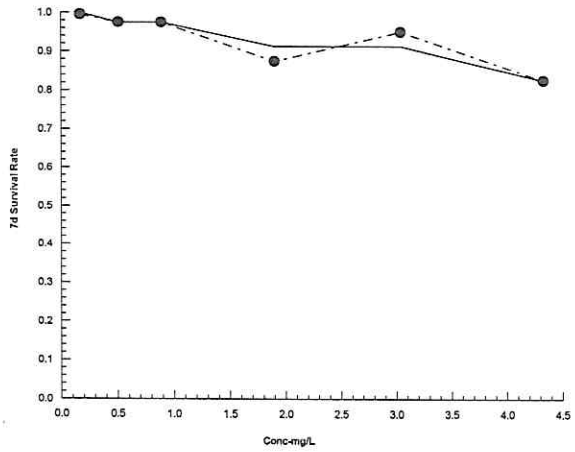
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	10/10	10/10	10/10	10/10
0.51		10/10	10/10	9/10	10/10
0.89		10/10	9/10	10/10	10/10
1.9		7/10	9/10	9/10	10/10
3.04		9/10	10/10	10/10	9/10
4.33		7/10	10/10	8/10	8/10

Analyst: KL QA: Jan 16/20

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

Analysis ID:	15-1142-7854	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:05	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: IGL QA: 1/16/20

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-8963-1070	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:05	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology		

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
16	66.96	-126.7	-124.4	0.4291	Yes	0.3506	3.16	0.7892	Non-Significant Lack of Fit

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	3.194	n/a	3.997
IC10	3.598	n/a	4.294
IC15	3.873	2.495	4.425
IC20	4.095	3.512	4.506
IC25	4.287	3.844	4.647
IC40	4.788	3.677	5.791
IC50	5.108	3.273	7.972

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	0.6026	0.01658	0.5681	0.6371	36.35	<1.0E-37	Significant Parameter
γ	6.27	4.716	-3.537	16.08	1.33	0.1979	Non-Significant Parameter
δ	5.108	0.6789	3.696	6.52	7.524	2.2E-07	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	7.942	2.647	3	640.5	<1.0E-37	Significant
Lack of Fit	0.004792	0.001597	3	0.3506	0.7892	Non-Significant
Pure Error	0.08201	0.004556	18			
Residual	0.0868	0.004133	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance Test	5.559	11.07	0.3515	Equal Variances
	Mod Levene Equality of Variance	0.8775	2.773	0.5157	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9809	0.9169	0.9121	Normal Distribution
	Anderson-Darling A2 Normality Te	0.2193	2.492	0.8715	Normal Distribution

Mean Dry Biomass-mg Summary

			Calculated Variate						
Conc-mg/L	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.17	N	4	0.6308	0.602	0.679	0.01682	0.03364	5.33%	0.0%
0.51		4	0.5945	0.553	0.639	0.01804	0.03608	6.07%	5.75%
0.89		4	0.5843	0.514	0.629	0.0273	0.0546	9.35%	7.37%
1.9		4	0.5995	0.485	0.678	0.04642	0.09284	15.49%	4.96%
3.04		4	0.5805	0.504	0.616	0.02628	0.05257	9.06%	7.97%
4.33		4	0.4448	0.372	0.596	0.05133	0.1027	23.08%	29.49%

Analyst: KSC QA: JM 1/16/20

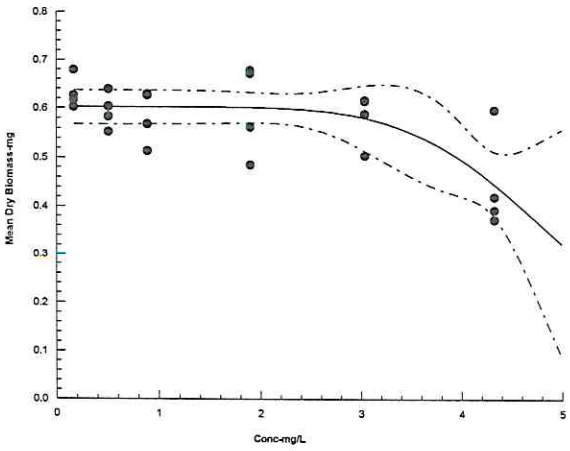
Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

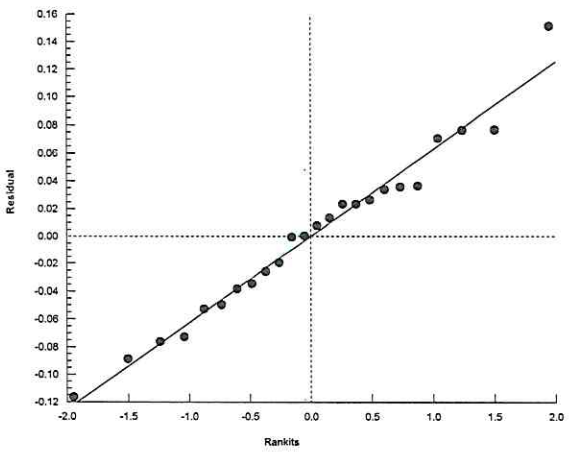
Analysis ID:	18-8963-1070	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:05	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1

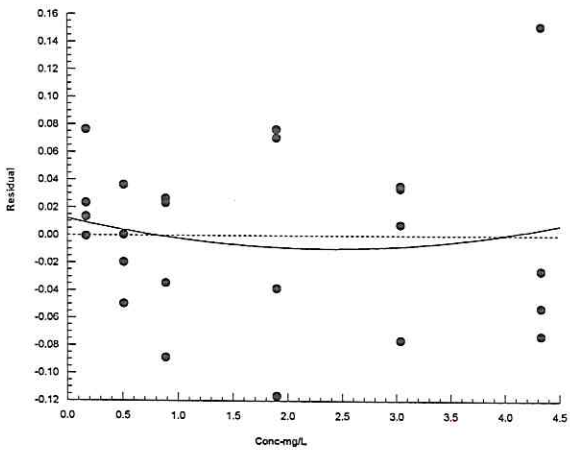
Mean Dry Biomass-mg Detail

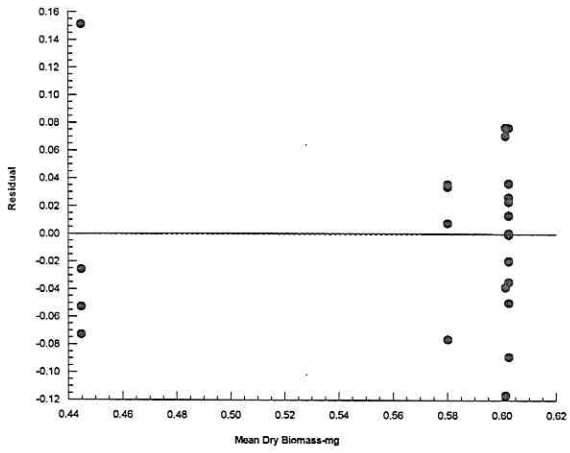
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	0.679	0.602	0.626	0.616
0.51		0.583	0.603	0.553	0.639
0.89		0.629	0.514	0.568	0.626
1.9		0.485	0.563	0.678	0.672
3.04		0.504	0.588	0.614	0.616
4.33		0.419	0.596	0.372	0.392

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]









CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-3875-3809	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:05	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology		

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
34	71.67	-136.1	-133.8	0.2565	Yes	2.782	3.16	0.0707	Non-Significant Lack of Fit

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	3.589	n/a	4.489
IC10	4.037	n/a	4.61
IC15	4.343	3.707	4.757
IC20	4.588	2.813	5.316
IC25	4.801	n/a	6.025
IC40	5.355	n/a	n/a
IC50	5.708	n/a	n/a

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	0.6298	0.0136	0.6016	0.6581	46.32	<1.0E-37	Significant Parameter
γ	6.345	7.501	-9.254	21.94	0.8459	0.4072	Non-Significant Parameter
δ	5.708	1.873	1.814	9.602	3.048	0.0061	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	9.027	3.009	3	1079	<1.0E-37	Significant
Lack of Fit	0.01856	0.006187	3	2.782	0.0707	Non-Significant
Pure Error	0.04003	0.002224	18			
Residual	0.05859	0.00279	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance Test	3.972	11.07	0.5534	Equal Variances
	Mod Levene Equality of Variance	1.835	2.773	0.1567	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9349	0.9169	0.1257	Normal Distribution
	Anderson-Darling A2 Normality Te	0.6582	2.492	0.0861	Normal Distribution

Mean Dry Weight-mg Summary

			Calculated Variate						
Conc-mg/L	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.17	N	4	0.6308	0.602	0.679	0.01682	0.03364	5.33%	0.0%
0.51		4	0.6099	0.583	0.639	0.01168	0.02337	3.83%	3.31%
0.89		4	0.5985	0.568	0.629	0.01675	0.0335	5.60%	5.11%
1.9		4	0.6859	0.6256	0.7533	0.0265	0.05301	7.73%	-8.75%
3.04		4	0.6116	0.56	0.6844	0.02666	0.05333	8.72%	3.04%
4.33		4	0.5374	0.465	0.5986	0.03496	0.06992	13.01%	14.8%

Analyst: KJL QA: JMT 1/16/20

Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

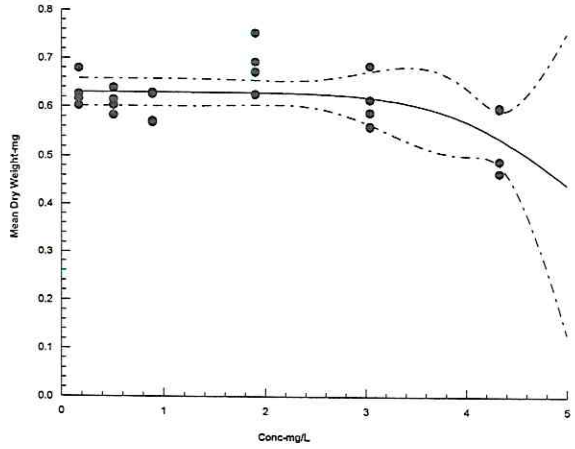
Analysis ID:	08-3875-3809	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:05	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1

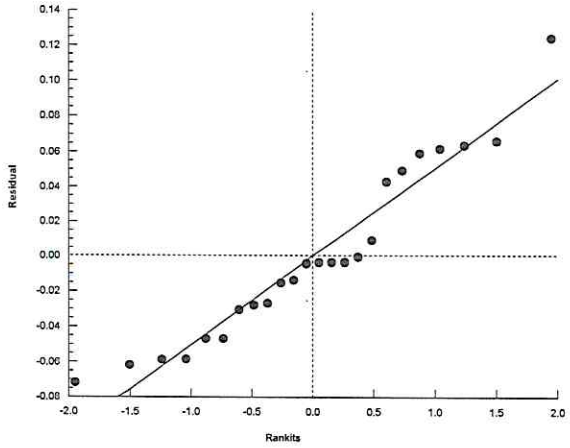
Mean Dry Weight-mg Detail

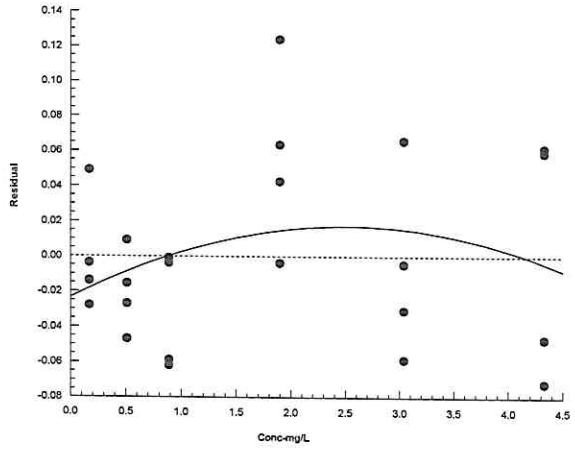
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	0.679	0.602	0.626	0.616
0.51		0.583	0.603	0.6144	0.639
0.89		0.629	0.5711	0.568	0.626
1.9		0.6929	0.6256	0.7533	0.672
3.04		0.56	0.588	0.614	0.6844
4.33		0.5986	0.596	0.465	0.49

