City of Morro Bay and
Cayucos Sanitary District

MONITORING AND REPORTING PROGRAM

EFFLUENT SAMPLING

CHEMICAL AND BIOASSAY ANALYSIS RESULTS

JULY 2019

Marine Research Specialists

4744 Telephone Rd Ste 3 PMB 315
Ventura California 93003

Report to

City of Morro Bay and
Cayucos Sanitary District

955 Shasta Avenue
Morro Bay, California 93442
(805) 772-6272

MONITORING AND REPORTING PROGRAM

ANNUAL EFFLUENT REPORT

CHEMICAL AND BIOASSAY ANALYSIS RESULTS

JULY 2019

Prepared by

Douglas A. Coats

Marine Research Specialists

4744 Telephone Rd Ste 3 PMB 315
Ventura California 93003

Telephone: (805) 644-1180
E-mail: Marine@Rain2.org

September 2019

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Mr. John Gunderlock
Wastewater/Collections System Supervisor
City of Morro Bay/Cayucos CSD Wastewater Treatment Plant

Date: 9/17/19

marine research specialists
4744 Telephone Rd., Suite 3 PMB 315 • Ventura, CA 93003 • 805-644-1180

John Gunderlock
Wastewater & Collection Systems Supervisor
City of Morro Bay/Cayucos Sanitary District
955 Shasta Avenue
Morro Bay, CA 93442

17 September 2019

Reference: Annual Effluent Self-Monitoring Report for January through December 2019

Dear Mr. Gunderlock:

This self-monitoring report documents the chemical and bioassay results for analyses of effluent samples as required by NPDES discharge permit CA0047881.[1] Analyses were conducted to determine:

- Metal concentrations within a composite sample collected on July 23rd;
- Nutrient and ammonia concentrations within grab samples collected on July 23rd; and
- Chronic bioassays conducted on composite samples collected on July 22nd, 23rd, and 25th.

Three attachments to this report demonstrate that all chemical concentrations and toxicological endpoints were within the limitations specified in the discharge permit.

- **Attachment A** compares the results of the analyses with the limitations established for each of the effluent parameters specified in the permit. The comparisons are consistent with the minimum-level (ML) reporting protocols promulgated in §XII.B.4 of Attachment E to the discharge permit and in §III.A.7 of the California Ocean Plan (COP).[2] Units are consistent with those contained within Table E-3 in §IV.A.1 of Attachment E to the discharge permit.
- **Attachment B** contains a discharge monitoring report (DMR) that was submitted electronically under separate cover to the California State Water Resources Control Board within the California Integrated Water Quality System (CIWQS). All units were converted to those used in the DMR.
- **Attachment C** collates the original laboratory reports, including raw data and results, pertinent QA/QC analyses, and chains of custody.

The chemical and bioassay analyses of effluent samples collected during July 2019 augment a comprehensive dataset spanning two-and-a-half decades. Together, these measurements demonstrate the consistently benign character of the discharge from the MBSCD[3] treatment plant. The general lack of toxicity and chemical contaminants within the effluent samples reflects the absence of heavy industry within the collection area and the performance of the treatment process. The concentrations of the few chemical compounds detected in the July 2019 samples were typical of wastewater derived from domestic sources, and all concentrations were considerably below the limits specified in the NPDES discharge permit.

Twelve of the fifteen chemical compounds that are monitored on an annual basis were detected in the July 2019 composite and grab samples. Of those, eight had concentrations high enough to be quantified above their respective MLs. Three were nutrients whose discharge is not limited in the permit.[4] The five remaining substances with quantifiable concentrations consist of ammonia, and four trace metals. Ammonia, copper,

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[1] Regional Water Quality Control Board (RWQCB) - Central Coast Region. 2017. Waste Discharge Requirements (Order No. R3-2017-0050) and National Pollutant Discharge Elimination System (NPDES Permit No. CA0047881) for the Morro Bay and Cayucos Wastewater Treatment Plant Discharges to the Pacific Ocean, Morro Bay, San Luis Obispo County. Effective 1 March 2018.

[2] State Water Resources Control Board. 2015. Water Quality Control Plan Ocean Waters of California. California Ocean Plan (COP). State Water Resources Control Board. California Environmental Protection Agency. Effective 28 January 2016.

[3] City of Morro Bay and the Cayucos Sanitary District, joint owners of the wastewater treatment and disposal facility

[4] Refer to Footnote ***f*** in Attachment A. In contrast to other effluent parameters, the California Ocean Plan does not specify numerical objectives for nutrient compounds other than ammonia. Although the MBCSD discharge permit requires reporting of nitrate, urea, orthophosphate, and silica concentrations, they have no bearing on the compliance assessment of effluent quality.

lead, and zinc are common wastewater constituents. Ammonia derives from its domestic sewage origin. Copper, lead, and zinc enter the wastewater collection system through erosion of natural mineral deposits along the central California coast that are rich in these metals. They also enter the system through corrosion of household plumbing systems.

Regardless of their source, these four constituents are no longer considered a compliance concern. Discharge limits on their effluent concentrations were eliminated when the current MBCSD discharge permit was issued. Based on statistical analyses of the large historical database, their effluent concentrations do not exhibit a reasonable potential to exceed the COP water-quality objectives. Nevertheless, the discharge permit requires regular reporting of their concentrations. In accordance with the historical database, their concentrations within the July 2019 effluent samples were found to be low, and well below levels that would be of concern for the protection of marine aquatic life. Because their concentrations were similar to historical levels, there was no indication of the presence of a new or enhanced input of these constituents to the collection system.

Hexavalent chromium was the only other chemical constituent with a low-but-quantifiable concentration within the July 2019 effluent samples. At 0.65 µg/L, its concentration was 400-times smaller than the 270-µg/L threshold deemed deleterious to marine organisms. Nevertheless, its sudden measurable presence in the July 2019 effluent sample was noteworthy because it departed from the undetectable and non-quantifiable concentrations found in 39 prior effluent samples collected over the past two decades.

However, the July 2019 chromium concentration did not become quantifiable because of a change in effluent quality. Instead, it was purely an artifact of a change in the chemical analysis method that was necessitated when the current discharge permit became effective in 2018. Footnotes in the COP and in prior MBCSD permits allowed compliance with hexavalent chromium objective to be evaluated using total chromium, rather than the concentration associated with the +6 oxidation state alone. That footnote appears to have been inadvertently omitted in the current MBCSD discharge permit. As a result, the more costly and sensitive EPA Method 218.6 was required to determine hexavalent chromium concentrations in the July 2019 chemical assay. Its 0.2-µg/L quantification limit is 50-times lower than the 10-µg/L limit associated with the total chromium methodology. Thus, the 0.65-µg/L chromium concentration found in the July 2019 sample would not have been detected, much less quantified, using the historical EPA Method 200.7 for total chromium.

Chronic toxicity tests conducted on July-2019 composite effluent samples measured the effluent's potential to impact a variety of marine organisms by exposing those organisms to a range of effluent dilutions in the laboratory. The three bioassays assessed: 1) the development of larval red abalone (*Haliotis rufescens*); 2) the germination of kelp (*Macrocystis pyrifera*) spores and the growth of kelp germ tubes; and 3) the survival and growth of larval topsmelt (*Atherinops affinis*). Although these organisms are highly sensitive to contaminants, adverse effects were not observed within effluent-seawater mixtures that were more than four times more concentrated than that allowed by the discharge permit (Red Abalone End Point in Table 1).

Table 1. Comparison of Measured Toxicity Levels during July 2019[5]

Bioassay Test	End Point (%)	Concentration (TU)	Limit (TU)
Topsmelt (*A. affinis*)			
Survival	32.0	3.12	134
Growth	32.0	3.12	134
Giant Kelp (*M. pyrifera*)			
Germination	10.0	10.0	134
Growth	10.0	10.0	134
Red Abalone (*H. rufescens*)			
Development	3.2	31.2	134

[5] Results reported for toxicity tests conducted using laboratory water for dilution and control

In accordance with the toxicity-screening requirements of the current NPDES discharge permit, bioassays were conducted on three species to identify the organism that is most sensitive to the MBCSD effluent. As in the screening studies conducted last year, and in 2009 and 2010, larval abalone specimens were found to be significantly more sensitive than the other test organisms. In the July 2019 bioassays, adverse effects in kelp and topsmelt were not observed within effluent-seawater mixtures that were more than 13- and 40-times more concentrated than that allowed by the discharge permit. These toxicity testing results were based on bioassays that were conducted using laboratory seawater to dilute the wastewater sample, and to perform the control (no wastewater) testing.

In contrast to prior permits that explicitly allowed the use of laboratory water, the current discharge permit requires that the dilution and control water be collected "*from an area of the receiving waters, typically upstream, which is unaffected by the discharge*."[6] However, this requirement does not apply if the receiving water itself exhibits toxicity. This was the case for the 20 gallons of seawater collected near the outfall on the morning of July 23rd. As with the July 2018 bioassays, it was collected and transported to the bioassay laboratory for use as dilution and control water in the toxicity tests. The July 2019 seawater samples exhibited a distinctive red tinge indicative of the presence of a harmful algal bloom (HAB), or red tide (Figure 1). The seawater was collected at a reference site well away from the influence of the discharge but the HAB was occurring throughout the region around the time of collection.

Figure 1. Photograph of Receiving Water upon Delivery to the Bioassay Laboratory

The visible presence of red tide within the receiving-water sample made it immediately obvious that toxic algae were present, and its use as dilution and control water in toxicity tests would likely invalidate some or all of the tests. To definitively demonstrate that the receiving-water sample had unacceptable levels of HAB contamination, a series of three separate bioassays were conducted. Their results are reported in the expanded bioassay reporting contained in Attachment C. First, toxicity tests were conducted on the three test species using laboratory water for effluent dilution and for control (without effluent). The results of that bioassay are reported in Table 1 and, as allowed by the NPDES discharge permit when receiving water is toxic, they were also reported for regulatory compliance purposes. Second, the same full suite of toxicity tests was conducted on effluent samples using the HAB-contaminated receiving water for dilution and control. Predictably, test results for one of the test species, larval abalone, were invalidated because of toxic response in the control test chambers. Third, another series of three side-by-side toxicity tests were conducted using three types of control water (without effluent). These last series of tests unequivocally confirmed that the receiving-seawater sample was toxic to larval abalone.

Shellfish are known to be particularly susceptible to HAB toxicity. Accordingly, impacts to larval red abalone test specimens from exposure to the HAB-contaminated receiving seawater shown in Figure 1 were visually apparent (Figure 2a on the following page). In contrast, abalone larvae residing within laboratory seawater did not exhibit gross anatomical irregularities (Figure 2b). While HABs impact entire marine ecosystems, other organisms such as fish and kelp tend to be more tolerant of HAB toxicity. Consequently, microscopic examination of giant kelp spores and larval topsmelt test specimens did not exhibit obvious structural deformity after exposure to the HAB-contaminated seawater.

[6] Page E-12 in §V.A of Attachment E — Monitoring and Reporting Program (MRP)

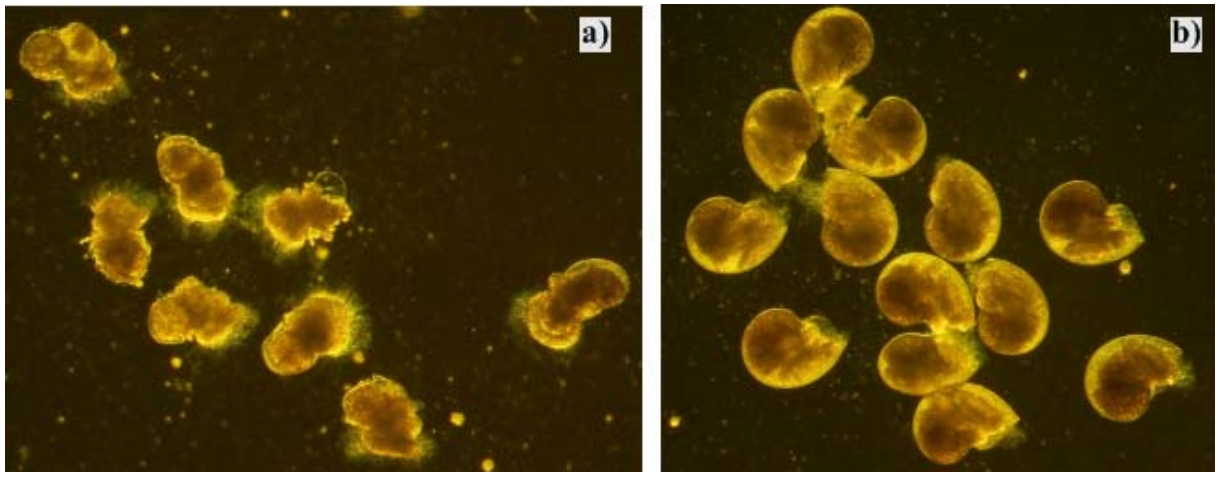

Figure 2. Photographs of Larval Red Abalone in a) HAB Contaminated Seawater and b) Laboratory Dilution Water

The second effluent bioassay that was conducted using the receiving-seawater sample determined toxicity endpoints for giant kelp and topsmelt that were identical to those determined using laboratory water for dilution and control (Table 1). As expected, however, the larval abalone toxicity test did not yield usable results because the specimens within the receiving-water control chambers exhibited a significant toxic response.

The extent of impacts from HAB contamination described above was further quantified by side-by-side comparisons of control bioassays conducted using the three forms dilution water without effluent (Table 2). As predicted by the anecdotal information and visual evidence described, the development of larval abalone was substantially reduced by exposure to the HAB-contaminated seawater. In contrast, little difference was found in the giant kelp and topsmelt response among the three types of dilution water. Moreover, there was no difference in abalone development within laboratory and culture water test chambers. The HAB-contaminated receiving-seawater caused an unacceptable toxic response, but only to the abalone specimens.

Table 2. Comparison of Toxicity End Points within three Seawater Control Samples

Bioassay Test	Laboratory	Culture	Receiving
Topsmelt (*A. affinis*)			
Survival (%)	96.	96.	100.
Biomass (mg)	2.058	2.386	2.388
Giant Kelp (*M. pyrifera*)			
Germination (%)	82.4	84.6	86.0
Tube Length (µm)	15.70	15.75	15.70
Red Abalone (*H. rufescens*)			
Development (%)	95.3	95.5	**17.8**[7]

Based on these findings, HAB-contaminated receiving seawater should not be used in future bioassays conducted to evaluate MBCSD effluent toxicity larval abalone. While the extensive suite of tests conducted in 2019 was necessary to unequivocally demonstrate this fact, laboratory water should be routinely used in future bioassays when there is any evidence of HAB contamination within receiving waters. Laboratory and culture water for dilution and control provide bioassay results that are identical to those using receiving water except when larval abalone are tested and the receiving water was collected during a red tide. This

[7] The 17.8% development determined for Red Abalone in Receiving Seawater was far below the 80% quality-control threshold deemed acceptable by EPA Test Criteria. It was also markedly lower than the 95% development determined in tests conducted with laboratory and culture waters. The difference between the receiving and culture water abalone development results were found to be statistically significant with a high degree of confidence.

consideration is particularly important because larval abalone have been repeatedly found to be the species most sensitive to effluent exposure, and will be tested alone in bioassays conducted after the screening study. Bioassays conducted in July 2019 using laboratory and culture water (Table 1), and in prior years in the absence of HAB contamination, reveal identical results for all three types of dilution and control water, including receiving seawater. If giant kelp or topsmelt had been found to be more sensitive, then the confounding influence of HAB-contaminated receiving seawater would be less of a concern. During the 2019 bioassays, however, abalone development results associated with HAB-contaminated seawater were rendered meaningless for compliance-reporting purposes. Repeating these futile tests in future bioassays serves no environmental or regulatory purpose. We recommend the use of laboratory water alone when there is any indication of HAB contamination within receiving waters.

Please contact the undersigned if you have questions regarding these results.