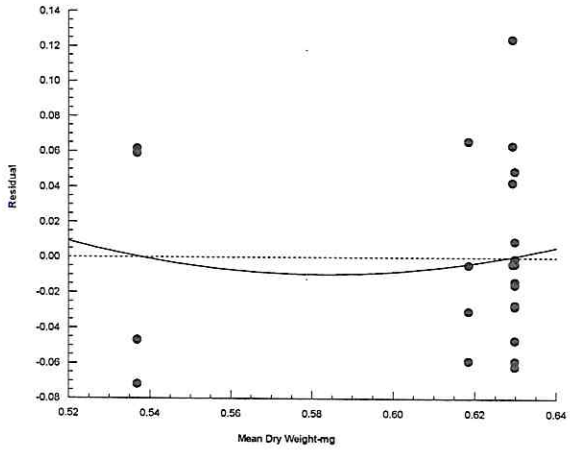
Graphics

Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]









Analyst: FJL QA: JM 1/16/20

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-2774-3121	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:09	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	Site Control passed 7d survival rate	6.13%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Site Control	1.732	1.943	0.091	6	CDF	0.0670	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0132797	0.0132797	1	3	0.1340	Non-Significant Effect
Error	0.0265593	0.0044266	6			
Total	0.039839		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Distribution	Shapiro-Wilk W Normality Test	0.8489	0.6451	0.0929	Normal Distribution

7d Survival Rate Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.17	N	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
0.21	XC	4	0.9500	0.8581	1.0000	0.9500	0.9000	1.0000	0.0289	6.08%	5.00%

Angular (Corrected) Transformed Summary

Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.17	N	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
0.21	XC	4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	5.77%

7d Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	1.0000	1.0000	1.0000	1.0000
0.21	XC	1.0000	0.9000	0.9000	1.0000

Angular (Corrected) Transformed Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	1.412	1.412	1.412	1.412
0.21	XC	1.412	1.249	1.249	1.412

7d Survival Rate Binomials

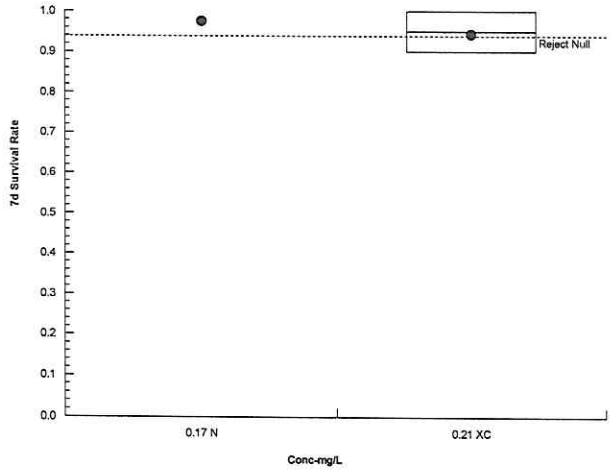
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	10/10	10/10	10/10	10/10
0.21	XC	10/10	9/10	9/10	10/10

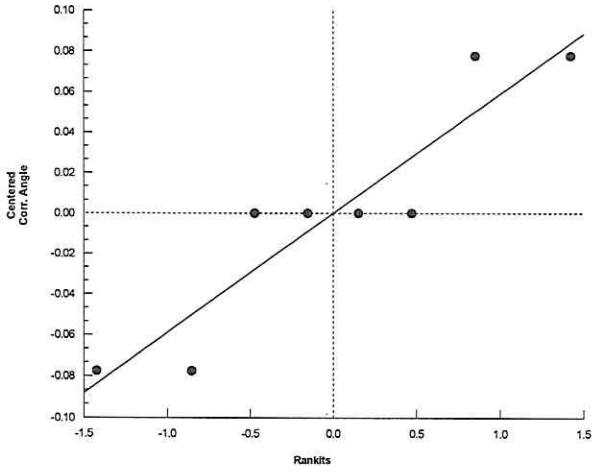
N= lab control
XC= site control (MW-11)

Fathead Minnow 7-d Larval Survival and Growth Test **Nautilus Environmental**

Analysis ID:	18-2774-3121	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:09	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





CETIS Analytical Report

Report Date: 16 Jan-20 11:09 (p 1 of 1)
Test Code/ID: 191281b / 12-5973-4283

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-7099-3661	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:09	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	Site Control passed mean dry biomass-mg	9.53%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Site Control	0.4281	1.943	0.060	6	CDF	0.3418	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0003511	0.0003511	1	0.1833	0.6835	Non-Significant Effect
Error	0.011494	0.0019157	6			
Total	0.0118451		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.385	47.47	0.4939	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.897	0.6451	0.2715	Normal Distribution

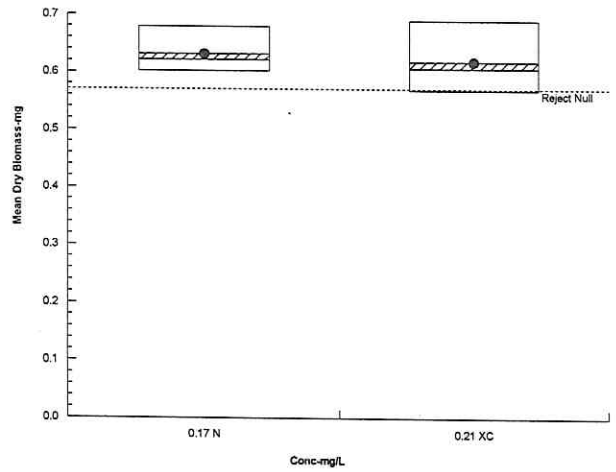
Mean Dry Biomass-mg Summary

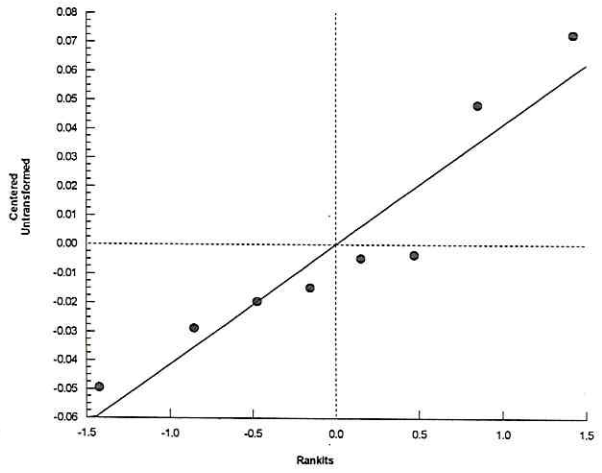
Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.17	N	4	0.6308	0.5772	0.6843	0.621	0.602	0.679	0.01682	5.33%	0.00%
0.21	XC	4	0.6175	0.5348	0.7002	0.606	0.568	0.69	0.02598	8.41%	2.10%

Mean Dry Biomass-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	0.679	0.602	0.626	0.616
0.21	XC	0.69	0.568	0.598	0.614

Graphics





N= lab control
XC= site control

Analyst: MV QA: Jm 1/16/20

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	19-0918-7801	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Jan-20 11:09	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	05-6678-6169	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	23 Apr-19 13:40	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	30 Apr-19 14:25	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	7d 1h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	17-4881-3663	**Code:**	683CC75F	**Project:**	
Sample Date:	19 Mar-19	**Material:**	Diesel	**Source:**	WA Dept of Ecology
Receipt Date:	20 Mar-19 11:07	**CAS (PC):**		**Station:**	DW-3
Sample Age:	35d 14h	**Client:**	WA State Dept of Ecology		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	Site Control passed mean dry weight-mg	7.36%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		Site Control	-0.8007	1.943	0.046	6	CDF	0.7731	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0007327	0.0007327	1	0.6412	0.4538	Non-Significant Effect
Error	0.0068563	0.0011427	6			
Total	0.0075889		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.019	47.47	0.9877	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9124	0.6451	0.3713	Normal Distribution

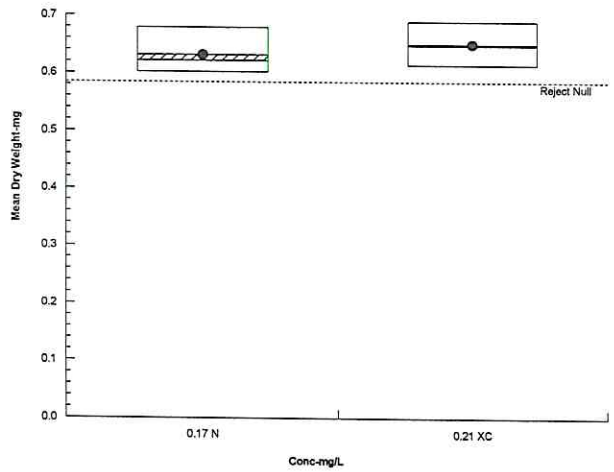
Mean Dry Weight-mg Summary

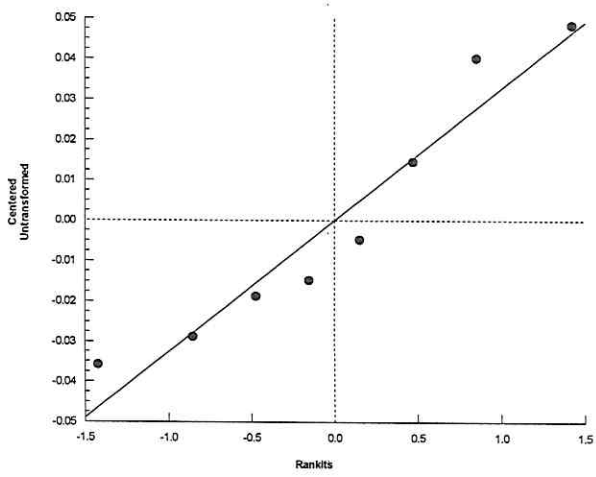
Conc-mg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.17	N	4	0.6308	0.5772	0.6843	0.621	0.602	0.679	0.01682	5.33%	0.00%
0.21	XC	4	0.6499	0.5958	0.7039	0.6478	0.614	0.69	0.01698	5.23%	-3.03%

Mean Dry Weight-mg Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4
0.17	N	0.679	0.602	0.626	0.616
0.21	XC	0.69	0.6311	0.6644	0.614

Graphics





N= lab control
XC= site control

Analyst: [illegible] QA: Jan. 16/20

APPENDIX D – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: WDOE
Work Order No.: 191282

Start Date/Time: Mar 11/19 @ 1500h
Set up by: KL/SSK

Sample Information:

Sample ID: DW-3 (range finder)
Sample Date: Jan 29/19
Date Received: Jan 30/19
Sample Volume: 5x20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 4.0 to 8.4 ; pH = 6.0 to 9.0

Test Organism Information:

Broodstock No.: BS022719A
Age of young (Day 0): <24-h (within 8-h)
Avg No. young in first 3 broods of previous 7 d: 42
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: 4,6-8,10-12,17,20

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd215
Stock Solution ID: 18NaCl (100g/L)
Date Initiated: Mar 5/19

7-d LC50 (95% CL): 2.0 (1.7-2.3) g/L NaCl
7-d IC50 (95% CL): 1.8 (1.4-2.0) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.0-2.1) g/L NaCl CV (%): 18

Test Results:

	Survival	Reproduction
LC50 %v/v (95% CL)	~~>100~~ 5.53	
IC25 %v/v (95% CL)		~~>100~~ 5.53
IC50 %v/v (95% CL)		~~>100~~ 5.53
NOEC %v/v	~~100~~ 5.53	~~>100~~ 5.53
LOEC %v/v	~~>100~~ >5.53	~~>100~~ >5.53

Reviewed by: [signature]
Date reviewed: Aug 14/19

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3
Work Order #: WDOE cerro range finder 191282

Start Date & Time: Mar 11/19 @1500h
Stop Date & Time: Mar 17/19 @ ~~1515~~ 1500h
CER #: 4
Test Species: *Ceriodaphnia dubia*

7-(V/V) CONTROL

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	8.3	8.0	8.1	8.1	8.1	8.0	8.1	8.1	7.3	7.1	7.2		
pH	8.2	8.2	8.2	8.2	7.9	7.9	8.2	8.1	8.2	7.9	7.2	7.9		
Cond. (µS/cm)	219	223		223		221		220		220		229		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

Concentration	Days													
	0	1		2		3		4		5		6		7
SITE CONTROL	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.4	8.3	~~8.24~~	8.3	8.4	8.3	8.4	~~8.2~~ 7.1	8.1	7.4	7.0	7.4		
pH	~~7.9~~ ①	8.2	8.2	8.1	8.1	8.2	8.3	8.2	8.2	8.1	8.1	8.0		
Cond. (µS/cm)	~~312~~ ②	321		325		320		319		312		332		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

① 8.0 ② 315

Concentration	Days													
	0	1		2		3		4		5		6		7
0.10	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	8.3	8.3	8.3	8.3	8.3	8.3	7.3	8.1	7.3	7.0	7.2		
pH	7.9	8.1	8.1	8.1	8.1	8.2	8.3	8.0	8.2	8.1	8.1	8.0		
Cond. (µS/cm)	212	221		222		223		220		226		235		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

Concentration	Days													
	0	1		2		3		4		5		6		7
0.39	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.4	8.3	8.3	8.3	8.3	8.3	8.3	7.3	8.1	7.4	7.1	7.3		
pH	7.9	8.1	8.1	8.1	8.1	8.2	8.3	8.0	8.2	8.0	8.1	8.0		
Cond. (µS/cm)	219	216		219		220		225		226		236		
Initials	JB	SSK		SSK		CSK		SSK		A		A		

Thermometer: 4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control	MW11(SiRes)	DW-3 (100%)	
Hardness*	102	180	400	
Alkalinity*	100	164	30	

* mg/L as CaCO3

Analysts: JB, AWD, SSK
Reviewed by:
Date reviewed: Aug. 14, 2019

Sample Description: Brown, some particulates, organic (hydrocarbon odour).

Comments: Broodboard Used: BOO2719A (#4, 6-8, 10-12, 17, 20)

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3
Work Order #: WDOE Ceno rangefinder 191282

Start Date & Time: March 6 @ 1500h
Stop Date & Time: March 12 @ 1500h
CER #: 4
Test Species: *Ceriodaphnia dubia*

Y-(v/v) Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.4	8.3	8.3	8.3	8.3	8.3	8.3	7.3	8.0	7.3	7.1	7.3		
pH	7.9	8.2	8.1	8.2	8.0	8.2	8.3	8.2	8.3	7.1	7.2	8.0		
Cond. (µS/cm)	218	222		224		221		226		227		236		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

Concentration 6.3	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.4	8.3	8.4	8.3	8.4	8.3	8.3	7.3	7.9	7.3	7.1	7.4		
pH	8.0	8.2	8.1	8.2	8.0	8.2	8.3	8.1	8.3	7.1	7.1	8.0		
Cond. (µS/cm)	219	221		222		224		228		230		238		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

Concentration 25	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.4	8.3	8.4	8.3	8.4	8.3	8.4	7.1	7.8	7.4	7.1	7.5		
pH	7.9	8.2	8.1	8.2	8.0	8.2	8.3	8.1	8.2	7.1	7.1	8.0		
Cond. (µS/cm)	232	233		231		231		235		233		239		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.4	8.3	8.4	8.3	8.4	8.3	8.4	7.1	8.0	7.3	7.1	7.4		
pH	7.8	8.1	7.9	8.2	7.9	8.2	8.1	8.0	8.1	7.1	7.2	7.1		
Cond. (µS/cm)	285	286		287		283		282		288		285		
Initials	JB	SSK		SSK		SSK		SSK		A		A		

Thermometer: 4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control	MWH (SK Cost)	DW-3 (100%)	
Hardness*	102	150	400	
Alkalinity*	100	164	30	

* mg/L as CaCO3

Analysts: JB, AWD, SSK
Reviewed by: SSK
Date reviewed: Aug. 14, 2019

Sample Description: see pg 1

Comments: Broodboard Used: see pg 1

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: WDOE
Sample ID: DW-3
Work Order: WDOE cento rangefinder 191282

Start Date & Time: Mar 11/19 @ 1500h
Stop Date & Time: Mar 17, 19 @ 1500h
Set up by: JB/KL

Days	Concentration: CONTROL											Concentration: SITE CNTRL 7-(V/V)											Concentration: 0.10										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK
2	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK
3	✓	✓	✓	X	✓						SSK	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK
4	3	4	3	3	4						SSK	2	✓	2	✓	2						SSK	3	6	4	6	4						SSK
5	6	5	6	8	6						A	2	3	3	3	3						A	6	9	8	7	8						A
6	9	9	8	8	9						M	3	2	3	2	2						A	8	7	8	9	8						M
7																																	
8			✓																														
Total	18	18	19	19	19						JB	7	5	8	5	7						JB	19	22	20	20	20						JB
			17	30																													

Days	Concentration: 0.39											Concentration: 0-SSK 1.6											Concentration: 6.3										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK
2	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK
3	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK
4	4	✓	5	4	5						SSK	4	5	3	4	4						SSK	4	4	4	3	5						SSK
5	8	✓	7	8	8						A	7	8	7	9	7						A	7	7	8	6	7						A
6	7	7	8	7	8						M	9	8	9	9	7						A	8	9	9	8	9						M
7																																	
8																																	
Total	19	7	20	19	21						JB	20	21	19	22	18						JB	19	20	21	17	21						JB

Days	Concentration: 25											Concentration: 100											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK											
2	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK											
3	✓	✓	✓	✓	✓						SSK	✓	✓	✓	✓	✓						SSK											
4	3	5	4	4	5						SSK	5	4	3	4	6						SSK											
5	7	6	7	8	9						A	9	8	7	8	9						A											
6	8	8	7	9	8						M	9	10	9	9	10						A											
7																																	
8																																	
Total	18	19	18	21	22						JB	23	22	19	21	25						JB											

Notes: X = mortality.

Comments: 1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

2. Ephippia present in Controls (Y) (N) ?

Reviewed by: [signature]

Date reviewed: Aug 14, 2019

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	10-2017-7832	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 13:56	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	00-6510-9183	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	11 Mar-19 15:00	**Protocol:**	Washington DOE (2016)	**Diluent:**	20% Perrier Water
Ending Date:	17 Mar-19 15:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	10-2477-5369	**Code:**	DW-3	**Project:**	
Sample Date:	10 Mar-19 Jan29/19	**Material:**	Water Sample	**Source:**	WDOE
Receipt Date:	11 Mar-19 Jan30/19	**CAS (PC):**		**Station:**	wdoe
Sample Age:	39h 0846	**Client:**	WDOE		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1038395	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>5.53	n/a	n/a	<18.08	n/a	n/a
EC10	>5.53	n/a	n/a	<18.08	n/a	n/a
EC15	>5.53	n/a	n/a	<18.08	n/a	n/a
EC20	>5.53	n/a	n/a	<18.08	n/a	n/a
EC25	>5.53	n/a	n/a	<18.08	n/a	n/a
EC40	>5.53	n/a	n/a	<18.08	n/a	n/a
EC50	>5.53	n/a	n/a	<18.08	n/a	n/a

6d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0.15		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%
0.16		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%
0.19	N	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%
0.191		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%
0.3		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%
0.89		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%
5.53		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	5/5	1	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.15		1.0000	1.0000	1.0000	1.0000	1.0000
0.16		1.0000	1.0000	1.0000	1.0000	1.0000
0.19	N	1.0000	1.0000	1.0000	1.0000	1.0000
0.191		1.0000	1.0000	1.0000	1.0000	1.0000
0.3		1.0000	1.0000	1.0000	1.0000	1.0000
0.89		1.0000	1.0000	1.0000	1.0000	1.0000
5.53		1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.15		1/1	1/1	1/1	1/1	1/1
0.16		1/1	1/1	1/1	1/1	1/1
0.19	N	1/1	1/1	1/1	1/1	1/1
0.191		1/1	1/1	1/1	1/1	1/1
0.3		1/1	1/1	1/1	1/1	1/1
0.89		1/1	1/1	1/1	1/1	1/1
5.53		1/1	1/1	1/1	1/1	1/1

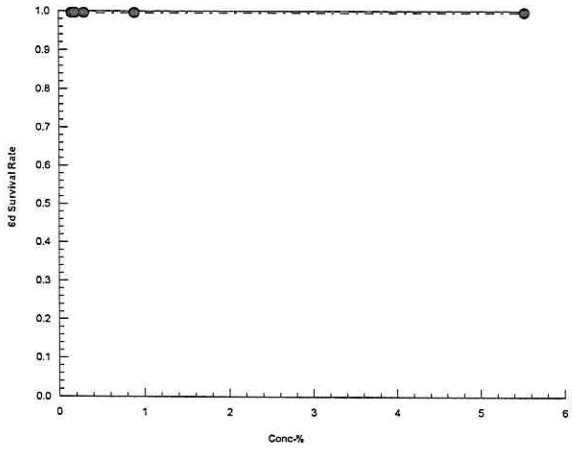
N= lab control

Analyst: _____ QA: Dec-19/19

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	10-2017-7832	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 13:56	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: _____ QA: _____ Dec-19/19

Ceriodaphnia 7-d Survival and Reproduction Test — Nautilus Environmental

Analysis ID:	06-3368-0096	Endpoint:	Reproduction	CETIS Version:	CETISv1.9.4
Analyzed:	18 Dec-19 13:56	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	00-6510-9183	Test Type:	Reproduction-Survival (7d)	Analyst:	Kania Lywe
Start Date:	11 Mar-19 15:00	Protocol:	Washington DOE (2016)	Diluent:	20% Perrier Water
Ending Date:	17 Mar-19 15:00	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	6d 0h	Taxon:	Branchiopoda	Source:	In-House Culture Age: <24
Sample ID:	10-2477-5369	Code:	DW-3	Project:	
Sample Date:	10 ~~Mar-19~~ 29-Jan-19	Material:	Water Sample	Source:	WDOE
Receipt Date:	11 ~~Mar-19~~ 30-Jan-19	CAS (PC):		Station:	wdoe
Sample Age:	39h 08:46	Client:	WDOE		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1865638	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>5.53	n/a	n/a	<18.08	n/a	n/a
IC10	>5.53	n/a	n/a	<18.08	n/a	n/a
IC15	>5.53	n/a	n/a	<18.08	n/a	n/a
IC20	>5.53	n/a	n/a	<18.08	n/a	n/a
IC25	>5.53	n/a	n/a	<18.08	n/a	n/a
IC40	>5.53	n/a	n/a	<18.08	n/a	n/a
IC50	>5.53	n/a	n/a	<18.08	n/a	n/a

Reproduction Summary

			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0.15		5	20.6	19	22	1.342	6.51%	0.0%	20.6	0.0%
0.16		5	17.2	7	21	5.762	33.50%	16.5%	19.43	5.66%
0.19	N	5	18.2	17	19	0.8367	4.60%	11.65%	19.43	5.66%
0.191		5	20	18	22	1.581	7.91%	2.91%	19.43	5.66%
0.3		5	19.6	17	21	1.673	8.54%	4.85%	19.43	5.66%
0.89		5	19.6	18	22	1.817	9.27%	4.85%	19.43	5.66%
5.53		5	22	19	25	2.236	10.16%	-6.8%	19.43	5.66%

Reproduction Detail

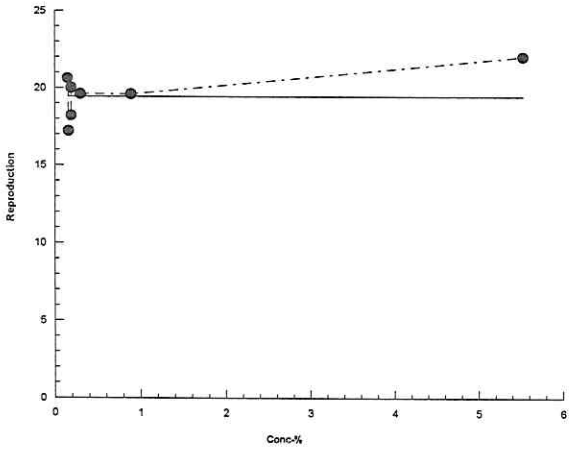
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.15		19	22	20	22	20
0.16		19	7	20	19	21
0.19	N	18	18	17	19	19
0.191		20	21	19	22	18
0.3		19	20	21	17	21
0.89		18	19	18	21	22
5.53		23	22	19	21	25