Sincerely,

Douglas A. Coats
Vice President
MARINE RESEARCH SPECIALISTS
2019.09.17 15:31:43 -07'00'

Douglas A. Coats
Program Manager

ATTACHMENT A

MINIMUM LEVEL REPORTING

ATTACHMENT A

Analytical Results for Effluent Samples Collected during July 2019

Chemical Compound or Parameter	Units	Method	Detection Limit [a]	Practical Quantification Limit [b]	Minimum Level [c]	Permit Limit [d]	Reported Value
Nutrients							
Nitrate (as N)	mg/L	300.0	0.01	0.1	—[e]	—[f]	DNQ 0.02 Est. Conc.
Urea (as N)	mg/L	Mulvenna & Savidge	0.008	0.01	—[e]	—[f]	0.143 as measured
Ortho-Phosphate (as P)	mg/L	300.0	0.01	0.1	—[e]	—[f]	2.6 as measured
Dissolved Silica (Si02)	mg/L	200.7	0.5[g]	0.5[g]	—[e]	—[f]	11. as measured
Objectives for the Protection of Marine Aquatic Life							
Ammonia (as N)	mg/L	350.1	6.7	20.	—[e]	—[h]	44. as measured[i]
Arsenic	µg/L	200.8	0.7	2.	2.	670.	DNQ 1.5 Est. Conc.
Cadmium	µg/L	200.7	1.1	10.	10.	130.	ND
Chromium VI[j]	µg/L	218.6	0.032	0.2	—[e]	270.	0.65 as measured
Copper	µg/L	200.7	1.2	10.	10.	—[h]	17. as measured

[a] The Method Detection Limit (MDL) is the analysis- and instrument-specific minimum concentration at which the presence of a substance can be reported with 99% confidence. It is determined from an analysis of a sample in a matrix containing the analyte.

[b] The Practical Quantification Limit (PQL) is the analysis- and instrument-specific minimum concentration of a substance that can be routinely determined with a high degree of certainty (>99.9% confidence).

[c] The Minimum Level (ML) is the method-specific minimum concentration of a substance that can be quantitatively measured in a sample given the current analytical performance used by most certified laboratories within California, as specified in Appendix II of the 2005 Ocean Plan.

[d] The Permit Limit is the lowest, most-stringent threshold that is associated with the longest-duration averaging period. For limits established to protect marine aquatic life, the six-month median is the most stringent threshold. For other constituents, limits are imposed only on monthly averages.

[e] No Minimum Level was specified for this analysis method in Appendix II of the 2005 Ocean Plan.

[f] Permit limits were not specified for nutrients.

[g] It is unclear why the laboratory reported an MDL that equals the PQL. It suggests that one of the two reported limits contains a typographical error.

[h] Effluent limitations for ammonia, copper, lead, selenium, and zinc were removed in the current discharge permit based on reasonable potential analyses of historical effluent data

[i] The detection and quantitation limits were raised due to sample dilution caused by high analyte concentration or matrix interference.

[j] As described in this report's cover letter, the analysis of hexavalent chromium departs from compliance evaluations of past reports, which were based on total chromium. Additionally, EPA Method 218.6 determines dissolved hexavalent chromium concentrations, rather than "Total Recoverable" hexavalent concentrations specified in the discharge permit.

Analytical Results for Effluent Samples Collected during July 2019

Chemical Compound or Parameter	Units	Method	Detection Limit [a]	Practical Quantification Limit [b]	Minimum Level [c]	Permit Limit [d]	Reported Value
Lead	µg/L	200.8	0.1	1.	0.5	—[h]	0.74 as measured [k]
Mercury	µg/L	245.1	0.029	0.2	0.2	5.29	ND
Nickel	µg/L	200.7	2.3	10.	20.	670.	DNQ 5.1 Est. Conc.
Selenium	µg/L	200.8	0.19	2.	2.	—[h]	DNQ 1.5 Est. Conc.
Silver	µg/L	200.7	1.3	10.	10.	70.	ND
Zinc	µg/L	200.7	9.5	50.	20.	—[h]	52. as measured
Toxicity-Chronic: *M. pyrifera*	TUc	600/R-95/136	—	—	—	134.	10. as measured
Toxicity-Chronic: *H. Rufescens*	TUc	600/R-95/136	—	—	—	134.	31.2 as measured
Toxicity-Chronic: *A. affinis*	TUc	600/R-95/136	—	—	—	134.	3.12 as measured

[k] Because the reported copper concentration (0.74 µg/L) was below the PQL (1. µg/L), it was flagged as an "Estimated Value" by the chemistry laboratory (See Attachment C). However, in accordance with the guidance from the COP, the reported value is listed "as measured" herein, because it exceeded the ML (0.5 µg/L).

ATTACHMENT B

DISCHARGE MONITORING REPORTS

eSMR PDF
Summary: DMR

NPDES Permit #: CA0047881 **Facility:** THE CITY OF MORRO BAY/CAYUCOS SANITARY DISTRICT WWTP

DMR Parameters

Feature - LS: 001-Y **Monitoring Period:** 01/01/2019 - 12/31/2019

Loc	Sea	Param	Param Text	Q1	Q2	C1	C2	C3	Excur Count	Analy Freq	Sample Type
1	0	00610	Nitrogen, ammonia total (as N)					44.0 mg/L Daily Maximum	0	Annual	GRAB
1	0	00620	Nitrogen, nitrate total (as N)					NODI: Q Daily Maximum			
1	0	00955	Silica, dissolved (as SiO2)					11.0 mg/L Daily Maximum	0	Annual	GRAB
1	0	00978	Arsenic, total recoverable	NODI: Q 6 Month Median	NODI: Q Daily Maximum	NODI: Q 6 Month Median	NODI: Q Daily Maximum	NODI: Q Instantaneous Maximum			
1	0	00981	Selenium, total recoverable					NODI: Q Daily Maximum			
1	0	01032	Chromium, hexavalent (as Cr)	8.0E-4 lb/d 6 Month Median	8.0E-4 lb/d Daily Maximum	0.65 ug/L 6 Month Median	0.65 ug/L Daily Maximum	0.65 ug/L Instantaneous Maximum	0	Annual	COMP24
1	0	01074	Nickel, total recoverable	NODI: Q 6 Month Median	NODI: Q Daily Maximum	NODI: Q 6 Month Median	NODI: Q Daily Maximum	NODI: Q Instantaneous Maximum			
1	0	01079	Silver total recoverable	NODI: B 6 Month Median	NODI: B Daily Maximum	NODI: B 6 Month Median	NODI: B Daily Maximum	NODI: B Instantaneous Maximum			
1	0	01094	Zinc, total recoverable					52.0 ug/L Daily Maximum	0	Annual	COMP24
1	0	01113	Cadmium, total recoverable	NODI: B 6 Month Median	NODI: B Daily Maximum	NODI: B 6 Month Median	NODI: B Daily Maximum	NODI: B Instantaneous Maximum			

Feature - LS: 001-Y **Monitoring Period:** 01/01/2019 - 12/31/2019

Loc	Sea	Param	Param Text	Q1	Q2	C1	C2	C3	Excur Count	Analy Freq	Sample Type
1	0	01114	Lead, total recoverable					0.74 ug/L Daily Maximum	0	Annual	COMP24
1	0	01119	Copper, total recoverable					17.0 ug/L Daily Maximum	0	Annual	COMP24
1	0	04175	Phosphate, ortho (as P)					2.6 mg/L Daily Maximum	0	Annual	GRAB
1	0	71800	Urea					0.143 mg/L Daily Maximum	0	Annual	GRAB
1	0	71901	Mercury, total recoverable	NODI: B 6 Month Median	NODI: B Daily Maximum	NODI: B 6 Month Median	NODI: B Daily Maximum	NODI: B Instantaneous Maximum			
1	0	TTJ3L	Static 72Hr Chronic Strongyl. Purpuratus					NODI: 9 Daily Maximum			
1	0	TTJ3N	Static 72Hr Chronic Dendraster Excentri.					NODI: 9 Daily Maximum			
1	0	TTK1D	Static 48Hr Chronic Macrocystis Pyrifera					10.0 tox chronic Daily Maximum	0	Annual	COMP24
1	0	TTK3O	Static 48Hr Chronic Crassostrea Gigas					NODI: 9 Daily Maximum			
1	0	TTK3R	Static 48Hr Chronic Haliotis Rufescens					31.2 tox chronic Daily Maximum	0	Annual	COMP24
1	0	TTK3S	Static 48Hr Chronic Mytilis Species					NODI: 9 Daily Maximum			

Feature - LS: 001-Y **Monitoring Period:** 01/01/2019 - 12/31/2019

Loc	Sea	Param	Param Text	Q1	Q2	C1	C2	C3	Excur Count	Analy Freq	Sample Type
1	0	TTP3E	Static Renewal 7-Day Chronic Mysidopsis bahia					NODI: 9 Daily Maximum			
1	0	TTP3Q	Static Renewal 7-Day Chronic Holmesimysis costata					NODI: 9 Daily Maximum			
1	0	TTP6J	Static Renewal 7-Day Chronic Menidia beryllina					NODI: 9 Daily Maximum			
1	0	TTP6L	Static Renewal 7-Day Chronic Atherinops affinis					3.12 tox chronic Daily Maximum	0	Annual	COMP24
1	0	TTS3L	Static 20Min Chronic Strongyl. Purpuratus					NODI: 9 Daily Maximum			
1	0	TTS3N	Static 20Min Chronic Dendraster Excentri					NODI: 9 Daily Maximum			

ATTACHMENT C
LABORATORY REPORTS

Date of Report: 08/02/2019

John Gunderlock

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Client Project:	[none]
BCL Project:	Annual Effuent Sampling
BCL Work Order:	1924237
Invoice ID:	B349514

Enclosed are the results of analyses for samples received by the laboratory on 7/24/2019. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Contact Person: Christina Herndon
Client Service Rep

Stuart Buttram
Technical Director

Table of Contents

BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

Chain of Custody

* Required Fields 19-24237

TEMP: _____

Client/Company Name *:	Report Attention *:	Phone * #:	FAX * #:
City of Morro Bay	John Gunderlock	805-772-6272	
		E-mail: jgunderlock@morrobayca.gov	

Address *	City *	State *	Zip *
160 Atascadero Road, Morro Bay, CA			93442

Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other:

Project Information:	PO # / BCL Quote #
Annual Effluent Sampling	

How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only

Regulatory Compliance Electronic Data Transfer System No. *: Y ☑ N ☐

Sampler Name Printed / Signature	QC Request	Result Request ** Surcharge
	☐ STD ☐ Level II	☐ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day**

Matrix Types: RSW = Raw Surface Water CFW = Chlorinated Finished Water CWW = Chlorinated Waste Water BW = Bottled Water RGW = Raw Ground Water FW = Finished Water WW = Waste Water SW = Storm Water DW = Drinking Water SO = Solid

ANALYSIS REQUESTED

Sample #	# Bottles	Sampled Date	Sampled Time	Sample Description / Location *	Matrix *	Comments / Station Code	Ammonia (as N)	Hexavalent Chromium VI	Aresenic (As)	Cadmium (Cd)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Zinc (Zn)
-1	1	7/23/19	0730	Grab Effluent ARS	WW		✓										
-2	2	7/23/19	0730	Comp Effluent ARS	WW			✓	✓	✓	✓	✓	✓	✓	✓		

SHORT HOLDING TIME
Cr^{+6} NO_2 NO_3 OP SS
DO Cl_2 BOD MBAS COT

DISTRIBUTION
WK WC
SUB OUT ☐

Relinquished by: (Signature and Printed Name)	Company	Date	Time	Received by (Signature and Print Name)	Company
John Gunderlock	City of Morro Bay	7/24/19	1140		BCL
	BCL	7/24/19	1800		
Received for Lab by: (Signature and Printed Name)		Date	Time	Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init.	

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

7/24/19 1800

19-24237

July 2019 Annual Effluent Sampling				
Level IIA QC Report concentrations that are detected above the MDL, but are below the PQL				
Analysis	Method	Effluent Sample	Amount	Laboratory
Ammonia (as N)	[EPA 350.1]	Grab	16 oz. (YEL)	BC Labs
Arsenic, Total Recoverable	[EPA 200.8]	C-24	*	BC Labs
Cadmium, Total Recoverable	[EPA 200.7]	C-24	*	BC Labs
Chromium (VI), Total Recoverable	[EPA 200.7]	C-24	2 oz.	BC Labs
Copper, Total Recoverable	[EPA 200.7]	C-24	*	BC Labs
Lead, Total Recoverable	[EPA 200.8]	C-24	*	BC Labs
Mercury, Total Recoverable	[EPA 245.1]	C-24	*	BC Labs
Nickel, Total Recoverable	[EPA 200.7]	C-24	*	BC Labs
Selenium, Total Recoverable	[EPA 200.8]	C-24	*	BC Labs
Silver, Total Recoverable	[EPA 200.7]	C-24	*	BC Labs
Zinc, Total Recoverable	[EPA 200.7]	C-24	*	BC Labs
			* 16 oz. (RED)	

4100 Atlas Court Bakersfield, CA 93308 (661) 327-4911 FAX (661) 327-1918 www.bclabs.com

Chain of Custody and Cooler Receipt Form for 1924237 Page 3 of 3

BC LABORATORIES INC. COOLER RECEIPT FORM Page 1 Of 1

Submission #: ~~19-24236~~ BK 19-24237

SHIPPING INFORMATION	SHIPPING CONTAINER	FREE LIQUID
Fed Ex ☐ UPS ☐ Ontrac ☐ Hand Delivery ☐	Ice Chest ☑ None ☐ Box ☐	YES ☐ NO ☐
BC Lab Field Service ☑ Other ☐ (Specify)_____	Other ☐ (Specify)_____	W / S

Refrigerant: Ice ☑ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals Ice Chest ☐ Intact? Yes ☐ No ☐ Containers ☐ Intact? Yes ☐ No ☐ None ☑ Comments:

All samples received? Yes ☑ No ☐ All samples containers intact? Yes ☑ No ☐ Description(s) match COC? Yes ☑ No ☐

☑ COC Received ☑ YES ☐ NO

Emissivity: 0.98 Container: PE Thermometer ID: 208 Date/Time 7/24 1800

Temperature: (A) 0.8 °C / (C) 1.5 °C Analyst Init EMK

SAMPLE CONTAINERS	SAMPLE NUMBERS 1	2	3	4	5	6	7	8	9	10
QT PE UNPRES										
4oz / 8oz / 16oz PE UNPRES										
2oz Cr^{+6}		A								
QT INORGANIC CHEMICAL METALS										
INORGANIC CHEMICAL METALS 4oz / 8oz / 16oz		B								
PT CYANIDE	A									
PT NITROGEN FORMS										
PT TOTAL SULFIDE										
2oz. NITRATE / NITRITE										
PT TOTAL ORGANIC CARBON										
PT CHEMICAL OXYGEN DEMAND										
PTA PHENOLICS										
40ml VOA VIAL TRAVEL BLANK										
40ml VOA VIAL										
QT EPA 1664										
PT ODOR										
RADIOLOGICAL										
BACTERIOLOGICAL										
40 ml VOA VIAL- 504										
QT EPA 508/608/8080										
QT EPA 515.1/8150										
QT EPA 525										
QT EPA 525 TRAVEL BLANK										
40ml EPA 547										
40ml EPA 531.1										
8oz EPA 548										
QT EPA 549										
QT EPA 8015M										
QT EPA 8270										
8oz / 16oz / 32oz AMBER										
8oz / 16oz / 32oz JAR										
SOIL SLEEVE										
PCB VIAL										
PLASTIC BAG										
TEDLAR BAG										
FERROUS IRON										
ENCORE										
SMART KIT										
SUMMA CANISTER										

Comments:

Sample Numbering Completed By: EMK Date/Time: 7-24-19 1931 Rev 21 05/23/2016

A = Actual / C = Corrected

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Laboratory / Client Sample Cross Reference

Laboratory	Client Sample Information			
1924237-01	**COC Number:**	---	**Receive Date:**	07/24/2019 18:00
	Project Number:	---	**Sampling Date:**	07/23/2019 07:30
	Sampling Location:	---	**Sample Depth:**	---
	Sampling Point:	Grab Effluent ARS	**Lab Matrix:**	Water
	Sampled By:	John Gunderlock	**Sample Type:**	Wastewater
1924237-02	**COC Number:**	---	**Receive Date:**	07/24/2019 18:00
	Project Number:	---	**Sampling Date:**	07/23/2019 07:30
	Sampling Location:	---	**Sample Depth:**	---
	Sampling Point:	Comp Effluent ARS	**Lab Matrix:**	Water
	Sampled By:	John Gunderlock	**Sample Type:**	Wastewater

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effluent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Water Analysis (General Chemistry)

BCL Sample ID: 1924237-01 | **Client Sample Name:** Grab Effluent ARS, 7/23/2019 7:30:00AM, John Gunderlock

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Ammonia as N	**44**	**mg/L**	**20**	**6.7**	**EPA-350.1**	ND	**A07**	1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-350.1	07/29/19 15:30	07/31/19 14:48	JMH	SC-1	100	B052314

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effluent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Metals Analysis

BCL Sample ID: 1924237-02 | **Client Sample Name:** Comp Effluent ARS, 7/23/2019 7:30:00AM, John Gunderlock

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Hexavalent Chromium	**0.65**	**ug/L**	**0.20**	**0.032**	**EPA-218.6**	ND		1
Total Recoverable Arsenic	**1.5**	**ug/L**	**2.0**	**0.70**	**EPA-200.8**	ND	**J**	2
Total Recoverable Cadmium	ND	ug/L	10	1.1	EPA-200.7	ND		3
Total Recoverable Copper	**17**	**ug/L**	**10**	**1.2**	**EPA-200.7**	ND		3
Total Recoverable Lead	**0.74**	**ug/L**	**1.0**	**0.10**	**EPA-200.8**	ND	**J**	2
Total Recoverable Mercury	ND	ug/L	0.20	0.029	EPA-245.1	ND		4
Total Recoverable Nickel	**5.1**	**ug/L**	**10**	**2.3**	**EPA-200.7**	ND	**J**	3
Total Recoverable Selenium	**1.5**	**ug/L**	**2.0**	**0.19**	**EPA-200.8**	ND	**J**	2
Total Recoverable Silver	ND	ug/L	10	1.3	EPA-200.7	ND		3
Total Recoverable Zinc	**52**	**ug/L**	**50**	**9.5**	**EPA-200.7**	ND		3

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-218.6	07/24/19 18:00	07/24/19 20:38	KEB	IC-4	1	B052114
2	EPA-200.8	07/29/19 09:35	07/29/19 18:40	ARD	PE-EL4	1	B052237
3	EPA-200.7	07/29/19 09:30	07/30/19 14:42	JRG	PE-OP2	1	B052235
4	EPA-245.1	07/30/19 10:00	07/31/19 08:39	TMT	CETAC3	1	B052390

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Water Analysis (General Chemistry)

Quality Control Report - Method Blank Analysis

Constituent	QC Sample ID	MB Result	Units	PQL	MDL	Lab Quals
QC Batch ID: B052314						
Ammonia as N	B052314-BLK1	ND	mg/L	0.20	0.067	

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Water Analysis (General Chemistry)

Quality Control Report - Laboratory Control Sample

Constituent	QC Sample ID	Type	Result	Spike Level	Units	Percent Recovery	RPD	Control Limits Percent Recovery	Control Limits RPD	Lab Quals
QC Batch ID: B052314										
Ammonia as N	B052314-BS1	LCS	0.96290	1.0000	mg/L	96.3		90 - 110		

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Water Analysis (General Chemistry)

Quality Control Report - Precision & Accuracy

Constituent	Type	Source Sample ID	Source Result	Result	Spike Added	Units	RPD	Percent Recovery	Control Limits RPD	Control Limits Percent Recovery	Lab Quals
QC Batch ID: B052314	Used client sample: N										
Ammonia as N	DUP	924137-01RE1	ND	0.72400		mg/L			10		J
	MS	924137-01RE1	ND	12.210	11.111	mg/L		110		90 - 110	
	MSD	924137-01RE1	ND	11.992	11.111	mg/L	1.8	108	10	90 - 110	

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Metals Analysis

Quality Control Report - Method Blank Analysis

Constituent	QC Sample ID	MB Result	Units	PQL	MDL	Lab Quals
QC Batch ID: B052114						
Hexavalent Chromium	B052114-BLK1	ND	ug/L	0.20	0.032	
QC Batch ID: B052235						
Total Recoverable Cadmium	B052235-BLK1	ND	ug/L	10	1.1	
Total Recoverable Copper	B052235-BLK1	ND	ug/L	10	1.2	
Total Recoverable Nickel	B052235-BLK1	ND	ug/L	10	2.3	
Total Recoverable Silver	B052235-BLK1	ND	ug/L	10	1.3	
Total Recoverable Zinc	B052235-BLK1	ND	ug/L	50	9.5	
QC Batch ID: B052237						
Total Recoverable Arsenic	B052237-BLK1	ND	ug/L	2.0	0.70	
Total Recoverable Lead	B052237-BLK1	ND	ug/L	1.0	0.10	
Total Recoverable Selenium	B052237-BLK1	ND	ug/L	2.0	0.19	
QC Batch ID: B052390						
Total Recoverable Mercury	B052390-BLK1	ND	ug/L	0.20	0.029	

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Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Metals Analysis

Quality Control Report - Laboratory Control Sample

Constituent	QC Sample ID	Type	Result	Spike Level	Units	Percent Recovery	RPD	Control Limits Percent Recovery	Control Limits RPD	Lab Quals
QC Batch ID: B052114										
Hexavalent Chromium	B052114-BS1	LCS	20.767	20.000	ug/L	104		90 - 110		
QC Batch ID: B052235										
Total Recoverable Cadmium	B052235-BS1	LCS	194.74	200.00	ug/L	97.4		85 - 115		
Total Recoverable Copper	B052235-BS1	LCS	373.82	400.00	ug/L	93.5		85 - 115		
Total Recoverable Nickel	B052235-BS1	LCS	407.71	400.00	ug/L	102		85 - 115		
Total Recoverable Silver	B052235-BS1	LCS	97.233	100.00	ug/L	97.2		85 - 115		
Total Recoverable Zinc	B052235-BS1	LCS	517.11	500.00	ug/L	103		85 - 115		
QC Batch ID: B052237										
Total Recoverable Arsenic	B052237-BS1	LCS	99.752	100.00	ug/L	99.8		85 - 115		
Total Recoverable Lead	B052237-BS1	LCS	105.70	100.00	ug/L	106		85 - 115		
Total Recoverable Selenium	B052237-BS1	LCS	102.92	100.00	ug/L	103		85 - 115		
QC Batch ID: B052390										
Total Recoverable Mercury	B052390-BS1	LCS	0.95000	1.0000	ug/L	95.0		85 - 115		

City of Morro Bay
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Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Metals Analysis

Quality Control Report - Precision & Accuracy

Constituent	Type	Source Sample ID	Source Result	Result	Spike Added	Units	RPD	Percent Recovery	Control Limits RPD	Control Limits Percent Recovery	Lab Quals
QC Batch ID: B052114	Used client sample: N										
Hexavalent Chromium	DUP	1924006-01	1.5570	1.5470		ug/L	0.6		10		
	MS	1924006-01	1.5570	22.310	20.202	ug/L		103		90 - 110	
	MSD	1924006-01	1.5570	21.972	20.202	ug/L	1.5	101	10	90 - 110	
QC Batch ID: B052235	Used client sample: N										
Total Recoverable Cadmium	DUP	1924288-01	ND	ND		ug/L			20		
	MS	1924288-01	ND	198.55	200.00	ug/L		99.3		75 - 125	
	MSD	1924288-01	ND	203.84	200.00	ug/L	2.6	102	20	75 - 125	
Total Recoverable Copper	DUP	1924288-01	ND	ND		ug/L			20		
	MS	1924288-01	ND	384.49	400.00	ug/L		96.1		75 - 125	
	MSD	1924288-01	ND	392.89	400.00	ug/L	2.2	98.2	20	75 - 125	
Total Recoverable Nickel	DUP	1924288-01	ND	ND		ug/L			20		
	MS	1924288-01	ND	414.32	400.00	ug/L		104		75 - 125	
	MSD	1924288-01	ND	424.15	400.00	ug/L	2.3	106	20	75 - 125	
Total Recoverable Silver	DUP	1924288-01	ND	ND		ug/L			20		
	MS	1924288-01	ND	96.994	100.00	ug/L		97.0		75 - 125	
	MSD	1924288-01	ND	100.38	100.00	ug/L	3.4	100	20	75 - 125	
Total Recoverable Zinc	DUP	1924288-01	ND	ND		ug/L			20		
	MS	1924288-01	ND	522.75	500.00	ug/L		105		75 - 125	
	MSD	1924288-01	ND	537.32	500.00	ug/L	2.7	107	20	75 - 125	
QC Batch ID: B052237	Used client sample: N										
Total Recoverable Arsenic	DUP	**1924172-08**	**1.5810**	**1.1340**		**ug/L**	**32.9**		**20**		**J,A02**
	MS	**1924172-08**	**1.5810**	**106.01**	**100.00**	**ug/L**		**104**		**70 - 130**	
	MSD	**1924172-08**	**1.5810**	**102.21**	**100.00**	**ug/L**	**3.7**	**101**	**20**	**70 - 130**	
Total Recoverable Lead	DUP	1924172-08	16.103	15.313		ug/L	5.0		20		
	MS	1924172-08	16.103	119.48	100.00	ug/L		103		70 - 130	
	MSD	1924172-08	16.103	114.59	100.00	ug/L	4.2	98.5	20	70 - 130	
Total Recoverable Selenium	DUP	1924172-08	ND	ND		ug/L			20		
	MS	1924172-08	ND	103.01	100.00	ug/L		103		70 - 130	
	MSD	1924172-08	ND	99.483	100.00	ug/L	3.5	99.5	20	70 - 130	
QC Batch ID: B052390	Used client sample: N										
Total Recoverable Mercury	DUP	1924434-01	ND	ND		ug/L			20		
	MS	1924434-01	ND	1.1625	1.0000	ug/L		116		70 - 130	
	MSD	1924434-01	ND	1.1725	1.0000	ug/L	0.9	117	20	70 - 130	

City of Morro Bay
160 Atascadero Rd.
Morro Bay, CA 93442

Reported: 08/02/2019 17:07
Project: Annual Effuent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Notes And Definitions

J	Estimated Value (CLP Flag)
MDL	Method Detection Limit
ND	Analyte Not Detected
PQL	Practical Quantitation Limit
A02	The difference between duplicate readings is less than the quantitation limit.
A07	Detection and quantitation limits were raised due to sample dilution caused by high analyte concentration or matrix interference.

City of Morro Bay Public Works/WWTP
John Gunderlock
955 Shasta Ave.
Morro Bay, CA 93442

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS (6227)
www.MBASinc.com
ELAP Certification Number: 2385
Thursday, August 01, 2019

Lab Number: 190724_01-01 **Sample Description: Morro Bay WWTP Annual Effluent, M1 ARS Grab**

Collection Date/Time: 7/23/2019 07:30 Sample Collector: Gunderlock J Client Sample #: A 2019
Submittal Date/Time: 7/24/2019 09:10 System ID:

Analyte	Method	Unit	Result	Dil.	Qual	PQL	MDL	Analysis Date / Time		Analyst
Silica SiO2, Dissolved	EPA200.7	mg/L	11	1		0.5	0.5	7/31/2019	11:44	MW
Nitrate as N	EPA300.0	mg/L	0.02	1	J, LN	0.1	0.01	7/24/2019	17:32	BS
LN: MS and/or MSD below acceptance limits.										
Orthophosphate as P	EPA300.0	mg/L	2.6	1		0.1	0.01	7/24/2019	17:32	BS
Urea-N	Mulvenna&Savidge	µg/L	143	1	LN, IL	10	8	7/31/2019	15:02	OW
LN: MS and/or MSD below acceptance limits. IL: RPD exceeds laboratory control limit										

Report Approved by:
David Holland, Laboratory Director

mg/L : Millgrams per liter (=ppm) µg/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance
MDL = Method Detection Limit J = Result is less than PQL ND = Non Detect

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Thursday, August 01, 2019

QC Results

QCBatch ID	QC ID	Parameter	Results	Units	% Rec	% RPD	Control Limits
QC19072507	190724_14-02: MS 1	Nitrate as N	8.79	mg/L	82		80 - 120
	190724_14-02: MSD 1	Nitrate as N	8.65	mg/L	75	9.0	0 - 10
	CCVB 1	Nitrate as N	ND	mg/L		< 0.1	
	LCS 1	Nitrate as N	1.91	mg/L	96		90 - 110
	LCSD 1	Nitrate as N	1.91	mg/L	95	0.2	0 - 10
	LCSL 1	Nitrate as N	0.17	mg/L	86		50 - 150
	Method Blank 1	Nitrate as N	ND	mg/L		< 0.1	
	190724_14-02: MS 1	Orthophosphate as P	2.05	mg/L	103		80 - 120
	190724_14-02: MSD 1	Orthophosphate as P	2.07	mg/L	103	0.6	0 - 10
	CCVB 1	Orthophosphate as P	ND	mg/L		< 0.1	
	LCS 1	Orthophosphate as P	2.06	mg/L	103		90 - 110
	LCSD 1	Orthophosphate as P	2.06	mg/L	103	< 0.1	0 - 10
	LCSL 1	Orthophosphate as P	0.2	mg/L	101		50 - 150
	Method Blank 1	Orthophosphate as P	ND	mg/L		< 0.1	
QC19080109	190717_13-14: MS 1	Urea-N	107.0	ug/L	87		85 - 115
	190717_13-14: MSD 1	Urea-N	116.0	ug/L	96	9.8	0 - 20
	190724_01-01: MS 2	Urea-N	235.0	ug/L	92		85 - 115
	190724_01-01: MSD 2	Urea-N	219.0	ug/L	76	19.0	0 - 20
	LFB 1	Urea-N	95.0	ug/L	95		85 - 115
	LFBD 1	Urea-N	101.0	ug/L	101	6.1	0 - 25
	LFBL 1	Urea-N	9.0	ug/L	90		70 - 130
	Method Blank 1	Urea-N	ND	µg/L		< 0.1	
	QCS 1	Urea-N	43.0	ug/L	91		90 - 110
	QCSD 1	Urea-N	50.0	ug/L	106	15.1	0 - 25

mg/L : Millgrams per liter (=ppm) µg/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance
MDL = Method Detection Limit J = Result is less than PQL ND = Non Detect

City of Morro Bay Public Works/WWTP
John Gunderlock
955 Shasta Ave.
Morro Bay, CA 93442

Monterey Bay Analytical Services
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www.MBASinc.com
ELAP Certification Number: 2385

Thursday, August 01, 2019

QC Results

QCBatch ID	QC ID	Parameter	Results	Units	% Rec	% RPD	Control Limit
QC19080115	190724_41-02: MS 1	Silica (SiO2), Total	65.59	mg/L	82		70 - 130
	190724_41-02: MSD 1	Silica (SiO2), Total	64.56	mg/L	80	2.5	0 - 20
	CCVB 1	Silica (SiO2), Total	ND	mg/L		< 0.1	
	LCB 1	Silica (SiO2), Total	ND	mg/L		< 0.1	
	LCS 1	Silica (SiO2), Total	49.84	mg/L	100		95 - 105
	LCSD 1	Silica (SiO2), Total	49.24	mg/L	98	1.2	0 - 10
	LFB 1	Silica (SiO2), Total	45.65	mg/L	91		85 - 115
	LFBD 1	Silica (SiO2), Total	44.58	mg/L	89	2.4	0 - 20
	Method Blank 1	Silica (SiO2), Total	ND	mg/L		< 0.1	
	QCS 1	Silica (SiO2), Total	49.0	mg/L	98		95 - 105

City of Morro Bay Public Works/WWTP
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Morro Bay, CA 93442

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ELAP Certification Number: 2385
Thursday, August 01, 2019

Sample Condition Upon Receipt

Order ID: 190724_01

Is there evidence of chilling? *NOTE: Systems are encouraged but not required to hold samples <10ÁC (Microbiology) or <6ÁC (Chemistry) during transit.	Yes (Recv'd via FedEx)
Did bottle arrive intact?	Yes
Did bottle labels agree with COC?	Yes
Adequate sample volume?	Yes
Sample preservative (HNO3, NaOH, H2SO4, Na2S2O3, HCl, Other)	#01: pre-filtered for Diss SiO2. Presrvd w/HNO3 pH<2.

mg/L : Millgrams per liter (=ppm) Õg/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance
MDL = Method Detection Limit J = Result is less than PQL ND = Non Detect

190724_01

Monterey Bay Analytical Services Chain Of Custody / Analysis Request

4 Justin Ct. Suite D • Monterey, Ca 93940 • (831) 375-MBAS (6227) • (831) 641-0734 (Fax)

MBAS
Monterey Bay Analytical Services

Client/Company Name: City of Morro Bay WWTP

Attention: John Gunderlock

Billing Address: 955 Shasta Avenue, Morro Bay, CA 93442

Project/System Information: Morro Bay WWTP Annual Effluent

E-Mail Address(es): jgunderlock@morrobayca.gov

Contract/P.O.#:

For Regulatory Complaince? YES ☑ NO ☐
For State or Local Health Department reporting:
Electronic Data Transfer (EDT)? YES ☐ NO ☑
System ID Number: _____

Turn Around Time: STD (7-14 Days) ☑ 48-Hour ☐ 5-Day ☐ 24-Hour ☐

Phone # 805.772.6272

Fax #

Drinking water ☐ Wastewater ☐ Monitoring Well ☐ Soil ☐ Sludge ☐ Other ☐

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	CL2 Residual	Coliform Analysis: Routine	Other	Repeat	Special	# Cont.	Container Type	Container Size	Nitrate (as NO3) [EPA 300.0]	O-Phosphate-P [EPA 300.0]	Dissolved Silica (as SiO2) [EPA 4500-SI-E] Filtered	Urea-N [Mulvenna & Savid]		
01	A 2019	M1 ARS Grab	7/23/19	0730	0.1						1			✓	✓		✓		
	A 2019	M1 ARS Grab*	7/23/19	0730							1						✓		
	A 2019	M1 ARS Grab	7/23/19	0730							1					✓			

Analysis Requested

	Printed Name	Signature	Date	Time
Sampled by:	John Gunderlock			
Relinquished by:	John Gunderlock		7/23/19	1400
Received by:	Lexi Matsushima		7/24/19	9:10
Relinquished by:				
Received by:				

Comments or Special Instructions:

* Pour off 50ml freeze to hold for Urea test.
Rec'd: Fedex

☐ Payment received Check # Amount: Receipt # Date:

LABORATORY REPORT

Aquatic Testing Laboratories
"dedicated to providing quality aquatic toxicity testing"
4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 FAX (805) 650-0756
CA ELAP Cert. No.: 1775

Date: August 1, 2019

Client: City of Morro Bay Public Works
Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442
Attn: John Gunderlock

Laboratory No.: A-19072303-001/003
Sample I.D.: Comp ARS (laboratory seawater used for dilution and control)

Sample Control: The samples were received by ATL within the recommended hold time, in a chilled state and with the chain of custody record attached. Client supplied receiving water was sampled during a red tide and filtered prior to use. Testing conducted with additional side-by-side testing using lab seawater as dilution/control per client instruction. This is the laboratory seawater used for dilution and control report.