N = lab control

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	06-3368-0096	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 13:56	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Analyst: _____ QA: Dec-19/19

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	12-2294-4036	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 14:07	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Batch ID:	00-6510-9183	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	11 Mar-19 15:00	**Protocol:**	Washington DOE (2016)	**Diluent:**	20% Perrier Water
Ending Date:	17 Mar-19 15:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	10-2477-5369	**Code:**	DW-3	**Project:**	
Sample Date:	10 Mar-19 29-Jan-19	**Material:**	Water Sample	**Source:**	WDOE
Receipt Date:	11 Mar-19 30-Jan-19	**CAS (PC):**		**Station:**	wdoe
Sample Age:	39h 0846	**Client:**	WDOE		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	5.53	>5.53	n/a	18.08

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		0.15	1.0000	Exact	1.0000	Non-Significant Effect
		0.16	1.0000	Exact	1.0000	Non-Significant Effect
		0.191	1.0000	Exact	1.0000	Non-Significant Effect
		0.3	1.0000	Exact	1.0000	Non-Significant Effect
		0.89	1.0000	Exact	1.0000	Non-Significant Effect
		5.53	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0.15		5	0	5	1	0	0.0%
0.16		5	0	5	1	0	0.0%
0.19	N	5	0	5	1	0	0.0%
0.191		5	0	5	1	0	0.0%
0.3		5	0	5	1	0	0.0%
0.89		5	0	5	1	0	0.0%
5.53		5	0	5	1	0	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.15		1.0000	1.0000	1.0000	1.0000	1.0000
0.16		1.0000	1.0000	1.0000	1.0000	1.0000
0.19	N	1.0000	1.0000	1.0000	1.0000	1.0000
0.191		1.0000	1.0000	1.0000	1.0000	1.0000
0.3		1.0000	1.0000	1.0000	1.0000	1.0000
0.89		1.0000	1.0000	1.0000	1.0000	1.0000
5.53		1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

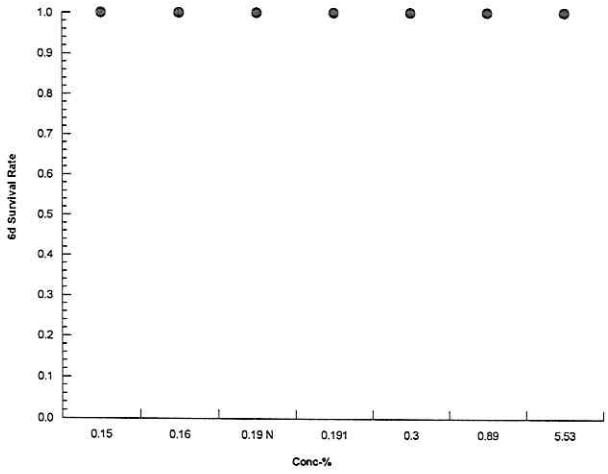
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.15		1/1	1/1	1/1	1/1	1/1
0.16		1/1	1/1	1/1	1/1	1/1
0.19	N	1/1	1/1	1/1	1/1	1/1
0.191		1/1	1/1	1/1	1/1	1/1
0.3		1/1	1/1	1/1	1/1	1/1
0.89		1/1	1/1	1/1	1/1	1/1
5.53		1/1	1/1	1/1	1/1	1/1

N= lab control

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	12-2294-4036	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 14:07	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1

Graphics



Analyst: _____ QA: Dee-19/19

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	01-4092-6723	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 14:07	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Batch ID:	00-6510-9183	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	11 Mar-19 15:00	**Protocol:**	Washington DOE (2016)	**Diluent:**	20% Perrier Water
Ending Date:	17 Mar-19 15:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	10-2477-5369	**Code:**	DW-3	**Project:**	
Sample Date:	10 Mar-19 29-Jan-19	**Material:**	Water Sample	**Source:**	WDOE
Receipt Date:	11 Mar-19 30-Jan-19	**CAS (PC):**		**Station:**	wdoe
Sample Age:	39h ~ 0846h	**Client:**	WDOE		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	5.53	>5.53	n/a	18.08	22.20%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.15	39	16	2	8	CDF	1.0000	Non-Significant Effect
		0.16	33	16	2	8	CDF	0.9932	Non-Significant Effect
		0.191	36	16	3	8	CDF	0.9994	Non-Significant Effect
		0.3	34.5	16	3	8	CDF	0.9979	Non-Significant Effect
		0.89	33	16	3	8	CDF	0.9932	Non-Significant Effect
		5.53	39	16	2	8	CDF	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	73.2	12.2	6	1.732	0.1503	Non-Significant Effect
Error	197.2	7.04286	28			
Total	270.4		34			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	18.92	16.81	0.0043	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.829	0.9146	8.0E-05	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.15		5	20.6	18.93	22.27	20	19	22	0.6	6.51%	0.00%
0.16		5	17.2	10.05	24.35	19	7	21	2.577	33.50%	16.50%
0.19	N	5	18.2	17.16	19.24	18	17	19	0.3742	4.60%	11.65%
0.191		5	20	18.04	21.96	20	18	22	0.7071	7.91%	2.91%
0.3		5	19.6	17.52	21.68	20	17	21	0.7483	8.54%	4.85%
0.89		5	19.6	17.34	21.86	19	18	22	0.8124	9.27%	4.85%
5.53		5	22	19.22	24.78	22	19	25	1	10.16%	-6.80%

Reproduction Detail

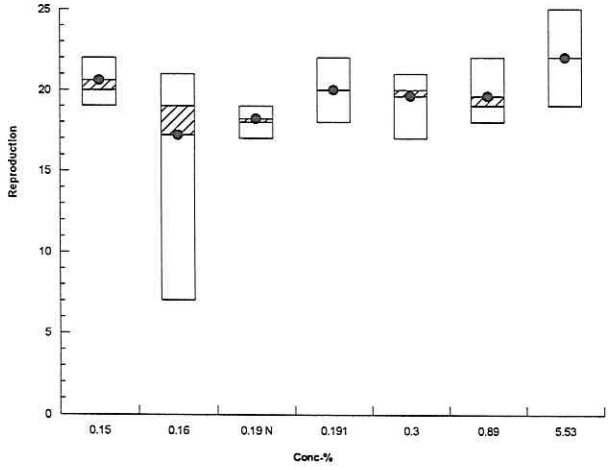
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.15		19	22	20	22	20
0.16		19	7	20	19	21
0.19	N	18	18	17	19	19
0.191		20	21	19	22	18
0.3		19	20	21	17	21
0.89		18	19	18	21	22
5.53		23	22	19	21	25

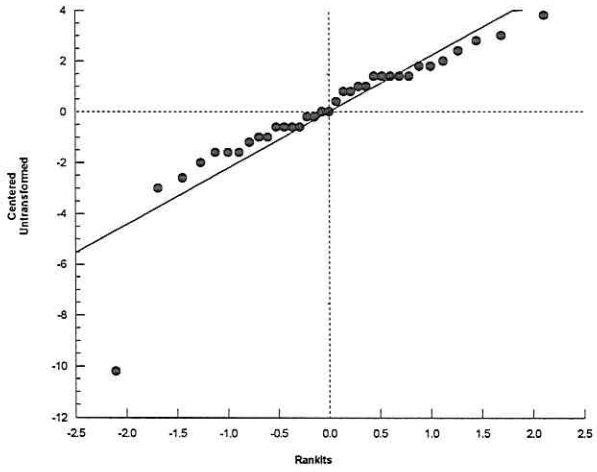
N= lab Control

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

Analysis ID:	01-4092-6723	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Dec-19 14:07	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1

Graphics





Analyst: _____ QA: Dec-19/19

Client: WDOE

W.O.#: 191282

Hardness and Alkalinity Datasheet

	Alkalinity							Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
QA/QC Blanks	March 11/19	March 11/19	100	10.4	10.6	102		50	5.0	100	KM
Sample DW-3	May 14/19	May 14/19	50	1.7	1.9	30		100	4.0	400	SSK
Site Cont MW-11	May 14/19	May 14/19	50	8.4	8.6	164		50	9.0	180	SSK

Notes: ① sample diluted to 100mL w/ DI water

Reviewed by: [signature]

Date Reviewed: Aug 14, 2019

Ceriodaphnia dubia Summary Sheet

Client: WDOE
Work Order No.: 191292

Start Date/Time: May 14/19 @ 1200h
Set up by: KL/SSK

Sample Information:

Sample ID: MW11, DW-3
Sample Date: Jan 29/19, Mar 19/19
Date Received: Jan 30/19, Mar 20/19
Sample Volume: (2x20L, 5x20L) & (3x4L, 5x20L)

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: BB050619A+B & BB050819A KSSK
Age of young (Day 0): <24-h (within ~~12~~-h)~
Avg No. young in first 3 broods of previous 7 d: 20
Mortality (%) in previous 7 d: 3
Individual female # used ≥8 young on test day: # 10, 19, 27 (BB050619A+B)
1, 2, 4, 6-9 (BB050819A)

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd220
Stock Solution ID: 18NaCl (100g/L NaCl)
Date Initiated: May 01/19

7-d LC50 (95% CL): 2.0 (1.7 - 2.3) g/L NaCL
7-d IC50 (95% CL): 1.2 (1.1 - 1.3) g/L NaCL

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8 - 2.2) g/L NaCL CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.1 - 2.3) 1.6 g/L NaCL CV (%): 20

Test Results:

	Survival (%)	Reproduction (Mean ± SD)
Negative Control	100	18.8 ± 2.4
MW - 11 (sink end)	100	15.5 ± 3.7
DW - 3	100	17.4 ± 4.2
		±
		±
		±
		±
		±
		±

Reviewed by: JGa

Date reviewed: July 9/19

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: WDOE
Sample ID: DW-3 (weathered diesel)
Work Order #: 191282

Start Date & Time: May 14/19 @ 1100h
Stop Date & Time: May 20/19 @ 1400h
CER #: 4
Test Species: *Ceriodaphnia dubia*

% (v/v) Concentration lab control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	24.0	24.0	24.0	25.0	25.0	25.0	25.0	24.0	25.0	24.0	24.0		
DO (mg/L)	8.1	~~7.3~~	8.0	7.2	8.0	7.2	8.1	7.4	8.2	7.4	8.2	7.5		
pH	8.3	8.0	8.2	8.0	8.3	8.0	8.3	7.9	8.2	7.9	8.2	7.8		
Cond. (µS/cm)	216	216		216		216		214		215		223		
Initials	SSK	SSK		SSK		SSK								

MW-11

Site Ctrl. Concentration ~~tap~~ SSK	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	~~24.0~~	~~25.0~~	24.0	24.5	25.0	25.0	25.0	24.0	25.0	24.0	24.0		
DO (mg/L)	8.2	~~7.4~~	~~8.2~~ ②	7.2	8.2	7.5	8.2	7.3	8.1	7.1	8.0	7.0		
pH	7.6	7.8	7.6	7.6	7.7	7.7	7.6	7.7	7.6	7.8	7.5	7.6		
Cond. (µS/cm)	326	315		326		328		329		328		340		
Initials	SSK	SSK		SSK		SSK								

② 8.2

~~MW-11~~ DW-3 Concentration ~~12.5~~ SSK	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	25.0	24.0	24.5	25.0	25.0	25.0	24.0	25.0	24.0	24.0		
DO (mg/L)	~~8.2~~ ①	7.4	~~8.2~~	7.2	8.2	7.5	8.2	7.3	8.1	6.9	8.0	7.0		
pH	6.7	6.8	6.5	7.0	6.7	7.0	6.6	6.8	6.7	6.9	6.7	7.0		
Cond. (µS/cm)	1414	1400		1432		1408		1439		1452		1446		
Initials	SSK	SSK		SSK		SSK								