Date Sampled:	07/22/19	07/23/19	07/25/19
Date Received:	07/23/19	07/23/19	07/26/19
Temp. Received:	1.3°C	1.3°C	1.0°C
Chlorine (TRC):	0.0 mg/l	0.0 mg/l	0.0 mg/l
Date Tested:	07/23/19 to 07/30/19		

Sample Analysis: The following analyses were performed on your sample:

Abalone Larval Development Short-Term Toxicity Test (EPA/600/R-95-136);
Giant Kelp Germination and Growth Short-Term Toxicity Test (EPA/600/R-95-136);
Topsmelt Larval Survival and Growth Test (EPA/600/R-95-136).

Result Summary:

Test	NOEC	TUc
Abalone Development:	3.2%	31.2
Kelp Spore Germination:	10%	10.0
Kelp Germ Tube Growth:	10%	10.0
Topsmelt Larval Survival:	32%	3.12
Topsmelt Larval Growth:	32%	3.12

Quality Control: Reviewed and approved by:

Joseph A. LeMay
Laboratory Director

Aquatic
Testing
Laboratories

Abalone Larval Development Short-Term Toxicity Test

1. Test and Results Summary

2. Raw Data

3. Statistical Analyses

ABALONE LARVAL DEVELOPMENT
SHORT-TERM TOXICITY TEST

Lab No.: A-19072303-002
Client/ID: Morro Bay WWTP

Date tested: 07/24/19 - 07/26/19

TEST SUMMARY

Species: *Haliotis rufescens*.
Protocol: EPA/600/R-95/136.
Test type: Static.
Test chamber: glass beakers.
Temperature: 15 +/- 1°C.
Number of embryos per chamber: 1600 (approx.).
QA/QC Batch No.: RT-190724 (ran concurrently)

Source: Cultured Abalone Farms.
Dilution water: Laboratory seawater.
Endpoints: NOEC.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.

RESULTS SUMMARY

Sample Concentration	Percent Normal Development	
Control-Brine (Culture / Lab Seawater)	94.6%	
Control-Dilution (Culture / Lab Seawater)	95.3%	
1.8%	96.0%	
3.2%	93.9%	
5.6%	17.8%	*
10.0%	0%	*
18.0%	0%	*
32.0%	0%	*

* Statistically significantly less than control at P = 0.05 level
Dilution water is laboratory (culture) seawater.
Culture water control obtained from The Cultured Abalone Farm.

CHRONIC TOXICITY

NOEC	3.2%
TUc	31.25

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control normality ≥80%	PASS (95.3%)
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-190724 report for additional test acceptability criteria.	

Abalone Larval Development Test-Proportion Normal

Start Date:	7/24/2019 16:00	Test ID:	19072303lw	Sample ID:	Morro Bay - Lab Dilution
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:35	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	HR-Haliotis rufescens

Comments:

Conc-%	1	2	3	4	5
B-Control	0.9537	0.9450	0.9810	0.9043	0.9450
D-Control	0.9806	0.9439	0.9386	0.9717	0.9292
1.8	0.9626	0.9304	0.9903	0.9545	0.9626
3.2	0.9450	0.9811	0.9550	0.9035	0.9099
5.6	0.3717	0.1132	0.1607	0.0962	0.1509
10	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000

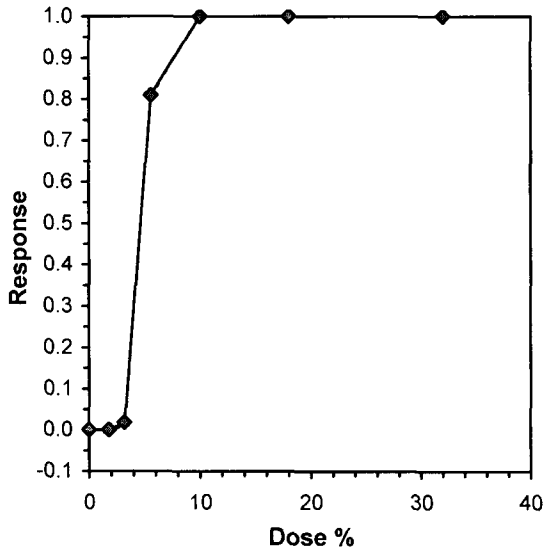
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	0.9458	0.9926	1.3421	1.2564	1.4323	4.678	5					
D-Control	0.9528	1.0000	1.3573	1.3015	1.4310	4.125	5	*			0.9558	1.0000
1.8	0.9601	1.0077	1.3769	1.3039	1.4721	4.423	5	-0.356	2.230	0.1228	0.9558	1.0000
3.2	0.9389	0.9854	1.3290	1.2549	1.4330	5.463	5	0.514	2.230	0.1228	0.9383	0.9817
*5.6	0.1785	0.1874	0.4251	0.3153	0.6556	31.725	5	16.933	2.230	0.1228	0.1811	0.1895
10	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
18	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
32	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.90586	0.905	1.32664	2.37903
Bartlett's Test indicates equal variances (p = 0.27)	3.92541	11.3449		
The control means are not significantly different (p = 0.70)	0.40279	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	3.2	5.6	4.2332	31.25	0.06398	0.06699	1.08132	0.00758	9.3E-12	3, 16

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	3.2961	0.0491	3.1771	3.3676	-2.5769
IC10	3.4476	0.0401	3.3342	3.5292	-0.2350
IC15	3.5991	0.0413	3.4848	3.6926	-0.1539
IC20	3.7505	0.0444	3.6297	3.8514	-0.0102
IC25	3.9020	0.0492	3.7699	4.0208	0.1535
IC40	4.3565	0.0692	4.1892	4.5447	0.5030
IC50	4.6594	0.0850	4.4717	4.9121	0.6128



ABALONE CHRONIC BIOASSAY

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay Effluent

Start Date: 07/24/2019

WATER QUALITY READINGS

Sample	Initial Readings				24 Hrs		Final Readings			
	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Control (brine)	14.2	8.6	8.0	34	15.0	8.0	14.8	8.1	8.1	34
Control (dilution)	14.6	8.5	8.0	34	14.8	8.0	14.7	7.9	8.0	34
1.8%	14.5	8.5	8.0	34	14.9	8.0	14.8	7.9	8.0	34
3.2%	14.4	8.6	8.0	34	14.8	8.0	14.8	7.8	8.0	34
5.6%	14.4	8.5	8.0	34	14.8	8.0	14.9	7.7	8.0	34
10%	14.3	8.5	8.0	34	14.8	8.0	14.7	7.9	8.0	34
18%	14.4	8.5	8.0	34	14.7	8.0	14.9	7.8	8.0	34
32%	14.5	8.4	8.0	34	14.7	8.0	14.8	7.7	8.0	34

Sample as received: Chlorine: 0 mg/l; pH: 7.7 ; Salinity: 0 ppt; Temp: 13 °C; DO: 5.9 mg/l; NH_3-N: 30 mg/l

Dilution water is laboratory seawater. 1.8% conc. added while mixing these solutions

Initial readings: [signature] Date/Time: 7-24-19 1600 Final readings: [signature] Date/Time: 7-26-19 1600

MICROSCOPIC EXAMINATION

Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal
1	5.6	42	71	15	C	101	6	29	32	0	100
2	10	0	100	16	BC	104	11	30	18	0	100
3	10	0	100	17	C	107	7	31	18	0	100
4	3.2	103	6	18	5.6	10	94	32	C	105	8
5	32	0	100	19	3.2	106	5	33	10	C	100
6	C	101	2	20	10	0	100	34	10	C	100
7	18	0	100	21	3.2	103	11	35	18	C	100
8	BC	103	5	22	5.6	16	90	1.8%A	1.8	103	4
9	5.6	12	94	23	3.2	101	10	1.8%B	1.8	107	8
10	BC	103	6	24	C	103	3	1.8%C	1.8	102	1
11	32	0	100	25	18	0	100	1.8%D	1.8	105	5
12	3.2	104	2	26	BC	103	6	1.8%E	1.8	103	4
13	5.6	18	94	27	32	0	100				
14	BC	103	2	28	32	0	100				

Microscopic examination: Analyst: [signature] Date: 7-27-19 Time: 0820

Aquatic Testing Laboratories

ABALONE CHRONIC BIOASSAY

Lab No.: A-19072303-002
Client ID: Morro Bay Effluent - lab water

Start Date: 07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	5.6	13	5.6	25	18	✓ Add 1600 fertilized eggs per 200 ml test volume.
2	10	14	BC	26	BC	
3	10	15	C	27	32	
4	3.2	16	BC	28	32	
5	32	17	C	29	32	
6	C	18	5.6	30	18	
7	18	19	3.2	31	18	
8	BC	20	10	32	C	
9	5.6	21	3.2	33	10	
10	BC	22	5.6	34	10	
11	32	23	3.2	35	18	
12	3.2	24	C			

Analyst: _____ Date: 7-24-18 Time: 0820

GIANT KELP GERMINATION AND AND GROWTH SHORT-TERM TOXICITY TEST

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client/ID: MRS - Morro Bay Comp. Effluent

Date Tested: 07/24/19 - 07/26/19

TEST SUMMARY

Species: *Macrocystis pyrifera.*
Protocol: EPA Method 1009.0.
Test type: Static.
Test chamber: glass beaker.
Temperature: 15 +/- 1°C.
Number of spores per ml: 7,500 (approx.).
QA/QC Batch No.: RT-190724 (ran concurrently).

Source: Field collected.
Dilution water: Laboratory seawater.
Endpoints: NOEC, IC25 at 48 hrs.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.

RESULTS SUMMARY

Sample Concentration	Percent Germination		Mean Germ Tube Length (μm)	
Control-Brine (Lab Water)	84.5%		15.90	
Control-Dilution (Lab Water)	82.4%		15.70	
3.2%	82.0%		15.60	
5.6%	84.4%		15.70	
10%	82.2%		15.00	
18%	68.6%	*	12.90	*
32%	62.2%	*	11.40	*

* Statistically significantly less than control at P = 0.05 level

Dilution/culture control water is laboratory seawater obtained from The Cultured Abalone Farm.

CHRONIC TOXICITY

END POINT	GERMINATION	GERM TUBE LENGTH
NOEC	10%	10%
TUc (100/NOEC)	10.0	10.0

QA/QC TEST ACCEPTABILITY

Parameter	Result
Mean control germination ≥ 70%	PASS (82.4%)
Mean control germination tube length >10 μm	PASS (15.70 μm)
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-190724 report for additional test acceptability criteria.	

Macrocystis Germination and Growth Test-Proportion Germinated

Start Date:	7/24/2019 16:00	Test ID:	19072303kl
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136
Comments:			

Sample ID:	Morro Bay - Lab Water
Sample Type:	EFF1-POTW
Test Species:	MP-Macrocystis pyrifera

Conc-%	1	2	3	4	5
B-Control	0.8614	0.7925	0.8598	0.9126	0.7981
D-Control	0.8738	0.8462	0.8077	0.8519	0.7387
3.2	0.8611	0.8077	0.8037	0.8654	0.7636
5.6	0.8447	0.8713	0.8119	0.8416	0.8519
10	0.8532	0.8148	0.8411	0.8155	0.7857
18	0.6346	0.6990	0.7593	0.6111	0.7264
32	0.6286	0.7027	0.5586	0.5556	0.6667

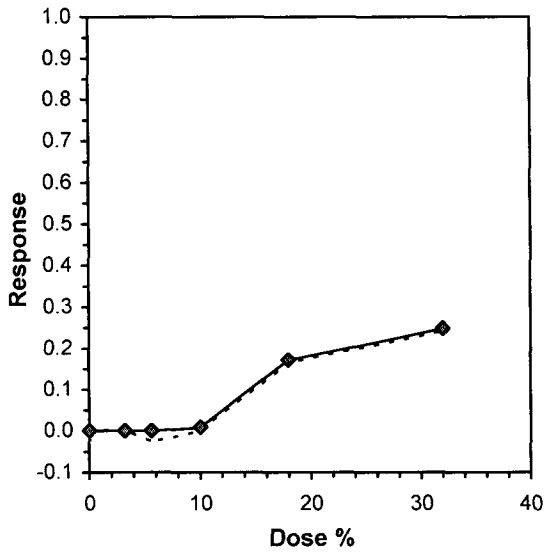
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	0.8449	1.0258	1.1699	1.0978	1.2707	6.086	5					
D-Control	0.8236	1.0000	1.1404	1.0343	1.2076	5.935	5	*			0.8290	1.0000
3.2	0.8203	0.9960	1.1352	1.0631	1.1951	4.936	5	0.149	2.360	0.0836	0.8290	1.0000
5.6	0.8443	1.0250	1.1658	1.1222	1.2039	2.526	5	-0.715	2.360	0.0836	0.8290	1.0000
10	0.8221	0.9981	1.1361	1.0895	1.1776	3.015	5	0.121	2.360	0.0836	0.8219	0.9915
*18	0.6861	0.8330	0.9775	0.8974	1.0580	6.861	5	4.599	2.360	0.0836	0.6862	0.8278
*32	0.6224	0.7557	0.9100	0.8411	0.9941	7.423	5	6.505	2.360	0.0836	0.6225	0.7509

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.9689	0.927	-0.2568	-0.795
Bartlett's Test indicates equal variances (p = 0.52)	4.21046	15.0863		
The control means are not significantly different (p = 0.52)	0.67109	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	10	18	13.4164	10	0.06764	0.0819	0.05657	0.00314	2.0E-07	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	12.027	0.996	8.824	13.932	-1.0733
IC10	14.470	1.259	11.777	18.476	0.9075
IC15	16.914	2.140	13.644	24.240	1.5694
IC20	23.059				
IC25	>32				
IC40	>32				
IC50	>32				



Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	19072303kl	Sample ID:	Morro Bay - Lab Water
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera

Comments:

Conc-%	1	2	3	4	5
B-Control	15.750	15.250	16.750	15.500	16.250
D-Control	15.750	15.500	16.000	15.750	15.500
3.2	16.000	15.500	15.500	15.500	15.500
5.6	15.500	15.750	15.750	16.000	15.500
10	15.250	15.750	15.250	14.500	14.250
18	14.000	14.750	12.500	12.000	11.250
32	10.500	12.000	12.750	10.500	11.250

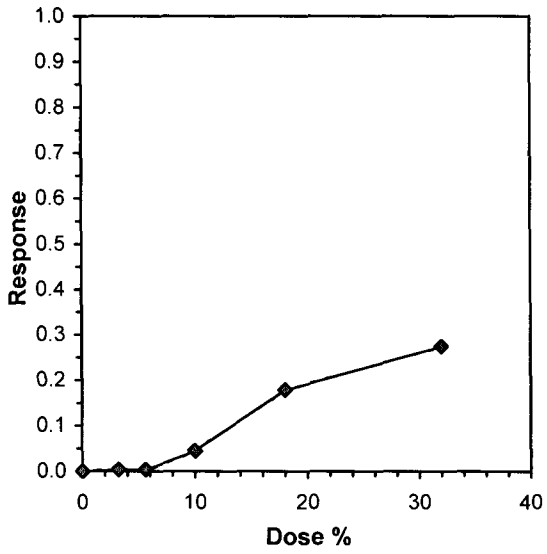
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
B-Control	15.900	1.0127	15.900	15.250	16.750	3.787	5				
D-Control	15.700	1.0000	15.700	15.500	16.000	1.332	5	*		15.700	1.0000
3.2	15.600	0.9936	15.600	15.500	16.000	1.433	5	23.50	16.00	15.650	0.9968
5.6	15.700	1.0000	15.700	15.500	16.000	1.332	5	27.50	16.00	15.650	0.9968
10	15.000	0.9554	15.000	14.250	15.750	4.082	5	18.00	16.00	15.000	0.9554
*18	12.900	0.8217	12.900	11.250	14.750	11.183	5	15.00	16.00	12.900	0.8217
*32	11.400	0.7261	11.400	10.500	12.750	8.578	5	15.00	16.00	11.400	0.7261

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.95627	0.927	0.38616	1.40189
Bartlett's Test indicates unequal variances (p = 2.93E-04)	23.3243	15.0863		
The control means are not significantly different (p = 0.50)	0.70165	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test Treatments vs D-Control	10	18	13.4164	10

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	10.324	1.096	7.479	12.804	0.1728
IC10	13.314	1.447	11.063	18.656	1.4404
IC15	16.305	2.063	13.351	23.112	1.1994
IC20	21.173	3.213	14.525	28.920	0.1387
IC25	28.500				
IC40	>32				
IC50	>32				



GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay -Lab

Start Date: 07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
1	3.2	108	93	15	6	7	7	5	7	6	6	7	7	6
2	C	103	90	13	7	7	6	6	7	8	8	3	4	7
3	18	104	66	38	5	7	6	7	6	5	5	4	5	6
4	5.6	103	87	16	7	5	7	6	6	7	8	4	6	6
5	BC	101	87	14	6	7	5	7	7	6	7	7	6	5
6	10	109	93	16	7	6	5	7	7	6	5	4	7	7
7	32	105	66	39	5	4	4	6	5	4	3	4	4	3
8	5.6	101	88	13	7	6	7	5	7	4	7	6	8	6
9	18	103	72	31	7	6	6	5	8	5	4	6	6	6
10	3.2	104	84	20	6	7	5	7	6	6	7	6	5	7
11	BC	106	84	22	6	7	7	8	4	5	5	7	6	6
12	10	108	88	20	6	6	8	8	7	6	5	5	6	6
13	C	104	88	16	7	6	7	7	5	7	6	6	7	4
14	32	111	78	33	4	7	3	4	5	4	6	6	4	5
15	3.2	107	86	21	6	6	5	6	7	7	5	7	6	7
16	10	107	90	17	6	7	7	6	5	4	7	6	7	6
17	32	111	62	49	6	5	5	4	4	5	7	4	5	6
18	BC	107	92	15	7	6	7	8	7	6	6	7	6	7
19	18	108	82	26	4	6	5	6	4	4	5	6	4	6
20	C	104	84	20	6	7	6	7	7	6	5	7	6	7

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay - Lab

Start Date: 07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
21	5.6	101	82	19	5	6	6	7	7	7	6	7	4	8
22	10	103	84	19	7	4	7	6	6	4	7	6	5	6
23	BC	103	94	9	7	6	7	5	7	6	6	5	6	7
24	5.6	101	85	16	7	7	5	6	6	7	8	7	5	6
25	18	108	66	42	6	3	3	4	5	7	6	7	4	3
26	3.2	104	90	14	6	7	5	7	6	6	7	6	5	7
27	C	108	92	16	7	6	6	7	8	4	5	7	6	7
28	32	108	60	48	3	4	7	3	4	4	3	5	5	4
29	C	111	82	29	6	4	7	7	7	6	5	6	7	7
30	10	112	88	24	6	5	7	5	6	6	7	5	4	6
31	32	108	72	36	7	4	3	4	3	6	4	5	6	3
32	5.6	108	92	16	6	5	7	6	6	7	7	5	6	7
33	18	106	77	29	6	3	4	7	3	4	4	6	3	5
34	BC	104	83	21	7	8	4	7	6	6	7	6	7	7
35	3.2	110	84	26	6	7	6	3	7	7	7	6	7	6
36														
37														
38														
39														
40														

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay - Lab

Start Date: 07/24/2019

WATER QUALITY READINGS

	Initial Readings				24 Hr		Final Readings			
Sample	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Brine Control	15.7	8.2	8.0	34	15.6	8.0	15.3	7.8	8.0	34
Control	15.6	8.0	8.0	34	15.5	8.0	15.2	7.9	8.0	34
3.2%	15.3	8.2	8.0	34	15.5	8.0	15.3	7.8	8.0	34
5.6%	15.4	8.3	8.0	34	15.5	8.0	15.8	7.9	8.0	34
10%	15.3	8.3	8.0	34	15.4	8.0	15.7	8.0	8.1	34
18%	15.2	8.3	8.1	34	15.4	8.0	15.6	7.9	8.1	34
32%	15.1	8.2	8.1	33	15.2	8.1	15.7	7.8	8.1	34

Sample as received: Chlorine: ~~0~~ mg/l; pH: 7.7; Salinity: 0 ppt; Temp: 13 °C; DO: 5.9 mg/l; NH_3-N: 30 mg/l

Control/dilution water is laboratory seawater.

Illumination (16 hr light / 8 hr dark at 50 ± 10 uE/m^2/s) at 5 locations in incubator: (four corners and center): 44, 40, 42, 41, 45 uE/m^2/s.

Initial readings: Analyst: JM Date: 7-24-19 Time: 16 00

Final readings: Analyst: JM Date: 7-26-19 Time: 16 00

Aquatic Testing Laboratories

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Lab No.: A-19072303-002
Client ID: Morro Bay – L.S

Start Date: 07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	3.2	13	C	25	18	
2	C	14	32	26	3.2	
3	18	15	3.2	27	C	
4	5.6	16	10	28	32	
5	MC	17	32	29	C	Need 7500/ml x 200 ml = 1,500,000 spores.
6	10	18	MC	30	10	
7	32	19	18	31	32	Add 1.0 ml spore stock of 6 spores per 5x5 hemacytometer grid
8	5.6	20	C	32	5.6	
9	18	21	5.6	33	18	
10	3.2	22	10	34	MC	
11	MC	23	MC	35	3.2	
12	10	24	5.6			

Analyst: _____ Date: 7-24-19 Time: 0800

Aquatic
Testing
Laboratories

Topsmelt Larvae Survival and Growth Short-Term Toxicity Test

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

TOPSMELT LARVAE CHRONIC BIOASSAY
SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A19072303-001/003
Client/ID: Morro Bay WWTP

Date Tested: 07/23/19 - 07/30/19

TEST SUMMARY

Species: *Atherinops affinis*.
Protocol: EPA/600/R-95/136.
Test type: Static renewal (90% daily).
Food: 40 b.s. nauplii per larvae 2X daily.
Test solution volume: 200 ml.
Number of larvae per chamber: 5.
Photoperiod: 16hr light / 8hr dark.
Dil. water: Laboratory seawater.

Source: Aquatic BioSystems.
Endpoints: NOEC, TUc.
Age: 11 days (9-15 days).
Test chamber size: 600 ml.
Number of replicates: 5.
Temperature: 20 +/- 1°C.
Salinity: 33 +/- 2 o/oo.
QA/QC Batch No.: RT-190723

RESULTS SUMMARY

Sample Concentration	Percent Survival		Mean Weight of Larvae (Biomass)	
Control-Brine (Lab seawater)	100%		2.327 mg	
Control-Dilution (Lab seawater)	96%		2.058 mg	
Control-Culture (Aquatic BioSystems)	96%		2.386 mg	
3.2%	100%		2.508 mg	
5.6%	96%		2.574 mg	
10.0%	100%		2.617 mg	
18.0%	96%		2.436 mg	
32.0%	96%		1.819 mg	

* No concentration statistically significantly less than control at P = 0.05 level.
Controls not statistically significantly different from each other.
Culture water control obtained from organism supplier Aquatic BioSystems.

CHRONIC TOXICITY

END POINT	SURVIVAL	GROWTH
NOEC	32%	32%
TUc (100/NOEC)	3.125	3.125

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control survival ≥80%	PASS (96%)
Average dry weight of control ≥0.85 mg (when starting with 9 day old larvae)	PASS (average control dry weight = 2.153 mg (11 day old))
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-190723 report for additional QA Information	

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	19072303tl	Sample ID:	MORRO BAY - Lab Water
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/22/2019 07:30	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis

Comments:

Conc-%	1	2	3	4	5
B-Control	1.0000	1.0000	1.0000	1.0000	1.0000
D-Control	1.0000	0.8000	1.0000	1.0000	1.0000
3.2	1.0000	1.0000	1.0000	1.0000	1.0000
5.6	1.0000	0.8000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
18	0.8000	1.0000	1.0000	1.0000	1.0000
32	1.0000	1.0000	1.0000	0.8000	1.0000

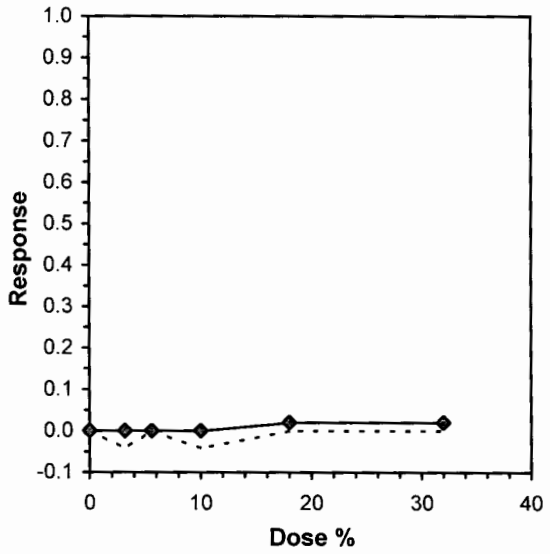
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
B-Control	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5				
D-Control	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	*		0.9800	1.0000
3.2	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0.9800	1.0000
5.6	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	27.50	16.00	0.9800	1.0000
10	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0.9800	1.0000
18	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	27.50	16.00	0.9600	0.9796
32	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	27.50	16.00	0.9600	0.9796

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.5958	0.927	-1.9353	2.45982
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.35)	1	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	32	>32		3.125
Treatments vs D-Control				

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	>32			
IC10	>32			
IC15	>32			
IC20	>32			
IC25	>32			
IC40	>32			
IC50	>32			



Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	19072303tl	Sample ID:	MORRO BAY - Lab Water
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/22/2019 07:30	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis

Comments:

Conc-%	1	2	3	4	5
B-Control	2.6200	2.1700	2.2500	2.5860	2.0080
D-Control	1.9540	1.9120	1.9460	2.2480	2.2280
3.2	2.7600	2.5300	2.2680	2.7100	2.2720
5.6	2.9500	2.5540	2.4340	2.5580	2.3720
10	2.4820	2.2880	2.7860	2.7440	2.7840
18	1.8660	2.4700	2.5380	2.5840	2.7200
32	1.8460	2.2800	1.4300	1.8100	1.7300

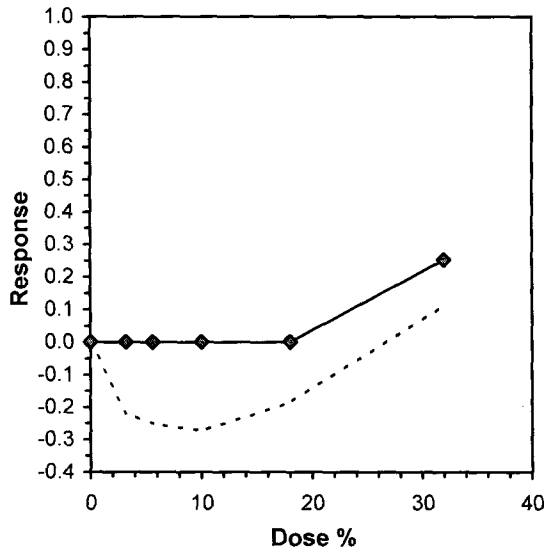
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	2.3268	1.1308	2.3268	2.0080	2.6200	11.477	5					
D-Control	2.0576	1.0000	2.0576	1.9120	2.2480	8.048	5	*			2.4390	1.0000
3.2	2.5080	1.2189	2.5080	2.2680	2.7600	9.310	5	-2.811	2.360	0.3782	2.4390	1.0000
5.6	2.5736	1.2508	2.5736	2.3720	2.9500	8.741	5	-3.220	2.360	0.3782	2.4390	1.0000
10	2.6168	1.2718	2.6168	2.2880	2.7860	8.525	5	-3.490	2.360	0.3782	2.4390	1.0000
18	2.4356	1.1837	2.4356	1.8660	2.7200	13.602	5	-2.359	2.360	0.3782	2.4356	0.9986
32	1.8192	0.8841	1.8192	1.4300	2.2800	16.776	5	1.488	2.360	0.3782	1.8192	0.7459

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.98731	0.927	-0.3007	0.14091
Bartlett's Test indicates equal variances (p = 0.82)	2.18215	15.0863		
The control means are not significantly different (p = 0.09)	1.91568	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	32	>32		3.125	0.37819	0.1838	0.51939	0.0642	1.4E-04	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	20.693	2.488	11.003	23.015	-1.1241
IC10	23.462				
IC15	26.232				
IC20	29.002				
IC25	31.772				
IC40	>32				
IC50	>32				



Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	Topsmelt-I	Sample ID:	CONTROLS-lab
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	AMB1-Ambient water
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
Control-lab	1.0000	0.8000	1.0000	1.0000	1.0000
ıne Control-lab	1.0000	1.0000	1.0000	1.0000	1.0000
Culture Water	0.8000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Control-lab	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5	*	
ıne Control-lab	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5		
Culture Water	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5	27.50	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.50963	0.842	-1.7788	1.40625
F-Test indicates equal variances (p = 1.00)	1	23.1545		
The control means are not significantly different (p = 0.35)	1	2.306		
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates no significant differences Treatments vs Control-lab				

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	Topsmelt-I	Sample ID:	CONTROLS-lab
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	AMB1-Ambient water
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
Control-lab	1.9540	1.9120	1.9460	2.2480	2.2280
ıne Control-lab	2.6200	2.1700	2.2500	2.5860	2.0080
Culture Water	2.0220	2.5180	2.2120	2.4120	2.7680

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control-lab	2.0576	0.8843	2.0576	1.9120	2.2480	8.048	5	*		
ıne Control-lab	2.3268	1.0000	2.3268	2.0080	2.6200	11.477	5			
Culture Water	2.3864	1.0256	2.3864	2.0220	2.7680	11.977	5	-2.226	1.860	0.2747

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.97027	0.842	0.13568	-0.3546
F-Test indicates equal variances (p = 0.32)	2.97966	23.1545		
The control means are not significantly different (p = 0.09)	1.91568	2.306		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs Control-lab	0.27471	0.13351	0.27027	0.05456	0.05667	1, 8

TOPSMELT CHRONIC BIOASSAY
Survival and Growth Raw Data Sheet

Aquatic Testing Laboratories

Lab No.: A-19072303-001/003 Start Date:07/23/2019

Client ID: Morro Bay – Lab Water

Sample	Rep	Number of Live Larvae / Day							Final Results		Dry Weight (mg)		
		1	2	3	4	5	6	7	# Tested	# Dead	Total Wt.	Tare Wt.	
Control - Lab Water	A	5	5	5	5	5	5	5	5	0	376.76	366.99	
	B	5	5	5	5	5	4	4	5	1	377.81	368.25	
	C	5	5	5	5	5	5	5	5	0	376.27	366.54	
	D	5	5	5	5	5	5	5	5	0	369.89	358.65	
	E	5	5	5	5	5	5	5	5	0	366.50	355.36	
3.2%	A	5	5	5	5	5	5	5	5	0	333.68	319.88	68
	B	5	5	5	5	5	5	5	5	0	339.84	327.19	
	C	5	5	5	5	5	5	5	5	0	346.81	329.47	
	D	5	5	5	5	5	5	5	5	0	335.60	322.05	
	E	5	5	5	5	5	5	5	5	0	332.99	321.63	
5.6%	A	5	5	5	5	5	5	5	5	0	341.02	326.27	
	B	5	5	5	5	5	5	5	5	0	340.32	327.55	
	C	5	5	5	5	5	5	4	5	1	314.79	302.62	75
	D	5	5	5	5	5	5	5	5	0	329.21	316.42	
	E	5	5	5	5	5	5	5	5	0	330.99	319.13	-
10%	A	5	5	5	5	5	5	5	5	0	336.01	323.60	78
	B	5	5	5	5	5	5	5	5	0	327.25	315.81	
	C	5	5	5	5	5	5	5	5	0	337.76	323.83	
	D	5	5	5	5	5	5	5	5	0	352.55	338.83	
	E	5	5	5	5	5	5	5	5	0	329.53	315.61	
18%	A	5	5	5	5	5	4	4	5	1	333.66	324.33	
	B	5	5	5	5	5	5	5	5	0	331.49	319.14	
	C	5	5	5	5	5	5	5	5	0	342.73	330.04	
	D	5	5	5	5	5	5	5	5	0	337.32	324.40	
	E	5	5	5	5	5	5	5	5	0	342.05	328.45	
32%	A	5	5	5	5	5	5	5	5	0	327.12	317.89	88
	B	5	5	5	5	5	5	5	5	0	337.87	326.47	
	C	5	5	5	5	5	5	5	5	0	337.27	330.12	
	D	5	5	5	5	5	4	4	5	1	339.58	330.53	
	E	5	5	5	5	5	5	5	5	0	330.82	322.17	92