① 8.2

Concentration ~~100~~ SSK	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control	100%	site control	
Hardness*	400	400	180	
Alkalinity*	106	30	164	

* mg/L as CaCO3

Analysts: KL, AWD, SSK, JB
Reviewed by: JBR
Date reviewed: July 9/19

Sample Description: MW-11 clear, yellow no particulates, no odor
DW-3 clear, yellow, ~~no~~ m particulates, no odor

Comments: Broodboard Used: BB050619A&B (#10,19,27) & BB050819A (#1,2,4,6-9)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: WDOE
Sample ID: DW-3 (weathered diesel)
Work Order: 191282

(% v/v)

Start Date & Time: May 14/19 @ noon
Stop Date & Time: May 20/19 @ 1400h
Set up by: KL/AWD/JB/SSK

Days	Concentration: CONTROL (lab)										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SSK
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SSK
3	4	3	4	3	3	4	4	4	3	✓	SSK
4	/	/	5	5	/	6	6	6	6	3	[illegible]
5	5	5	/	/	5	/	/	/	✓	6	[illegible]
6	10	7	12	8	10	11	12	11	9	8	[illegible]
7											
8											
Total	19	15	21	16	18	21	22	21	18	17	JW

Days	Concentration: SITE Ctrl (100) MW-11										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SSK
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SSK
3	✓	4	3	2	4	✓	2	3	4	3	SSK
4	3	/	/	6	/	4	/	5	6	6	[illegible]
5	6	7	✓	8	8	7	7	✓	/	/	[illegible]
6	/	7	10	✓	9	/	5	9	8	9	WK
7											
8											
Total	9	18	13	16	21	11	14	17	18	18	KL

Days	Concentration: ~~MW-11~~ (100) DW-3										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SSK
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SSK
3	4	3	3	3	3	3	✓	4	3	3	SSK
4	/	/	6	/	/	7	6	6	/	/	[illegible]
5	7	5	✓	6	7	✓	7	✓	✓	✓	[illegible]
6	10	8	5	7	10	9	12	9	8	10	[illegible]
7											
8											
Total	21	16	14	16	20	19	25	19	11	13	KL

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Comments:
1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.
2. Ephippia present in Controls (Y) / (N) ? [N circled]

Reviewed by: [signature]

Date reviewed: July 9/19

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	07-8517-0948	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	26 Jun-19 14:00	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Batch ID:	06-1681-4698	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	14 May-19 12:00	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	
Ending Date:	20 May-19 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	105d 12h	WA State Dept of Ecolog	
DW-3	16-5145-0355	29 Jan-19	30 Jan-19 08:46	105d 12h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
MW-11	Diesel	WDOE	MW-11	
DW-3	Diesel	WDOE	DW-3	

Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Site Control		DW-3	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
MW-11	XC	10	0	10	1	0	0.0%
DW-3		10	0	10	1	0	0.0%

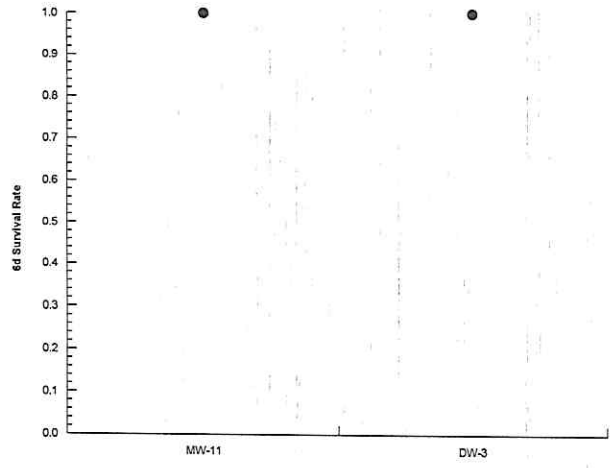
6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
MW-11	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DW-3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
MW-11	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
DW-3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



MW11 = on-site control well (site cont)
DW-3 = contaminated well

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	10-2638-7894	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	26 Jun-19 14:05	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	06-1681-4698	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	14 May-19 12:00	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	
Ending Date:	20 May-19 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	105d 12h	WA State Dept of Ecolog	
DW-3	16-5145-0355	29 Jan-19	30 Jan-19 08:46	105d 12h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
MW-11	Diesel	WDOE	MW-11	
DW-3	Diesel	WDOE	DW-3	

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	DW-3 passed reproduction	19.76%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		DW-3	-1.075	1.734	3.064	18	CDF	0.8518	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	18.05	18.05	1	1.157	0.2964	Non-Significant Effect
Error	280.9	15.6056	18			
Total	298.95		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.293	6.541	0.7080	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.964	0.866	0.6270	Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
MW-11	XC	10	15.5	12.86	18.14	16.5	9	21	1.167	23.80%	0.00%
DW-3		10	17.4	14.4	20.4	17.5	11	25	1.327	24.11%	-12.26%

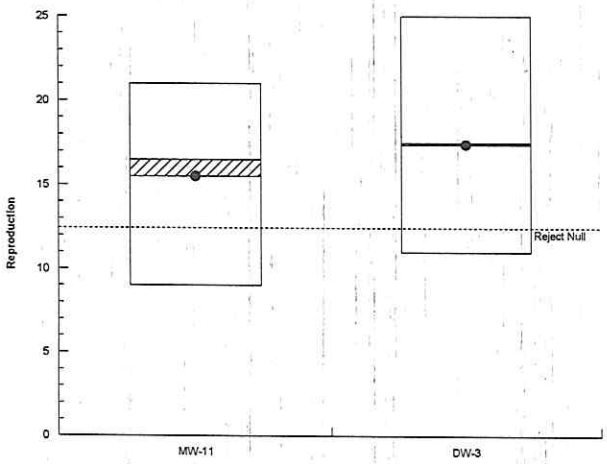
Reproduction Detail

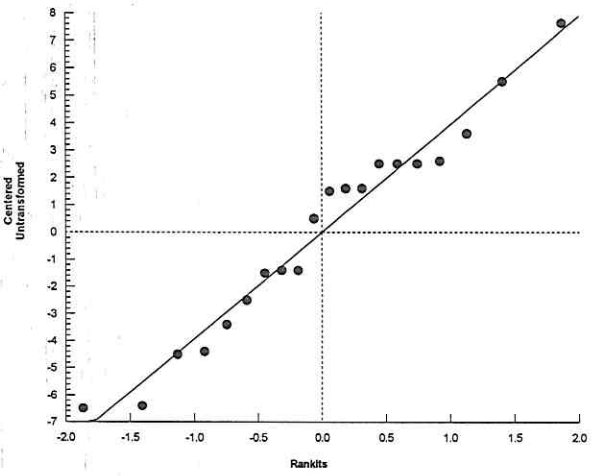
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
MW-11	XC	9	18	13	16	21	11	14	17	18	18
DW-3		21	16	14	16	20	19	25	19	11	13

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	10-2638-7894	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	26 Jun-19 14:05	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	06-1681-4698	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	14 May-19 12:00	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	
Ending Date:	20 May-19 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Lab Control	13-4083-0602	14 May-19	14 May-19	12h	WA State Dept of Ecolog	
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	105d 12h		
DW-3	16-5145-0355	29 Jan-19	30 Jan-19 08:46	105d 12h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Lab Control	Water Sample	WDOE	Lab Control	
MW-11	Diesel	WDOE	MW-11	
DW-3	Diesel	WDOE	DW-3	

SIngle Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
07-8517-0948	6d Survival Rate	Fisher Exact Test	1.0000	Lab Control passed 6d survival rate	1
07-8517-0948	6d Survival Rate	Fisher Exact Test	1.0000	MW-11 passed 6d survival rate	1
07-8517-0948	6d Survival Rate	Fisher Exact Test	1.0000	DW-3 passed 6d survival rate	1
15-6851-5108	Reproduction	Equal Variance t Two-Sample Test	0.1858	Lab Control passed reproduction	1
15-6851-5108	Reproduction	Equal Variance t Two-Sample Test	0.1858	MW-11 passed reproduction	1
15-6851-5108	Reproduction	Equal Variance t Two-Sample Test	0.1858	DW-3 passed reproduction	1

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
15-6851-5108	Reproduction	Control Resp	18.8	15	>>	Yes	Passes Criteria

6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
MW-11	XC	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
DW-3		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	L	10	18.8	17.09	20.51	15	22	0.7572	2.394	12.74%	0.00%
MW-11	XC	10	15.5	12.86	18.14	9	21	1.167	3.689	23.80%	17.55%
DW-3		10	17.4	14.4	20.4	11	25	1.327	4.195	24.11%	7.45%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MW-11	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DW-3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	L	19	15	21	16	18	21	22	21	18	17
MW-11	XC	9	18	13	16	21	11	14	17	18	18
DW-3		21	16	14	16	20	19	25	19	11	13

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	L	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MW-11	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
DW-3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Test Code/ID: 191282a / 10-2817-1520

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	20-2246-1753	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	26 Jun-19 14:01	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Batch ID:	06-1681-4698	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	14 May-19 12:00	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	
Ending Date:	20 May-19 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Lab Control	13-4083-0602	14 May-19	14 May-19	12h	WA State Dept of Ecolog	
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	105d 12h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Lab Control	Water Sample	WDOE	Lab Control	
MW-11	Diesel	WDOE	MW-11	

Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		Site Control	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	L	10	0	10	1	0	0.0%
MW-11	XC	10	0	10	1	0	0.0%

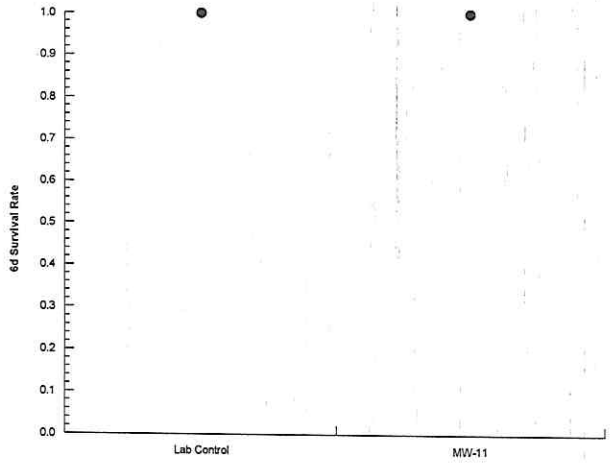
6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MW-11	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	L	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MW-11	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Analyst: VC QA: July 9/19

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	10-1694-2397	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	26 Jun-19 14:01	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	06-1681-4698	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe
Start Date:	14 May-19 12:00	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	
Ending Date:	20 May-19 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Test Length:	6d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Lab Control	13-4083-0602	14 May-19	14 May-19	12h	WA State Dept of Ecolog	
MW-11	19-3462-2452	29 Jan-19	30 Jan-19 08:46	105d 12h		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Lab Control	Water Sample	WDOE	Lab Control	
MW-11	Diesel	WDOE	MW-11	

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MW-11 failed reproduction	12.83%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		Site Control*	2.373	1.734	2.412	18	CDF	0.0145	Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	18.8	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	54.45	54.45	1	5.63	0.0290	Significant Effect
Error	174.1	9.67222	18			
Total	228.55		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.374	6.541	0.2138	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9619	0.866	0.5825	Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	L	10	18.8	17.09	20.51	18.5	15	22	0.7572	12.74%	0.00%
MW-11	XC	10	15.5	12.86	18.14	16.5	9	21	1.167	23.80%	17.55%