TOPSMELT CHRONIC BIOASSAY
Water Chemistries Raw Data Sheet

Aquatic Testing Laboratories

Lab No.: A-19072303-001/003
Client ID: Morro Bay - Lab W

Start Date:07/23/2019

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Analyst Initials:		J	J	J	J	J	J	J	J	J	J	J	J	J	J
Time of Readings:		1630	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1600	1630
Control - Lab Water	DO	7.6	7.0	7.4	6.9	7.0	6.1	6.6	5.9	6.9	6.2	7.0	6.4	7.0	6.1
	pH	8.1	7.9	8.0	7.8	8.0	7.8	8.0	7.9	8.0	7.9	8.0	8.0	8.1	7.9
	°C	20.5	19.9	20.0	20.1	20.2	20.0	20.1	20.2	20.2	20.0	20.1	19.5	20.1	20.2
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
3.2%	DO	7.6	6.8	7.2	6.7	7.1	6.1	7.1	5.9	6.9	6.3	7.0	6.4	7.1	6.0
	pH	8.1	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.0	8.0	8.1	8.1
	°C	20.7	19.9	20.1	20.2	20.3	20.0	20.1	20.2	20.2	20.1	20.2	20.0	20.0	20.1
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
5.6%	DO	7.6	6.8	7.1	6.7	7.1	6.1	6.9	5.9	6.7	6.1	6.8	6.2	7.2	5.9
	pH	8.1	7.9	8.0	7.9	8.1	7.9	8.0	8.0	8.0	7.9	8.0	8.0	8.1	8.0
	°C	20.7	19.9	20.0	20.1	20.2	20.1	20.2	20.3	20.3	19.9	20.4	19.9	19.5	20.0
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
10%	DO	7.6	6.7	7.1	6.7	7.1	6.0	6.5	5.8	6.7	6.2	6.9	6.2	7.2	6.0
	pH	8.1	8.0	8.1	7.9	8.1	7.9	8.1	7.9	8.0	7.9	8.1	8.0	8.1	8.0
	°C	20.7	19.8	20.1	20.1	20.2	20.0	20.1	20.2	20.2	20.0	20.2	19.9	19.5	20.1
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
18%	DO	7.5	6.6	7.0	6.8	6.8	6.1	6.4	5.9	6.6	5.8	6.7	6.0	7.0	5.9
	pH	8.1	8.0	8.1	7.9	8.1	8.0	8.0	8.0	8.1	8.0	8.1	7.9	8.1	8.0
	°C	20.6	19.9	20.1	20.0	20.1	20.0	20.2	20.2	20.2	19.9	20.1	19.9	20.0	20.1
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
32%	DO	7.5	6.6	7.1	6.4	7.0	6.1	6.4	5.6	6.5	5.6	6.8	5.7	7.3	5.8
	pH	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.0	8.2	8.0	8.2	8.0
	°C	20.6	19.9	20.1	20.1	20.2	20.1	20.1	20.2	20.2	20.0	20.1	19.9	20.0	20.1
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	~~33~~ 33	33

Comments:

Dissolved Oxygen (DO) readings in mg/l O_2; Salinity (Sal.) readings in ppt. **Day 1** sample used for initial (renewals) on Day 1 and Day 2; **Day 3** sample used for initial (renewals) on Day 3 and Day 4; **Day 5** sample used for initial (renewals) on Day 5, Day 6, and Day 7.

TOPSMELT CHRONIC BIOASSAY

Aquatic Testing Laboratories

Lab No.: A-19072303-additional controls
Client ID: Morro Bay - LW

Start Date: 07/23/2019

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr
Analyst Initials:		J	J	J	J	J	J	J	J	J	J	J	J	M	J
Time of Readings:		1630	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1600	1630
Brine Control Lab water	DO	7.6	6.9	7.1	6.9	7.0	6.1	6.6	6.0	6.6	5.9	6.9	6.4	7.0	5.7
	pH	8.1	7.9	8.0	7.9	7.9	7.8	7.8	7.7	7.8	7.7	7.8	7.8	7.9	7.5
	°C	20.9	19.8	20.0	20.1	20.1	20.1	20.2	20.2	20.2	20.1	20.2	20.1	20.1	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
Culture Water Control	DO	7.3	6.9	7.2	6.9	7.1	6.2	6.7	5.8	6.4	6.0	6.8	5.8	6.8	5.6
	pH	7.9	8.0	8.0	8.0	8.0	8.0	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.8
	°C	20.9	19.9	20.0	20.1	20.1	20.1	20.1	20.2	20.2	20.1	20.1	20.1	20.1	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33

Comments: Brine Control made with similar amount of sea salts used to adjust salinity of highest concentration of effluent in test (32%). Culture Water Control supplied by test organism provider.
Dissolved Oxygen (DO) readings in mg/l O_2. Salinity (Sal.) in ppt.
Original sample used for all renewals. No ammonia (< 0.1 mg/L NH_3-N) detected in either sample. (control)

Sample	Rep	Number of Live Larvae / Day							Final Results		Dry Weight (mg)		
		1	2	3	4	5	6	7	# Tested	# Dead	Total Wt.	Tare Wt.	
Brine Control Lab water	A	5	5	5	5	5	5	5	5	0	364.81	351.71	23
	B	5	5	5	5	5	5	5	5	0	365.68	354.83	
	C	5	5	5	5	5	5	5	5	0	349.27	338.02	
	D	5	5	5	5	5	5	5	5	0	367.62	354.69	
	E	5	5	5	5	5	5	5	5	0	374.49	364.45	
Culture Water Control	A	5	5	5	5	5	5	4	5	1	370.13	360.02	28
	B	5	5	5	5	5	5	5	5	0	381.39	368.80	
	C	5	5	5	5	5	5	5	5	0	370.39	359.33	
	D	5	5	5	5	5	5	5	5	0	372.31	360.25	-
	E	5	5	5	5	5	5	5	5	0	367.59	353.75	32

Additional Water Quality Parameters for 100% Effluent Samples as Received	Sample 001	Sample 002	Sample 003
DO (mg/L O_2)	4.7	5.9	4.7
pH	7.7	7.7	7.6
Salinity (ppt) - sample adjusted with sea salts	0	0	0
Ammonia (mg/l NH_3-N)	21	30	43

Aquatic
Testing
Laboratories

CHAIN OF CUSTODY

CHAIN OF CUSTODY

Client: City of Morro Bay Public Works

Address: Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442

Project Manager: John Gunderlock

Phone: (805) 772-6272

Fax:

Email: jgunderlock@morrobayca.gov

Purchase Order No:

Aquatic Testing Laboratories

4350 Transport St., Unit 107
Ventura, CA 93003
(805) 650-0546 Fax (805) 650-0756

Sample ID	Sample Date	Sample Time	Sample Type *	Chlorine (TRC)**	Number of Containers	Testing Requested
Comp ARS	07/22/19	0730	E	<.05	1 (2.5 gallon)	3 Species Marine Chronic
Comp ARS	07/23/19	0730	E	<.05	1 (2.5 gallon)	3 Species Marine Chronic
Sea Water	07/23/19	0745	RW	—	20 gallons	3 Species Marine Chronic

Special Instructions:

**** Note: Total residual chlorine must be taken immediately after sample collection if sample is a chlorinated effluent.**

* L - Liquid, S - Solid, SS - Semi-Solid/sludge, RW - Receiving Water, GW - Ground Water, E - Effluent

CUSTODY TRANSFERS

Relinquished by (signature)	Received by (signature)	Date (mm/dd/yy)	Time (hh:mm)	Custody Seals Intact? (Yes, No, NA)	Temperature Received (°C)
[signature]	—	7/23/19	1005	N/A	—
—	[signature]	7.23.19	1105	N/A	—
No SS	[signature]	7.23.19	3pm	N/A	1.3°C
				N/A	

CHAIN OF CUSTODY

Client: City of Morro Bay Public Works

Address: Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442

Project Manager: John Gunderlock

Phone: (805) 772-6272

Email: jgunderlock@morrobayca.gov

Purchase Order No:

Aquatic Testing Laboratories

4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 Fax (805) 650-0756

Sample ID	Sample Date	Sample Time	Sample Type *	Chlorine (TRC)**	Number of Containers	Testing Requested
Comp ARS	7/25/19	0745	E	<.05	1 (2.5 gallon)	3 Species Marine Chronic

Special Instructions:

**** Note: Total residual chlorine must be taken immediately after sample collection if sample is a chlorinated effluent.**

* **L** - Liquid, **S** - Solid, **SS** - Semi-Solid/sludge, **RW** - Receiving Water, **GW** - Ground Water, **E** - Effluent

CUSTODY TRANSFERS

Relinquished by (signature)	Received by (signature)	Date (mm/dd/yy)	Time (hh:mm)	Sample Intact? (Yes, No)	Temperature Received (°C)
		7/25/19	1340	—	—
		7-26-19	1000	Yes	1.0°

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REFERENCE TOXICANT DATA

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Laboratories

Abalone Larval Development Short-Term Toxicity Test

1. Test and Results Summary

2. Raw Data

3. Statistical Analyses

ABALONE LARVAL DEVELOPMENT
SHORT-TERM TOXICITY TEST
* REFERENCE TOXICANT *

Aquatic Testing Laboratories

QA/QC Batch No.: RT-190724

Date tested: 07/24/19 – 07/26/19

TEST SUMMARY

Species: *Haliotis rufescens*.
Protocol: EPA/600/R-95/136.
Test type: Static.
Test chamber: Plastic beakers.
Temperature: 15 +/- 1°C.
Number of embryos per chamber: 1600 (approx.).
Reference Toxicant: $ZnSO_4(7H_2O)$.

Source: Cultured Abalone Farm.
Dilution water: Lab seawater.
Endpoints: NOEC, IC25 at 48 hrs.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.
Ref. Tox. source: VWR.
Lot No.: 3357C295.

RESULTS SUMMARY

SAMPLE CONCENTRATION	PERCENT NORMAL DEVELOPMENT
Control	95.5%
10 µg/l	95.9%
18 µg/l	93.4%
32 µg/l	11.0% *
56 µg/l	0% *
100 µg/l	0% *
* Statistically significantly less than control at P = 0.05 level	

CHRONIC TOXICITY

NOEC	18 µg/l
IC25	21.7 µg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control normality ≥80%	Yes (95.5%)
56 µg/l treatment response significantly less than control response	Yes (NOEC = 18 µg/l)
%MSD <20% relative to control	Yes (%MSD = 6.2%)

Abalone Larval Development Test-Proportion Normal

Start Date:	7/24/2019 16:00	Test ID:	RT190724ab	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	ZNSO-Zinc sulfate
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	HR-Haliotis rufescens
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	0.9346	0.9266	0.9717	0.9537	0.9902
10	0.9903	0.9474	0.9316	0.9550	0.9717
18	0.9810	0.9115	0.9434	0.9375	0.8957
32	0.0714	0.1391	0.1682	0.0196	0.1509
56	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000

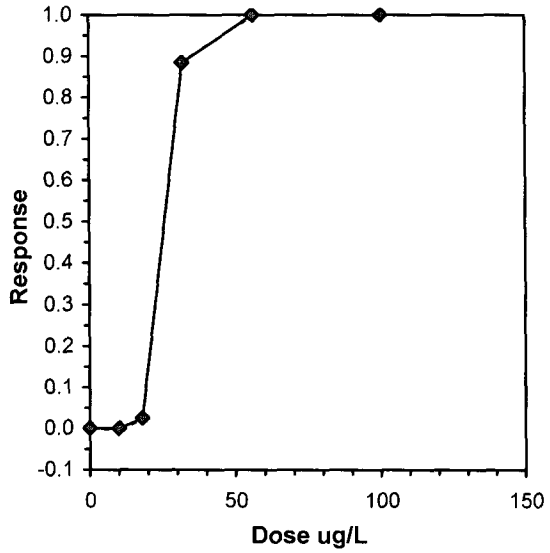
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9554	1.0000	1.3672	1.2965	1.4716	5.212	5				0.9566	1.0000
10	0.9592	1.0040	1.3753	1.3062	1.4721	4.666	5	-0.152	2.230	0.1188	0.9566	1.0000
18	0.9338	0.9774	1.3183	1.2419	1.4323	5.555	5	0.917	2.230	0.1188	0.9328	0.9752
*32	0.1099	0.1150	0.3230	0.1405	0.4226	36.396	5	19.602	2.230	0.1188	0.1107	0.1157
56	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94878	0.905	-0.3125	-0.022
Bartlett's Test indicates equal variances (p = 0.62)	1.78003	11.3449		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		0.05951	0.06204	1.33086	0.00709	1.1E-12	3, 16

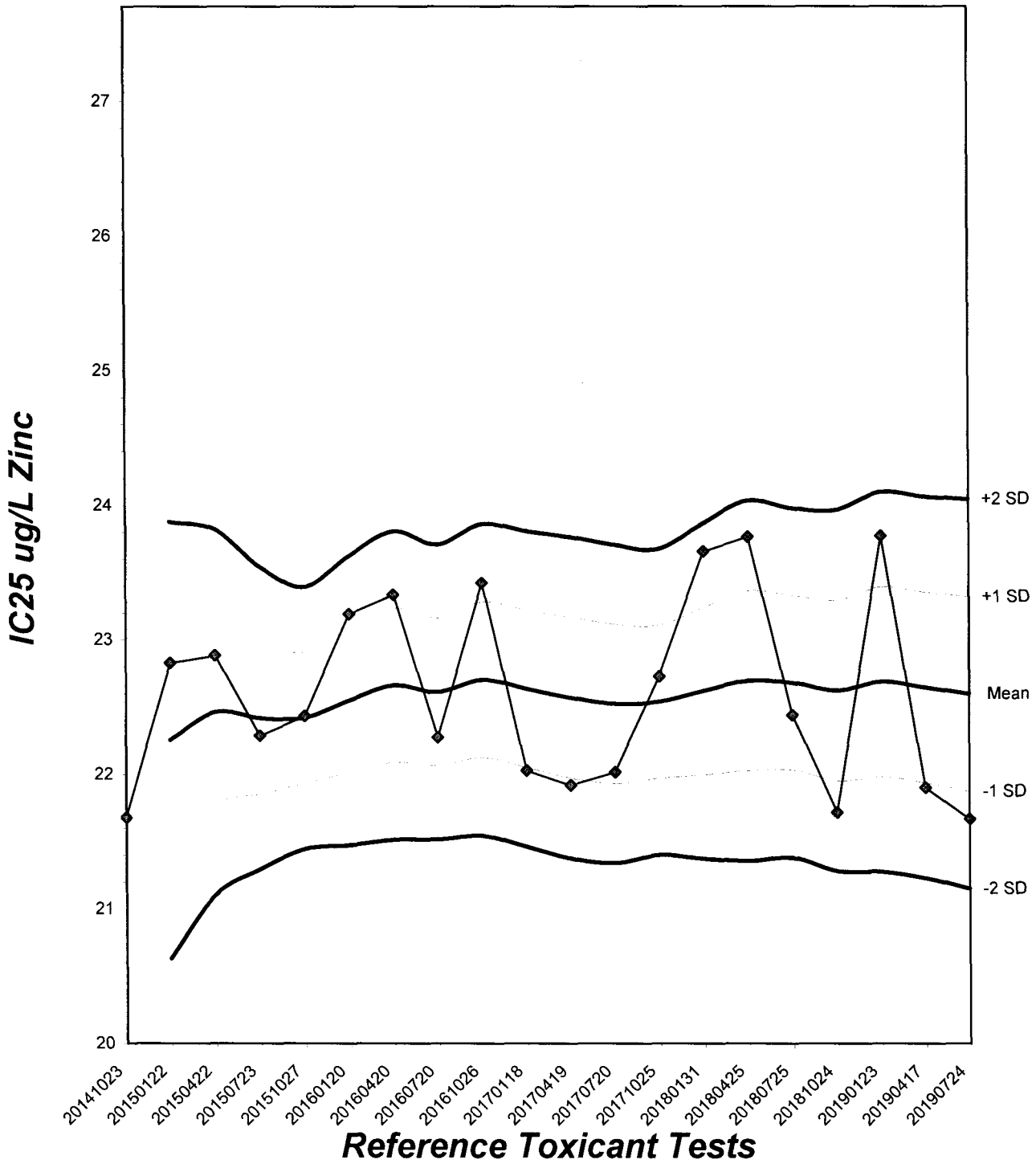
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	18.410	0.451	15.908	18.931	-3.5468
IC10	19.225	0.220	18.479	19.697	-0.2538
IC15	20.039	0.212	19.338	20.495	-0.2494
IC20	20.854	0.208	20.173	21.325	-0.2307
IC25	21.668	0.208	20.990	22.149	-0.2011
IC40	24.112	0.228	23.390	24.668	-0.1106
IC50	25.741	0.257	24.987	26.401	-0.0860



Abalone Larval Development Laboratory Control Chart

CV% = 3.2



ABALONE CHRONIC BIOASSAY
Reference Toxicant - Zinc Sulfate

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date: 07/24/2019

WATER QUALITY READINGS

	Initial Readings				24 Hr		Final Readings			
Sample	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Control	15.4	8.4	8.0	34	15.6	8.0	14.9	8.1	8.0	34
10 µg/l Zn	15.2	8.2	8.0	34	15.5	8.0	14.7	8.2	8.0	34
18 µg/l Zn	15.0	8.4	8.0	34	15.6	8.0	14.8	8.2	8.0	34
32 µg/l Zn	14.6	8.4	8.0	34	15.2	8.0	14.7	8.2	8.0	34
56 µg/l Zn	14.4	8.5	8.0	34	15.3	8.0	14.8	8.2	8.0	34
100 µg/l Zn	14.7	8.4	8.0	34	15.1	8.0	14.6	8.2	8.0	34

Control and dilutions made with laboratory reference seawater filtered to 0.2 µm.

Initial readings: [signature] Date/Time: 7-24-19 1600 Final readings: [signature] Date/Time: 7-26-19 1600

MICROSCOPIC EXAMINATION

Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal
1	32	8	104	11	10	108	6	21	10	106	5
2	56	0	100	12	C	101	8	22	100	0	100
3	10	102	1	13	56	0	100	23	32	2	100
4	100	0	100	14	10	109	8	24	C	103	5
5	18	103	2	15	32	18	89	25	32	16	90
6	C	100	7	16	100	0	100	26	C	101	1
7	56	0	100	17	18	100	6	27	18	103	12
8	32	16	99	18	C	103	3	28	100	0	100
9	100	0	100	19	56	0	100	29	56	0	100
10	18	103	10	20	18	105	7	30	10	103	3

Microscopic examination: Analyst: [signature] Date: 7-27-19 Time: 0900

ABALONE CHRONIC BIOASSAY
Reference Toxicant - Zinc Sulfate

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date: 07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.
1	32	11	10	21	10
2	56	12	C	22	1W
3	10	13	56	23	32
4	1W	14	10	24	C
5	18	15	32	25	32
6	C	16	1W	26	C
7	56	17	18	27	18
8	32	18	C	28	1W
9	1W	19	56	29	56
10	18	20	18	30	10

Notes

Number Males used: 4

Number females used: 6

Time H_2O_2 added: 12:30

Time water changed: 15:00

Time spawned: ♂ 1505 ♀ 1523

Time placed in test: 1600

Add 1600 fertilized eggs per 200 ml..

Time glutaraldehyde added: 1600

Analyst: [signature] Date: 7-24-19 Time: 0800

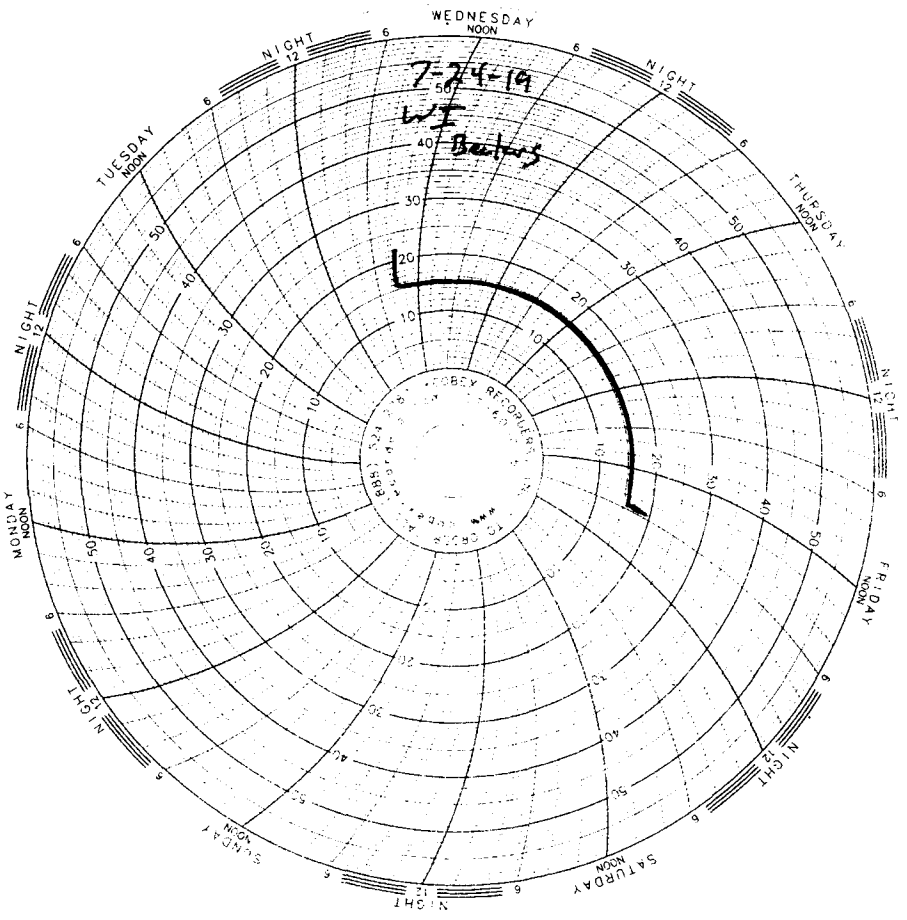
Aquatic Testing Laboratories

Test Temperature Chart

Test No: RT-190724

Date Tested: 07/24/19 to 07/26/19

Acceptable Range: 15 +/- 1°C



GIANT KELP GERMINATION AND AND GROWTH SHORT-TERM TOXICITY TEST

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

GIANT KELP GERMINATION AND GROWTH TEST
REFERENCE TOXICANT - COPPER

Aquatic Testing Laboratories

QA/QC Batch No.: RT-190724

Date Tested: 07/24/19 - 07/26/19

TEST SUMMARY

Species: *Macrocystis pyrifera.*
Protocol: EPA/600/R-95/136.
Test type: Static.
Test chamber: Plastic beakers.
Temperature: 15 +/- 1°C.
Number of spores per ml: 7,500 (approx.).
Standard toxicant: Copper chloride.
Lab seawater: 0.2 um filtered seawater.

Source: Field collected.
Dilution water: Lab seawater.
Endpoints: NOEC, IC25 at 48 hrs.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.
Ref. tox. source: Mallinckrodt.

RESULTS SUMMARY

Sample Concentration	Percent Germination		Mean Germ Tube Length (μm)	
Control	84.6%		15.75	
10 μg/l	85.6%		16.10	
18 μg/l	82.3%		15.35	*
32 μg/l	64.3%	*	12.85	*
56 μg/l	54.8%	*	10.75	*
100 μg/l	16.9%	*	6.40	*
180 μg/l	5.2%	*	5.45	*
* Statistically significantly less than control at P = 0.05 level				

CHRONIC TOXICITY

Germination NOEC	18 μg/l
Germination IC25	33.2 μg/l
Germ Tube Growth NOEC	10 μg/l
Germ Tube Growth IC25	42.4 μg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Mean control germination ≥70%	Yes (84.6%)
Mean control germination tube length >10 μm	Yes (15.75 μm)
Germination tube growth NOEC <35 μg/l Copper	Yes (10 μg/l)
%MSD <20% relative to control (germination & growth)	Yes (germ = 10.1%, growth = 7.5%)

Macrocystis Germination and Growth Test-Proportion Germinated

Start Date:	7/24/2019 16:00	Test ID:	RT190724k	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	0.8532	0.8058	0.8679	0.8058	0.8952
10	0.8544	0.7921	0.8641	0.8962	0.8725
18	0.8611	0.7885	0.8039	0.8137	0.8491
32	0.7103	0.6106	0.6481	0.6422	0.6058
56	0.4571	0.6321	0.6239	0.5487	0.4771
100	0.3010	0.0962	0.2037	0.0962	0.1485
180	0.0648	0.0545	0.0192	0.1009	0.0190

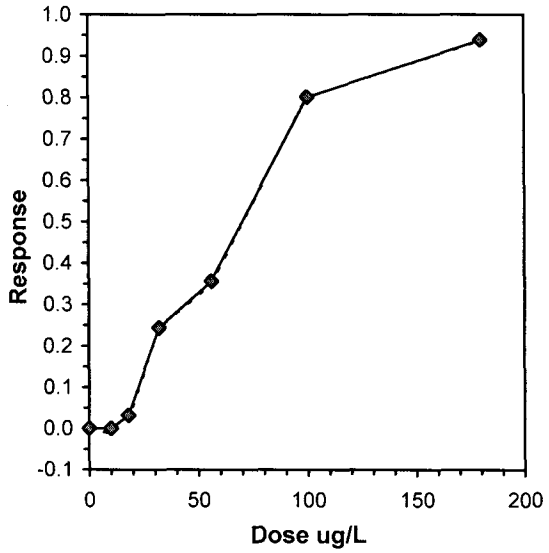
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8456	1.0000	1.1693	1.1145	1.2412	4.708	5				0.8512	1.0000
10	0.8559	1.0121	1.1837	1.0973	1.2428	4.540	5	-0.320	2.409	0.1080	0.8512	1.0000
18	0.8233	0.9736	1.1380	1.0929	1.1889	3.575	5	0.698	2.409	0.1080	0.8238	0.9678
*32	0.6434	0.7609	0.9313	0.8920	1.0024	4.744	5	5.307	2.409	0.1080	0.6433	0.7557
*56	0.5478	0.6478	0.8337	0.7425	0.9191	9.779	5	7.484	2.409	0.1080	0.5480	0.6438
*100	0.1691	0.2000	0.4150	0.3153	0.5807	27.088	5	16.822	2.409	0.1080	0.1692	0.1988
*180	0.0517	0.0612	0.2188	0.1385	0.3233	36.489	5	21.198	2.409	0.1080	0.0522	0.0614

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96961	0.934	0.32724	-0.2093
Bartlett's Test indicates equal variances (p = 0.41)	6.12675	16.8119		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		0.08517	0.10051	0.74187	0.00503	7.3E-20	6, 28

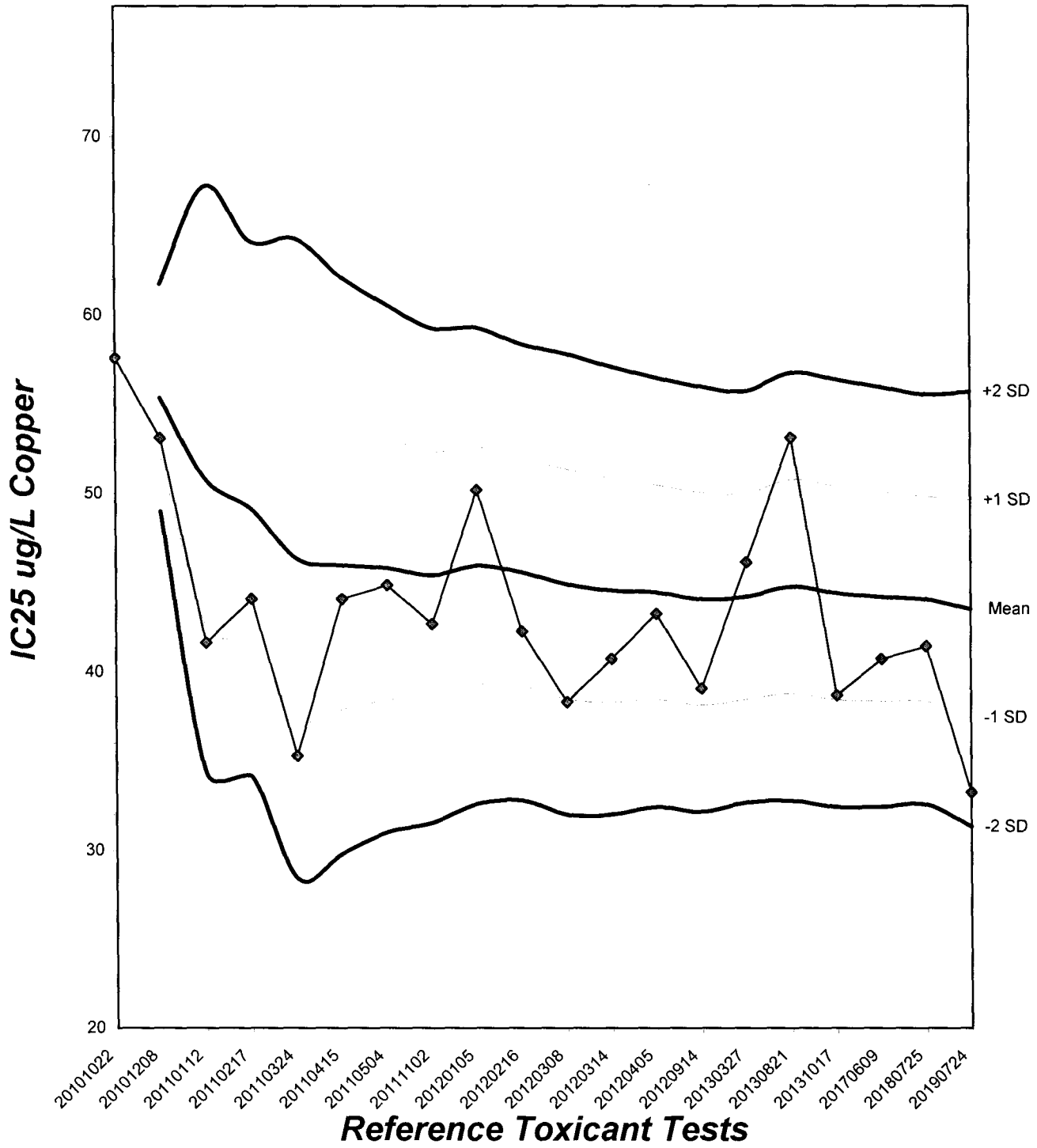
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	19.175	1.442	13.337	21.730	-0.9505
IC10	22.476	1.095	19.013	25.164	-0.2591
IC15	25.777	1.151	22.630	29.335	0.1008
IC20	29.078	1.371	25.715	33.934	0.6395
IC25	33.230	3.111	28.573	45.127	0.7887
IC40	60.330	3.511	46.908	67.900	-0.3820
IC50	70.219	2.925	60.314	77.603	-0.0422



Giant Kelp Germination Laboratory Control Chart

CV% = 14



Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	RT190724k	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	15.750	15.500	15.750	15.750	16.000
10	15.750	15.000	17.250	15.750	16.750
18	15.500	15.250	15.250	15.500	15.250
32	13.000	12.500	11.750	12.500	14.500
56	10.500	9.250	11.250	9.750	13.000
100	6.250	6.250	6.750	6.500	6.250
180	5.250	5.500	5.250	6.000	5.250