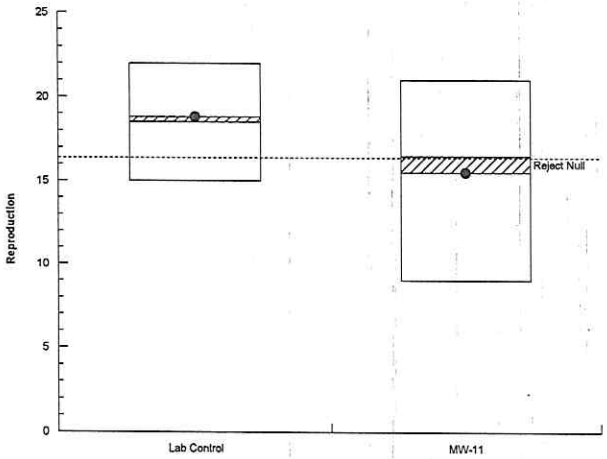
Reproduction Detail

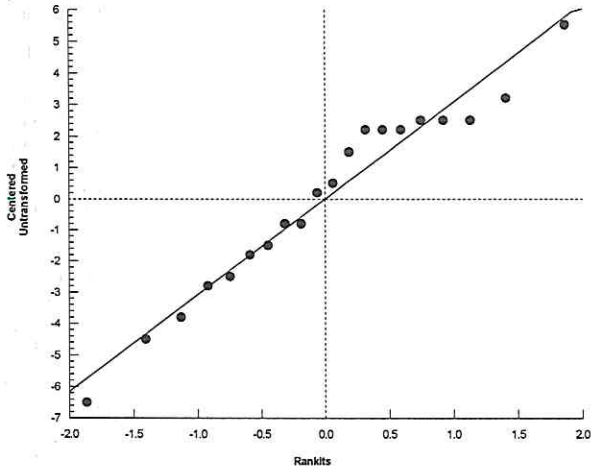
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	L	19	15	21	16	18	21	22	21	18	17
MW-11	XC	9	18	13	16	21	11	14	17	18	18

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

Analysis ID:	10-1694-2397	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	26 Jun-19 14:01	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Client: WDOE

W.O.#: 191282

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
Sample DW-3	May 14/19	May 14/19	50	10.7	10.9	30	100①	4.0	400	SSK
Site Cntrl MW-1	↓	↓	50	8.4	8.6	164	50	9.0	180	↓
20% pentr	May 14/19	May 14/19	100	10.8	11.0	106	50	5.0	100	K

Notes: ① sample diluted to 100mL w/DI water.

Reviewed by: JOK Date Reviewed: July 9/19

APPENDIX E – Analytical Chemistry

DEPARTMENT OF ECOLOGY
Manchester Environmental Laboratory
7411 Beach Drive East • Port Orchard, Washington 98366-8204

Case Narrative

February 14, 2019

To: Hobbs, William

Project: NWTPH-Dx Tox

Work Order: 1902025

Subject: Semivolatile Petroleum Products

From: Karin Bailey KB

Sample Receipt

Enclosed are the TPHD results for the samples received by MEL on February 7, 2019. All samples were received in acceptable condition unless noted in Analyst Comments. All samples were prepared and analyzed within holding times unless noted in Analyst Comments.

Analytical Methods

These samples were prepared, analyzed, and verified by MEL according to the submitted chain-of-custody and MEL's procedures. A Sample Correlation Table with batch summary is located in Appendix A. The samples were:

- extracted following a modification of method SW3535A.
- analyzed following a modification of method NWTPH-DX.

Analyst Comments

TPHD by GCFID. The samples were received at the lab out of temperature. As a result, the sample final concentrations are qualified as estimates.

Sample Qualification

The samples were qualified according to MEL's procedures. The table in Appendix B summarizes the manual qualifiers added by MEL. All results reported below the method reporting limit (RL) were automatically qualified as estimates, but not included in Appendix B.

The qualifiers are defined in Appendix C.

Sample Verification

All analyses met QC acceptance criteria except as noted in Appendix D. All analytes met linearity requirements unless noted in Appendix E.

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-stk-100-0-1**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: 1902025-01
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	6.29	J	0.15	
NULL	Residual Range Organics	4.75	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.272	0.220	124	50-150

Authorized by: LB **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-stk-100-0-2**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: 1902025-02
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	5.67	J	0.15	
NULL	Residual Range Organics	4.29	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.260	0.220	118	50-150

Authorized by: KB **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-stk-100-0-3**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 995 mL
Final Vol: 3 mL

Lab ID #: 1902025-03
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	5.90	J	0.15	
NULL	Residual Range Organics	4.50	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.241	0.221	109	50-150

Authorized by: VB **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-stk-0.5-0-1**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 985 mL
Final Vol: 3 mL

Lab ID #: 1902025-04
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	2.77	J	0.15	
NULL	Residual Range Organics	2.05	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.253	0.223	113	50-150

Authorized by: LR **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-stk-0.5-0-2**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 995 mL
Final Vol: 3 mL

Lab ID #: 1902025-05
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	2.38	J	0.15	
NULL	Residual Range Organics	1.71	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.223	0.221	101	50-150

Authorized by: KB **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-stk-0.5-0-3**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 995 mL
Final Vol: 3 mL

Lab ID #: 1902025-06
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	2.95	J	0.15	
NULL	Residual Range Organics	2.13	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.258	0.221	117	50-150

Authorized by: LB **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox **Field ID: mix-control-0-1**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: 1902025-07
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/14/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.30**	**J**	**0.15**	
NULL	Residual Range Organics	0.38	UJ	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.227	0.220	103	50-150

Authorized by: _____ **Release Date:** 2/14/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **Field ID: mix-control-0-2**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 995 mL
Final Vol: 3 mL

Lab ID #: 1902025-08
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/14/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.29**	**J**	**0.15**	
NULL	Residual Range Organics	0.38	UJ	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.241	0.221	109	50-150

Authorized by: LB **Release Date:** 2/14/19

Washington State Department of Ecology
Manchester Environmental Laboratory
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Project: NWTPH-Dx Tox **Field ID: mix-control-0-3**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 990 mL
Final Vol: 3 mL

Lab ID #: 1902025-09
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/14/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.27**	**J**	**0.15**	
NULL	Residual Range Organics	0.38	UJ	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.214	0.222	96	50-150

Authorized by: LB **Release Date:** 2/14/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **Field ID: mix-Ppro-BLNK-0-1**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 995 mL
Final Vol: 3 mL

Lab ID #: 1902025-10
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/14/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.15	UJ	0.15	
NULL	Residual Range Organics	0.38	UJ	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.242	0.221	109	50-150

Authorized by: _____ **Release Date:** 2/14/19

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Project: NWTPH-Dx Tox **Field ID: mix-Cdub-BLNK-0-1**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 990 mL
Final Vol: 3 mL

Lab ID #: 1902025-11
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/14/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.15	UJ	0.15	
NULL	Residual Range Organics	0.38	UJ	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.228	0.222	103	50-150

Authorized by: LB **Release Date:** 2/14/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **Field ID: mix-MARINE-BLNK-0-1**

Work Order: 1902025
Project Officer: Hobbs, William
Initial Vol: 1010 mL
Final Vol: 3 mL

Lab ID #: 1902025-12
Collected: 2/5/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/14/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.17**	**J**	**0.15**	
NULL	Residual Range Organics	0.37	UJ	0.37	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.238	0.218	109	50-150

Authorized by: LB **Release Date:** 2/14/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

QC Type : Method Blank

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: B19B033-BLK1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19B033-BLK1

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.15	UJ	0.15	
NULL	Residual Range Organics	0.38	U	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.167	0.220	76	50-150

Authorized by: VG **Release Date:** 2/14/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

QC Type : LCS

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: B19B033-BS1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19B033-BS1

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: %

Analyte	Result	Spike Level	RL	%Rec	%Rec Limits
Diesel Range Organics	2.31	3.00	0.15	77	70-130

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.233	0.220	106	50-150

Authorized by: _____ **Release Date:** 2/14/19

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Project: NWTPH-Dx Tox

QC Type : LCS Dup

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: B19B033-BSD1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19B033-BSD1

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: %

Analyte	Sample Result	Spike Level	%Rec	RPD	%Rec Limits	RPD Limit
Diesel Range Organics	1.03	3.00	34	77	70-130	40

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.123	0.220	56	50-150

Authorized by: LG **Release Date:** 2/14/19

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Project: NWTPH-Dx Tox

QC Type : Duplicate

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 995 mL
Final Vol: 3 mL

Lab ID #: B19B033-DUP1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19B033-DUP1
Source Lab ID #: 1902025-01

Batch ID: B19B033
Prepared: 2/8/2019
Analyzed: 2/13/2019
Matrix: Water
Units: mg/L

Analyte	Sample Result	Sample Qual	Source Result	RPD	RPD Limit
Diesel Range Organics	5.67		6.29	10	40
Residual Range Organics	3.94		4.75	19	40

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.251	0.221	113	50-150

Authorized by: _____ **Release Date:** 2/14/19

Appendix A
Sample Correlation Table

Batch ID: B19B033 **Prep Method:** SW3535A

Prepared: 2/8/2019 **Analysis Method:** NWTPH-DX

Field ID	MEL ID
mix-stk-100-0-1	1902025-01
mix-stk-100-0-2	1902025-02
mix-stk-100-0-3	1902025-03
mix-stk-0.5-0-1	1902025-04
mix-stk-0.5-0-2	1902025-05
mix-stk-0.5-0-3	1902025-06
mix-control-0-1	1902025-07
mix-control-0-2	1902025-08
mix-control-0-3	1902025-09
mix-Ppro-BLNK-0-1	1902025-10
mix-Cdub-BLNK-0-1	1902025-11
mix-MARINE-BLNK-0-1	1902025-12
Blank	B19B033-BLK1
LCS	B19B033-BS1
LCS Dup	B19B033-BSD1
Duplicate (mix-stk-100-0-1)	B19B033-DUP1

Appendix B
Manual Qualification Table

WO: 1902025 **Analysis:** TPHD

Reported result is estimated; sample was not properly preserved.

Diesel Range Organics J: 1902025-01, 1902025-02, 1902025-03, 1902025-04, 1902025-05, 1902025-06, 1902025-07, 1902025-08, 1902025-09, 1902025-12,

Residual Range Organics J: 1902025-01, 1902025-02, 1902025-03, 1902025-04, 1902025-05, 1902025-06,

Analyte was not detected at or above the estimated MRL; LCS recovery exceeded QC limits.

Diesel Range Organics UJ: B19B033-BLK1,

Analyte was not detected at or above the estimated MRL; sample was not properly preserved

Diesel Range Organics UJ: 1902025-10, 1902025-11,

Residual Range Organics UJ: 1902025-07, 1902025-08, 1902025-09, 1902025-10, 1902025-11, 1902025-12,

Appendix C
Data Qualifier Definitions

Code	Definition
E	Reported result is an estimate because it exceeds the calibration range.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the present of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
NAF	Not analyzed for.
NC	Not calculated.
REJ	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was not detected at or above the reported sample quantitation limit.
UJ	The analyte was not detected at or above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
bold	The analyte was present in the sample. (Visual aid to locate detected compounds on the analytical report.)

Appendix D
QC Exceptions Report

Lab ID	Analyte	Exception
B19B033-BSD1	Diesel Range Organics	Exceeds lower control limit
B19B033-BSD1	Diesel Range Organics	Exceeds RPD control limit

QC Exceptions determined using unrounded QC results but are reported as integers throughout this analytical report.

Appendix E
Initial Calibration Exceptions Report

Calibration ID: NA **Analysis:** TPHD

Lab Number	Analyte	QC Exception

No initial calibration exceptions noted.

DEPARTMENT OF ECOLOGY
Manchester Environmental Laboratory
7411 Beach Drive East • Port Orchard, Washington 98366-8204

Case Narrative

April 8, 2019

To: Hobbs, William

Project: NWTPH-Dx Tox

Work Order: 1903027

Subject: Semivolatile Petroleum Products

From: Karin Bailey KB

Sample Receipt

Enclosed are the TPHD results for the samples received by MEL on March 20, 2019. All samples were received in acceptable condition unless noted in Analyst Comments. All samples were prepared and analyzed within holding times unless noted in Analyst Comments.

Analytical Methods

These samples were prepared, analyzed, and verified by MEL according to the submitted chain-of-custody and MEL's procedures. A Sample Correlation Table with batch summary is located in Appendix A. The samples were:

- extracted following a modification of method SW3535A.
- analyzed following a modification of method NWTPH-DX.

Analyst Comments

TPHD by GCFID. The samples were received at the laboratory out of temperature. As a result, the sample final concentrations are qualified as estimates. The MRL was raised due to background in samples 1903027-02, -03, -06, -07, -10, -11, and -12.

Sample Qualification

The samples were qualified according to MEL's procedures. The table in Appendix B

summarizes the manual qualifiers added by MEL. All results reported below the method reporting limit (RL) were automatically qualified as estimates, but not included in Appendix B. The qualifiers are defined in Appendix C.

Sample Verification

All analyses met QC acceptance criteria except as noted in Appendix D. All analytes met linearity requirements unless noted in Appendix E.

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-100-72-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 940 mL
Final Vol: 3 mL

Lab ID #: 1903027-01
Collected: 3/14/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	5.48	J	0.16	
NULL	Residual Range Organics	5.71	J	0.40	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.190	0.234	81	50-150

Authorized by: KB **Release Date:** 4/8/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

Field ID: RF-Cdub-6.3-72-1

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 920 mL
Final Vol: 3 mL

Lab ID #: 1903027-02
Collected: 3/14/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.28	UJ	0.28	
NULL	Residual Range Organics	0.41	UJ	0.41	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.245	0.239	102	50-150

Authorized by: LG **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-6.3-72-2**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 890 mL
Final Vol: 3 mL

Lab ID #: 1903027-03
Collected: 3/14/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.27	UJ	0.27	
NULL	Residual Range Organics	0.42	UJ	0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.240	0.247	97	50-150

Authorized by: LS **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-0.39-72-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 880 mL
Final Vol: 3 mL

Lab ID #: 1903027-04
Collected: 3/14/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.17	UJ	0.17	
NULL	Residual Range Organics	0.43	UJ	0.43	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.258	0.250	103	50-150

Authorized by: _____ **Release Date:** 4/8/19

Washington State Department of Ecology
Manchester Environmental Laboratory
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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-100-96-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 870 mL
Final Vol: 3 mL

Lab ID #: 1903027-05
Collected: 3/15/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	3.75	J	0.17	
NULL	Residual Range Organics	3.71	J	0.43	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.216	0.253	85	50-150

Authorized by: _____ **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-6.3-96-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 820 mL
Final Vol: 3 mL

Lab ID #: 1903027-06
Collected: 3/15/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.25	UJ	0.25	
NULL	Residual Range Organics	0.46	UJ	0.46	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.279	0.268	104	50-150

Authorized by: LC **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-6.3-96-2**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 870 mL
Final Vol: 3 mL

Lab ID #: 1903027-07
Collected: 3/15/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.24	UJ	0.24	
NULL	Residual Range Organics	0.43	UJ	0.43	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.252	0.253	100	50-150

Authorized by: _____ **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-0.39-96-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 890 mL
Final Vol: 3 mL

Lab ID #: 1903027-08
Collected: 3/15/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.17	UJ	0.17	
NULL	Residual Range Organics	0.42	UJ	0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.243	0.247	98	50-150

Authorized by: _____ **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-100-120-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 940 mL
Final Vol: 3 mL

Lab ID #: 1903027-09
Collected: 3/16/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	5.24	J	0.16	
NULL	Residual Range Organics	5.38	J	0.40	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.210	0.234	90	50-150

Authorized by: LS **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-6.3-120-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 940 mL
Final Vol: 3 mL

Lab ID #: 1903027-10
Collected: 3/16/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.30	UJ	0.30	
NULL	Residual Range Organics	0.40	UJ	0.40	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.239	0.234	102	50-150

Authorized by: _____ **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-0.39-120-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 890 mL
Final Vol: 3 mL

Lab ID #: 1903027-11
Collected: 3/16/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.17	UJ	0.17	
NULL	Residual Range Organics	0.42	UJ	0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.234	0.247	95	50-150

Authorized by: LB **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox

Field ID: RF-Cdub-0-144-1

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 890 mL
Final Vol: 3 mL

Lab ID #: 1903027-12
Collected: 3/17/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.23	UJ	0.23	
NULL	Residual Range Organics	0.42	UJ	0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.241	0.247	97	50-150

Authorized by: _____ **Release Date:** 4/8/19

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Project: NWTPH-Dx Tox **Field ID: RF-Cdub-LabCont-144-1**

Work Order: 1903027
Project Officer: Hobbs, William
Initial Vol: 940 mL
Final Vol: 3 mL

Lab ID #: 1903027-13
Collected: 3/17/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.16	UJ	0.16	
NULL	Residual Range Organics	0.40	UJ	0.40	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.235	0.234	101	50-150

Authorized by: LB **Release Date:** 4/8/19

Washington State Department of Ecology
Manchester Environmental Laboratory
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Semivolatile Petroleum Products

Project: NWTPH-Dx Tox

QC Type : Method Blank

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: B19C132-BLK1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19C132-BLK1

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.15	U	0.15	
NULL	Residual Range Organics	0.38	U	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.205	0.220	93	50-150

Authorized by: _____ **Release Date:** 4/8/19

Washington State Department of Ecology
Manchester Environmental Laboratory
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Project: NWTPH-Dx Tox

QC Type : LCS

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: B19C132-BS1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19C132-BS1

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: %

Analyte	Result	Spike Level	RL	%Rec	%Rec Limits
Diesel Range Organics	2.46	3.00	0.15	82	70-130

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.214	0.220	97	50-150

Authorized by: LR **Release Date:** 4/8/19

Washington State Department of Ecology
Manchester Environmental Laboratory
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Project: NWTPH-Dx Tox **QC Type : LCS Dup**

Work Order: Batch QC
Project Officer: Hobbs, William
Initial Vol: 1000 mL
Final Vol: 3 mL

Lab ID #: B19C132-BSD1
Prep Method: SW3535A
Analysis Method: NWTPH-DX
Source Field ID: B19C132-BSD1

Batch ID: B19C132
Prepared: 3/21/2019
Analyzed: 4/5/2019
Matrix: Water
Units: %

Analyte	Sample Result	Spike Level	%Rec	RPD	%Rec Limits	RPD Limit
Diesel Range Organics	2.46	3.00	82	0.2	70-130	40

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.216	0.220	98	50-150

Authorized by: LB **Release Date:** 4/8/19

Appendix A
Sample Correlation Table

Batch ID: B19C132 **Prep Method:** SW3535A

Prepared: 3/21/2019 **Analysis Method:** NWTPH-DX

Field ID	MEL ID
RF-Cdub-100-72-1	1903027-01
RF-Cdub-6.3-72-1	1903027-02
RF-Cdub-6.3-72-2	1903027-03
RF-Cdub-0.39-72-1	1903027-04
RF-Cdub-100-96-1	1903027-05
RF-Cdub-6.3-96-1	1903027-06
RF-Cdub-6.3-96-2	1903027-07
RF-Cdub-0.39-96-1	1903027-08
RF-Cdub-100-120-1	1903027-09
RF-Cdub-6.3-120-1	1903027-10
RF-Cdub-0.39-120-1	1903027-11
RF-Cdub-0-144-1	1903027-12
RF-Cdub-LabCont-144-1	1903027-13
Blank	B19C132-BLK1
LCS	B19C132-BS1
LCS Dup	B19C132-BSD1

Appendix B
Manual Qualification Table

WO: 1903027 **Analysis:** TPHD

Reported result is estimated; sample was not properly preserved.

Diesel Range Organics J: 1903027-01, 1903027-05, 1903027-09,

Residual Range Organics J: 1903027-01, 1903027-05, 1903027-09,

Analyte was not detected at or above the estimated MRL; sample was not properly preserved

Diesel Range Organics UJ: 1903027-02, 1903027-03, 1903027-04, 1903027-06, 1903027-07, 1903027-08, 1903027-10, 1903027-11, 1903027-12, 1903027-13,

Residual Range Organics UJ: 1903027-02, 1903027-03, 1903027-04, 1903027-06, 1903027-07, 1903027-08, 1903027-10, 1903027-11, 1903027-12, 1903027-13,

Appendix C
Data Qualifier Definitions

Code	Definition
E	Reported result is an estimate because it exceeds the calibration range.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the present of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
NAF	Not analyzed for.
NC	Not calculated.
REJ	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was not detected at or above the reported sample quantitation limit.
UJ	The analyte was not detected at or above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
bold	The analyte was present in the sample. (Visual aid to locate detected compounds on the analytical report.)

Appendix D
QC Exceptions Report

Lab ID	Analyte	Exception

No QC exceptions reported.

QC Exceptions determined using unrounded QC results but are reported as integers throughout this analytical report.

Appendix E
Initial Calibration Exceptions Report

Calibration ID: B9D0401 **Analysis:** TPHD

LabNumber	Analyte	QC Exception

No ICAL exceptions.

DEPARTMENT OF ECOLOGY
Manchester Environmental Laboratory
7411 Beach Drive East • Port Orchard, Washington 98366-8204

Case Narrative

June 17, 2019

To: Hobbs, William

Project: NWTPH-Dx Tox

Work Order: 1905056

Subject: Semivolatile Petroleum Products

From: Karin Bailey KB

Sample Receipt

Enclosed are the TPHD results for the samples received by MEL on May 29, 2019. All samples were received in acceptable condition unless noted in Analyst Comments. All samples were prepared and analyzed within holding times unless noted in Analyst Comments.

Analytical Methods

These samples were prepared, analyzed, and verified by MEL according to the submitted chain-of-custody and MEL's procedures. A Sample Correlation Table with batch summary is located in Appendix A. The samples were:

- extracted following a modification of method SW3535A.
- analyzed following a modification of method NWTPH-DX.

Analyst Comments

TPHD by GCFID. Sample 1905056-02 arrived at the laboratory over temperature. Sample 1905056-09 arrived at the laboratory unpreserved and past the preparation holding time. Samples 1905056-01, -10, -11, -12, -13, and B19F001-DUP1 arrived at the laboratory past the preparation holding time.

Sample 1905056-06 was accidently concentrated to a low volume of approximately 0.25mL during the final volume step of the extraction process. Enough methylene chloride was added to adjust the final volume to the standard 3.0mL and the extract was analyzed. The surrogate

recovery was within QC limits indicating that the extract was not significantly affected by the low concentration volume.

Sample Qualification

The samples were qualified according to MEL's procedures. The table in Appendix B summarizes the manual qualifiers added by MEL. All results reported below the method reporting limit (RL) were automatically qualified as estimates, but not included in Appendix B. The qualifiers are defined in Appendix C.

Sample Verification

All analyses met QC acceptance criteria except as noted in Appendix D. All analytes met linearity requirements unless noted in Appendix E.