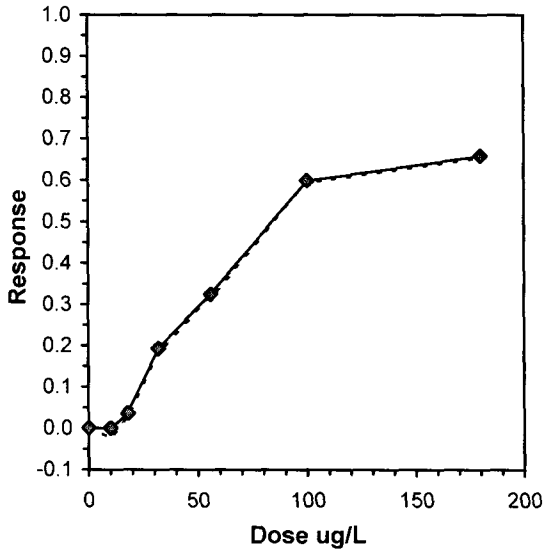
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
D-Control	15.750	1.0000	15.750	15.500	16.000	1.122	5			15.925	1.0000
10	16.100	1.0222	16.100	15.000	17.250	5.555	5	30.00	16.00	15.925	1.0000
*18	15.350	0.9746	15.350	15.250	15.500	0.892	5	16.00	16.00	15.350	0.9639
*32	12.850	0.8159	12.850	11.750	14.500	7.974	5	15.00	16.00	12.850	0.8069
*56	10.750	0.6825	10.750	9.250	13.000	13.660	5	15.00	16.00	10.750	0.6750
*100	6.400	0.4063	6.400	6.250	6.750	3.494	5	15.00	16.00	6.400	0.4019
*180	5.450	0.3460	5.450	5.250	6.000	5.981	5	15.00	16.00	5.450	0.3422

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.89266	0.934	0.96229	3.03257
Bartlett's Test indicates unequal variances (p = 2.37E-05)	31.1567	16.8119		

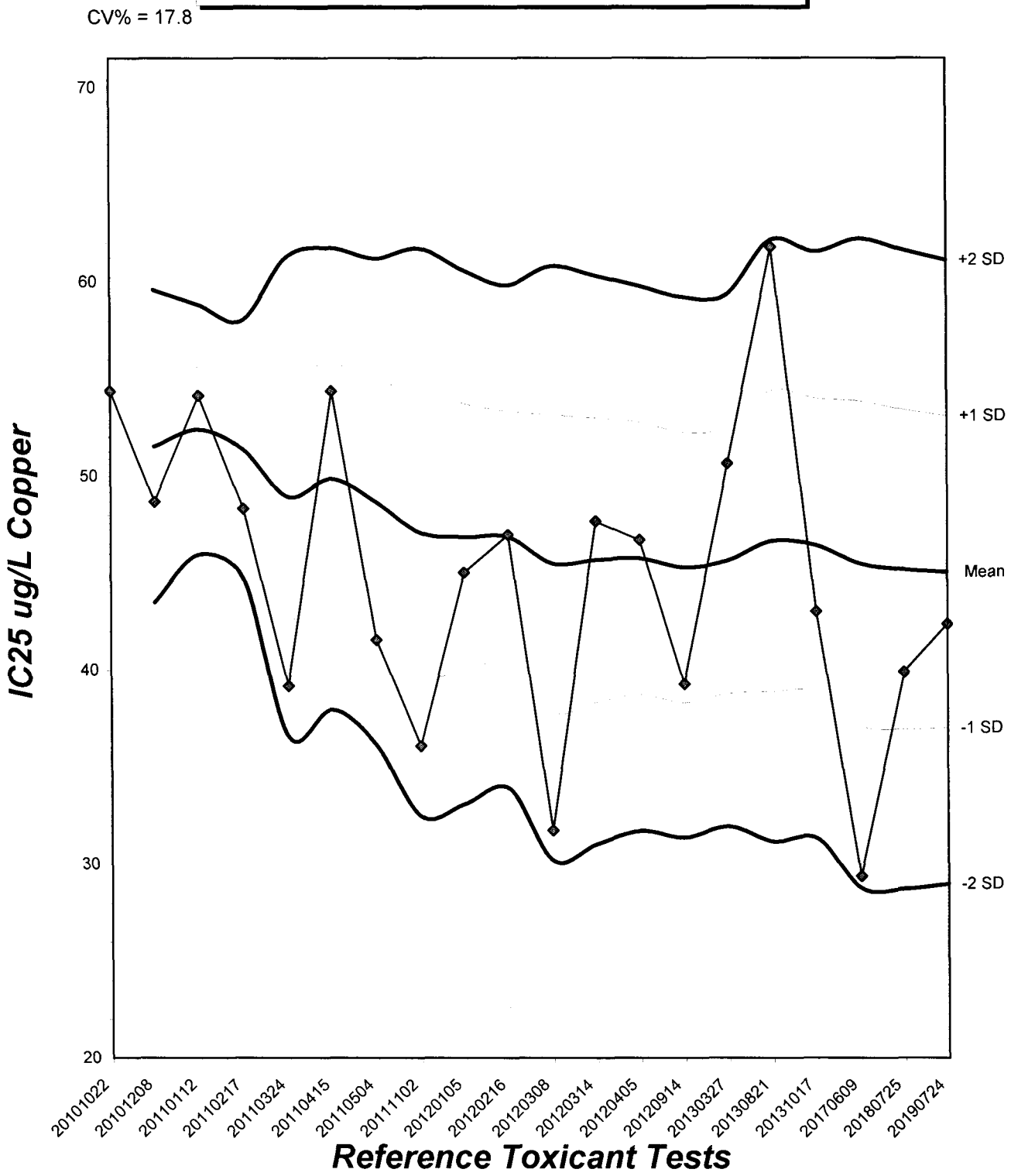
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	10	18	13.4164	
Treatments vs D-Control				

Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	19.239	1.062	15.395	21.835	-0.5169
IC10	23.698	1.426	20.266	29.327	1.0198
IC15	28.157	2.101	24.219	36.376	1.2592
IC20	33.257	3.624	27.369	44.982	1.1424
IC25	42.357	5.210	31.308	64.364	1.0226
IC40	68.087	4.881	51.601	79.496	-0.3272
IC50	84.195	2.573	75.129	90.016	-0.3930



Giant Kelp Germ Tube Length Laboratory Control Chart



Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	RT190724k	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	15.750	15.500	15.750	15.750	16.000
10	15.750	15.000	17.250	15.750	16.750
18	15.500	15.250	15.250	15.500	15.250
32	13.000	12.500	11.750	12.500	14.500
56	10.500	9.250	11.250	9.750	13.000
100	6.250	6.250	6.750	6.500	6.250
180	5.250	5.500	5.250	6.000	5.250

			Transform: Untransformed					1-Tailed		
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	15.750	1.0000	15.750	15.500	16.000	1.122	5			
10	16.100	1.0222	16.100	15.000	17.250	5.555	5	-0.713	2.409	1.182
18	15.350	0.9746	15.350	15.250	15.500	0.892	5	0.815	2.409	1.182
*32	12.850	0.8159	12.850	11.750	14.500	7.974	5	5.911	2.409	1.182
*56	10.750	0.6825	10.750	9.250	13.000	13.660	5	10.191	2.409	1.182
*100	6.400	0.4063	6.400	6.250	6.750	3.494	5	19.057	2.409	1.182
*180	5.450	0.3460	5.450	5.250	6.000	5.981	5	20.994	2.409	1.182

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.89266	0.934	0.96229	3.03257
Bartlett's Test indicates unequal variances (p = 2.37E-05)	31.1567	16.8119		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		1.18171	0.07503	98.6518	0.60179	1.8E-20	6, 28

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date:07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
1	32	107	76	31	4	6	5	6	4	6	5	6	6	4
2	16	108	93	15	4	7	7	6	5	7	7	6	7	6
3	56	105	48	57	3	4	3	7	3	6	6	3	4	3
4	10	103	88	15	7	6	5	7	8	7	4	6	6	7
5	100	103	31	72	2	3	2	2	3	2	2	3	3	3
6	C	109	93	16	6	7	7	6	8	7	5	4	6	7
7	180	108	7	101	2	2	2	2	3	2	2	2	2	2
8	10	101	80	21	6	7	7	5	7	6	6	5	5	6
9	56	106	67	39	3	4	3	4	5	3	3	4	5	3
10	C	103	83	20	6	4	6	7	7	6	7	6	7	6
11	32	113	69	44	6	5	6	4	4	5	4	6	6	4
12	18	104	82	22	6	7	6	5	7	7	6	5	6	6
13	100	104	10	94	3	2	2	4	3	2	2	2	3	2
14	180	110	6	104	2	2	3	2	2	2	2	3	2	2
15	10	103	89	14	7	8	7	6	7	7	6	8	7	6
16	100	108	22	86	3	2	2	3	4	3	3	2	2	3
17	32	108	70	38	6	4	5	4	5	4	6	6	3	4
18	56	109	68	41	5	4	3	6	6	7	4	3	3	4
19	C	106	92	14	4	7	7	6	7	8	6	4	7	7
20	18	102	82	20	6	4	7	7	5	7	6	7	6	6

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date:07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
21	180	104	2	102	2	2	2	2	3	2	2	2	2	2
22	100	104	10	94	3	2	2	4	2	2	3	3	3	2
23	32	109	70	39	4	6	6	7	4	5	4	4	6	4
24	10	106	95	11	6	7	6	5	4	8	7	7	6	7
25	C	103	83	20	6	7	7	6	5	7	6	6	7	6
26	56	113	62	51	4	5	3	3	4	7	3	4	3	3
27	180	109	11	98	2	3	3	2	3	2	2	3	2	2
28	18	102	83	19	6	7	7	6	5	7	4	6	7	7
29	C	105	94	11	7	6	8	5	7	6	6	7	6	6
30	100	101	15	86	3	2	2	3	2	2	3	3	2	3
31	18	106	90	16	5	7	6	6	5	7	6	7	6	6
32	56	109	52	57	4	6	7	4	6	6	8	4	4	3
33	180	105	2	103	2	2	2	2	2	3	2	2	2	2
34	32	104	63	41	6	5	7	6	7	6	4	5	6	6
35	10	102	89	13	7	6	7	8	7	7	6	5	7	7
36														
37														
38														
39														
40														

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date:07/24/2019

WATER QUALITY READINGS

	Initial Readings				24 Hrs		Final Readings			
Sample	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Control	15.5	8.2	8.0	34	15.5	8.0	15.8	7.9	8.0	34
10 µg/l	15.5	8.4	8.0	34	15.4	8.0	15.6	7.9	8.0	34
18 µg/l	15.6	8.4	8.0	34	15.4	8.0	15.4	8.0	8.0	34
32µg/l	15.5	8.5	8.0	34	15.4	8.0	15.7	8.1	8.0	34
56 µg/l	15.6	8.4	8.0	34	15.3	8.0	15.6	8.1	8.0	34
100 µg/l	15.5	8.4	7.9	34	15.3	7.9	15.2	8.1	8.0	34
180 µg/l	15.5	8.4	7.9	34	15.3	7.9	15.1	8.0	8.0	34

Comments:

Reference toxicant: Copper chloride.

All dilutions made with reference lab seawater.

Illumination (16 hr light / 8 hr dark at 50 ± 10 uE/m^2/s) at 5 locations in incubator:
(four corners and center): 44, 40, 42, 41, 45 uE/m^2/s.

Initial readings: Analyst: [signature] Date: 7-24-19 Time: 1600

Final readings: Analyst: [signature] Date: 7-26-19 Time: 1600

Aquatic Testing Laboratories

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

QA/QC No.: RT-190724

Start Date:07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	32	11	32	21	180	31	18	Need 7500/ml x 200 ml = 1,500,000 spores. Add 1.0 ml spore stock of 6 spores per 5x5 hemacytometer grid
2	18	12	18	22	1W	32	56	
3	56	13	1W	23	32	33	180	
4	10	14	180	24	10	34	32	
5	1W	15	10	25	C	35	10	
6	C	16	1W	26	56			
7	180	17	32	27	180			
8	10	18	56	28	18			
9	56	19	C	29	C			
10	C	20	18	30	1W			

Analyst: _____ Date: 7-24-19 Time: 0800

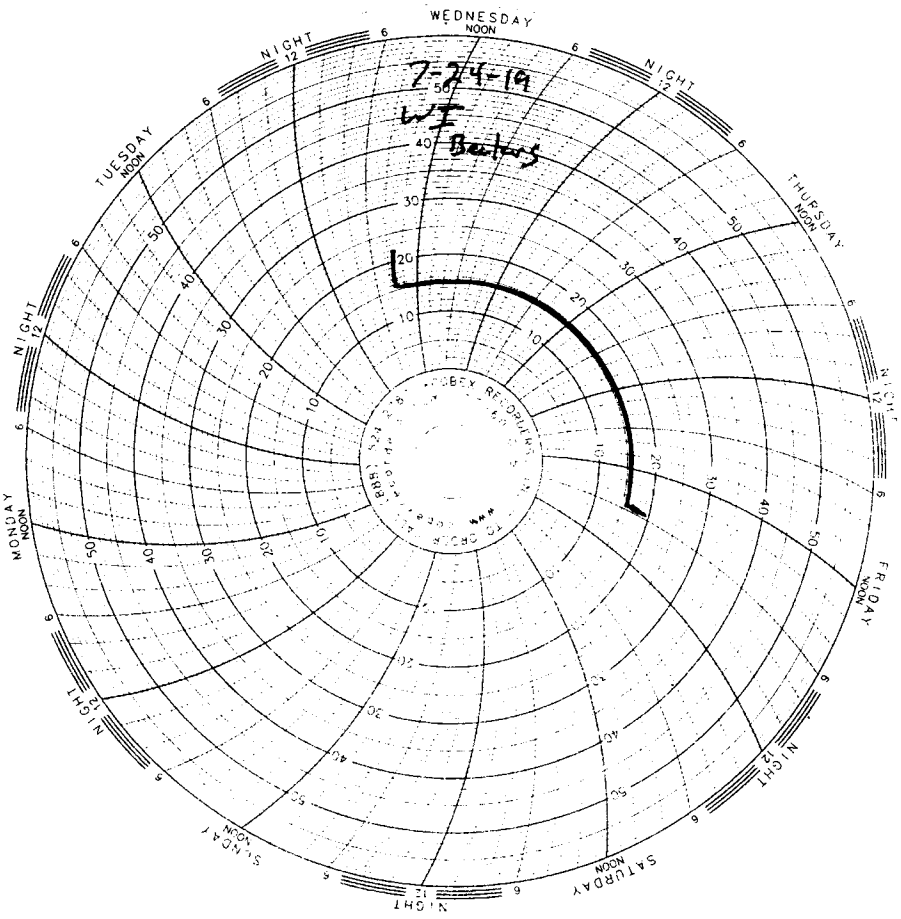
Aquatic Testing Laboratories

Test Temperature Chart

Test No: RT-190724

Date Tested: 07/24/19 to 07/26/19

Acceptable Range: 15 +/- 1°C



Aquatic
Testing
Laboratories

Topsmelt Larvae Survival and Growth Short-Term Toxicity Test

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

TOPSMELT LARVAE CHRONIC BIOASSAY
REFERENCE TOXICANT - Copper

Aquatic Testing Laboratories

QA/QC Batch No.: RT-190723

Date Tested: 07/23/19 - 07/30/19

TEST SUMMARY

Species: *Atherinops affinis*.
Protocol: EPA/600/R-95/136.
Test type: Static renewal (90% daily).
Food: 40 b.s. nauplii per larvae 2X daily.
Test solution volume: 200 ml.
Number of larvae per chamber: 5.
Photoperiod: 16hr light / 8hr dark.
Dil. water: Laboratory sea water.

Source: Aquatic BioSystems.
Endpoints: LC50, IC25.
Age: 11 days (9-15 days).
Test chamber size: 600 ml.
Number of replicates: 5.
Temperature: 20 +/- 1°C.
Salinity: 33 +/- 2 o/oo.

RESULTS SUMMARY

Sample Concentration	Percent Survival		Mean Weight of Larvae (Biomass)	
Control	96%		2.058 mg	
56 µg/l	100%		2.790 mg	
100 µg/l	100%		2.473 mg	
180 µg/l	52%	*	1.232 mg	**
320 µg/l	8%	*	0.177 mg	**

* Statistically significantly less than control at P = 0.05 level.
** Concentrations with significantly less than control survival rates are not used in ANOVA comparisons.

CHRONIC TOXICITY

Survival LC50	193.6 µg/l
Biomass IC25	140.4 µg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control survival ≥80%	PASS (96%)
Average dry weight of control ≥0.85 mg (when starting with 9 day old larvae)	PASS (average control dry weight = 2.153 mg (11 day old))
Survival LC50 ≤2 SD of control chart mean	PASS (see chart)
Survival LC50 <205 µg/l Copper	PASS (LC50 = 193.6 µg/l Copper)
%MSD of <25% relative to control survival	PASS (%MSD = 13.9%)
%MSD of <50% relative to control growth	PASS (%MSD = 21.8%)
Concentration response relationship acceptable	PASS (Response curve normal)

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	RT190723t	Sample ID:	REF-Ref Toxicant
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	0.8000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000
180	0.