Washington State Department of Ecology
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Final Report for
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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-100-24-1

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol:** 920 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-01
Collected: 5/15/2019
~~**Prep Method:** SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.02	J	0.16	
NULL	Residual Range Organics	4.48	J	0.41	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.221	0.217	102	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-100-48-1

Work Order: 1905056
Project Officer: Hobbs, William
~~Initial Vol: 970 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-02
Collected: 5/16/2019
~~Prep Method: SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~Analyzed: 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.13	J	0.15	
NULL	Residual Range Organics	4.60	J	0.39	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.213	0.206	103	50-150

Authorized by: LB Release Date: 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **Field ID: Ctox-Cdub-100-48-2**

Work Order: 1905056
Project Officer: Hobbs, William
~~Initial Vol: 900 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-03
Collected: 5/16/2019
~~Prep Method: SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~Analyzed: 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.24		0.17	
NULL	Residual Range Organics	4.56		0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.235	0.222	106	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-100-72-1

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol:** 820 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-04
Collected: 5/17/2019
~~**Prep Method:** SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.24		0.18	
NULL	Residual Range Organics	4.49		0.46	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.253	0.244	104	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-100-96-1

Work Order: 1905056
Project Officer: Hobbs, William
Initial Vol: 900 mL
Final Vol: 3 mL

Lab ID #: 1905056-05
Collected: 5/18/2019
Prep Method: SW3535A
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
Analyzed: 6/13/2019
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.02		0.17	
NULL	Residual Range Organics	4.29		0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.244	0.222	110	50-150

Authorized by: LAB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **Field ID: Ctox-Cdub-100-96-2**

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol: 940 mL**~~
Final Vol: 3 mL

Lab ID #: 1905056-06
Collected: 5/18/2019
~~**Prep Method: SW3535A**~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed: 6/13/2019**~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.13		0.16	
NULL	Residual Range Organics	4.56		0.40	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.238	0.213	112	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **Field ID: Ctox-Cdub-0-120-1**

Work Order: 1905056
Project Officer: Hobbs, William
~~Initial Vol: 825 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-08
Collected: 5/19/2019
~~Prep Method: SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~Analyzed: 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.28**		**0.18**	
NULL	Residual Range Organics	0.45	U	0.45	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.279	0.242	115	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox **'ield ID: Ctox-Cdub-LabCont-120-1**

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol: 970 mL**~~
Final Vol: 3 mL

Lab ID #: 1905056-09
Collected: 5/19/2019
~~**Prep Method: SW3535A**~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed: 6/13/2019**~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.16**	**J**	**0.15**	
NULL	Residual Range Organics	0.39	UJ	0.39	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.246	0.206	119	50-150

Authorized by: _____ **Release Date:** 6/17/19

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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-100-0-1

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol:** 895 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-10
Collected: 5/14/2019
~~**Prep Method:** SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	3.76	J	0.17	
NULL	Residual Range Organics	3.97	J	0.42	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.251	0.223	112	50-150

Authorized by: LB **Release Date:** 6/17/19

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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-100-0-2

Work Order: 1905056
Project Officer: Hobbs, William
~~Initial Vol: 990 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-11
Collected: 5/14/2019
~~Prep Method: SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~Analyzed: 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	4.38	J	0.15	
NULL	Residual Range Organics	4.77	J	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.241	0.202	120	50-150

Authorized by: LB

Release Date: 6/17/19

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Project: NWTPH-Dx Tox **Field ID: Ctox-Cdub-0-0-1**

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol: 1010 mL**~~
Final Vol: 3 mL

Lab ID #: 1905056-12
Collected: 5/14/2019
~~**Prep Method: SW3535A**~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed: 6/13/2019**~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.22**	**J**	**0.15**	
NULL	Residual Range Organics	0.37	UJ	0.37	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.215	0.198	108	50-150

Authorized by: KB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

Field ID: Ctox-Cdub-LabCont-0-1

Work Order: 1905056
Project Officer: Hobbs, William
~~**Initial Vol:** 930 mL~~
Final Vol: 3 mL

Lab ID #: 1905056-13
Collected: 5/14/2019
~~**Prep Method:** SW3535A~~
Analysis Method: NWTPH-DX

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	**Diesel Range Organics**	**0.17**	**J**	**0.16**	
NULL	Residual Range Organics	0.40	UJ	0.40	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.235	0.215	109	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Semivolatile Petroleum Products

Project: NWTPH-Dx Tox

QC Type : Method Blank

Work Order: Batch QC
Project Officer: Hobbs, William
~~**Initial Vol:** 1000 mL~~
Final Vol: 3 mL

Lab ID #: B19F001-BLK1
Prep Method: SW3535A
~~**Analysis Method:** NWTPH-DX~~
Source Field ID: B19F001-BLK1

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: mg/L

CAS#	Analyte	Result	Qualifier	RL	MDL
68476-34-6	Diesel Range Organics	0.15	U	0.15	
NULL	Residual Range Organics	0.38	U	0.38	

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.223	0.200	111	50-150

Authorized by: LB **Release Date:** 6/17/19

Washington State Department of Ecology
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Project: NWTPH-Dx Tox

QC Type : LCS

Work Order: Batch QC
Project Officer: Hobbs, William
~~**Initial Vol:** 1000 mL~~
Final Vol: 3 mL

Lab ID #: B19F001-BS1
Prep Method: SW3535A
~~**Analysis Method:** NWTPH-DX~~
Source Field ID: B19F001-BS1

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: %

Analyte	Result	Spike Level	RL	%Rec	%Rec Limits
Diesel Range Organics	2.52	3.00	0.15	84	70-130

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.228	0.200	114	50-150

Authorized by: LR **Release Date:** 6/17/19

Washington State Department of Ecology
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Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox

QC Type : LCS Dup

Work Order: Batch QC
Project Officer: Hobbs, William
~~**Initial Vol:** 1000 mL~~
Final Vol: 3 mL

Lab ID #: B19F001-BSD1
Prep Method: SW3535A
~~**Analysis Method:** NWTPH-DX~~
Source Field ID: B19F001-BSD1

Batch ID: B19F001
Prepared: 5/30/2019
~~**Analyzed:** 6/13/2019~~
Matrix: Water
Units: %

Analyte	Sample Result	Spike Level	%Rec	RPD	%Rec Limits	RPD Limit
Diesel Range Organics	2.42	3.00	81	4	70-130	40

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.199	0.200	99	50-150

Authorized by: KR **Release Date:** 6/17/19

Washington State Department of Ecology
Manchester Environmental Laboratory
Final Report for
Semivolatile Petroleum Products

Project: NWTPH-Dx Tox

QC Type : Duplicate

Work Order: Batch QC
Project Officer: Hobbs, William
~~Initial Vol: 1010 mL~~
Final Vol: 3 mL

Lab ID #: B19F001-DUP1
Prep Method: SW3535A
~~Analysis Method: NWTPH-DX~~
Source Field ID: B19F001-DUP1
Source Lab ID #: 1905056-11

Batch ID: B19F001
Prepared: 5/30/2019
~~Analyzed: 6/13/2019~~
Matrix: Water
Units: mg/L

Analyte	Sample Result	Sample Qual	Source Result	RPD	RPD Limit
Diesel Range Organics	3.76	J	4.38	15	40
Residual Range Organics	4.33	J	4.77	10	40

Surrogate Recovery:

CAS#	Analyte	Result	Spike Level	% Rec.	% Rec. Limits
629-99-2	Pentacosane	0.223	0.198	113	50-150

Authorized by: KB Release Date: 6/17/19

Appendix A
Sample Correlation Table

Batch ID: B19F001 **Prep Method:** SW3535A

Prepared: 5/30/2019 **Analysis Method:** NWTPH-DX

Field ID	MEL ID
Ctox-Cdub-100-24-1	1905056-01
Ctox-Cdub-100-48-1	1905056-02
Ctox-Cdub-100-48-2	1905056-03
Ctox-Cdub-100-72-1	1905056-04
Ctox-Cdub-100-96-1	1905056-05
Ctox-Cdub-100-96-2	1905056-06
Ctox-Cdub-0-120-1	1905056-08
Ctox-Cdub-LabCont-120-1	1905056-09
Ctox-Cdub-100-0-1	1905056-10
Ctox-Cdub-100-0-2	1905056-11
Ctox-Cdub-0-0-1	1905056-12
Ctox-Cdub-LabCont-0-1	1905056-13
Blank	B19F001-BLK1
LCS	B19F001-BS1
LCS Dup	B19F001-BSD1
Duplicate (Ctox-Cdub-100-0-2)	B19F001-DUP1

Appendix B
Manual Qualification Table

WO: 1905056 **Analysis:** TPHD

Reported result is estimated; Prep and/or analytical holdtime expired.

Diesel Range Organics J: 1905056-01, 1905056-10, 1905056-11, 1905056-12, 1905056-13, B19F001-DUP1,

Residual Range Organics J: 1905056-01, 1905056-10, 1905056-11, B19F001-DUP1,

Reported result is estimated; sample was not properly preserved.

Diesel Range Organics J: 1905056-02, 1905056-09,

Residual Range Organics J: 1905056-02,

Analyte was not detected at or above the estimated MRL; prep and/or analytical holdtime expired.

Residual Range Organics UJ: 1905056-12, 1905056-13,

Analyte was not detected at or above the estimated MRL; sample was not properly preserved

Residual Range Organics UJ: 1905056-09,

Appendix C
Data Qualifier Definitions

Code	Definition
E	Reported result is an estimate because it exceeds the calibration range.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the present of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
NAF	Not analyzed for.
NC	Not calculated.
REJ	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was not detected at or above the reported sample quantitation limit.
UJ	The analyte was not detected at or above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
bold	The analyte was present in the sample. (Visual aid to locate detected compounds on the analytical report.)

Appendix D
QC Exceptions Report

Lab ID	Analyte	Exception
No QC exceptions reported.		

QC Exceptions determined using unrounded QC results but are reported as integers throughout this analytical report.

Appendix E
Initial Calibration Exceptions Report

Calibration ID: B9F1201 **Analysis:** TPHD

LabNumber	Analyte	QC Exception

No ICAL exceptions.

APPENDIX F – Chain-of-Custody Forms

Chain of Custody

TESTING LOCATION (Please Circle)

NAUTILUS ENVIRONMENTAL

Burnaby
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary
#4, 6125 12 Street SE
Calgary, Alberta, Canada
T2H 2K1
Phone 403.253.7121

Date_____Page__of__

Report to:		**Invoice To:**	
Company	WA Dept of Ecology	**Company**	WA Dept of Ecology
Address	PO Box 47600	**Address**	PO Box 47612
City/State/Zip	Olympia, WA 98504	**City/State/Zip**	Olympia, WA 98504-7612
Contact	Will Hobbs	**Contact**	Accounts Payable or Nicki Christoffer
Phone	360-407-7512	**Phone**	360-407-7021
Email	whob461@ecy.wa.gov	**Email**	nchr461@ecy.wa.gov
		PO No.	19-23608

Sample Collection By: Hobbs **Sample Type:** **Grab** ○ **OR** **Composite** ○

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: as per project QAPP WDOE	7d topsmelt	Echinoderm ~~larval~~ dev. 48hr	7-d fatheads	7-d Ceriodaphnia						Receipt Temperature (°C)
1	DW-3	1/29/2019		water	5 x 20L	contaminated well	x	x	x	x	x						4.5
2	MW-11	1/29/2019		water	2 x 20L	on-site control well	x	x	x	x	x						4.5
3								1912791	1912880	1912881	1912882						
4																	
5																	
6																	
7																	
8								W3									
9																	
10																	

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

as per project plan

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers		4. Ice Present in Cooler?	Y / N
2. Courier		5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Printed Name) (Signature)

(Company) (Date and Time)

RECEIVED BY (LABORATORY)

Tyrone TY
(Printed Name) (Signature)

Jan 30/19 0846
(Company) (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

TESTING LOCATION (Please Circle)

Chain of Custody

NAUTILUS ENVIRONMENTAL

Burnaby
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary
#4, 6125 12 Street SE
Calgary, Alberta, Canada
T2H 2K1
Phone 403.253.7121

Date_____Page__of__

Report to:

Company	WA Dept of Ecology
Address	PO Box 47600
City/State/Zip	Olympia, WA 98504
Contact	Will Hobbs
Phone	360-407-7512
Email	whob461@ecy.wa.gov

Invoice To:

Company	WA Dept of Ecology
Address	PO Box 47612
City/State/Zip	Olympia, WA 98504-7612
Contact	Accounts Payable or Nicki Christoffer
Phone	360-407-7021
Email	nchr461@ecy.wa.gov
PO No.	19-23608

Sample Collection By: Hobbs **Sample Type:** Grab ○ OR Composite ○

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: as per project QAPP WDOE	7-d topsmelt	Echinoderm larval development	7-d fathead	7-d Ceriodaphnia	Ceriodaphnia P/A					Receipt Temperature (°C)
1	DW-3 *	3/19/2019		water	5 x 20L	contaminated well	x	x	x	x	x						4.3
2	MW-11 *	3/19/2019		water	5 x 4L	on-site control well	x	x	x	x	x						↓
3	BBT-MW1	3/19/2019		water	1 x 4L	on-site control well	x					x					
4								191279	191280	191281	191282	191283					
5																	
6																	
7																	
8								130									
9																	
10																	

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

as per project plan

*refresh sample; mix with Jan 29 sample

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers		4. Ice Present in Cooler?	Y / N
2. Courier		5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Printed Name) (Signature)

(Company) (Date and Time)

RECEIVED BY (LABORATORY)

Tyrone DH

(Printed Name) (Signature)

Mar 20/19 1107

(Company) (Date and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT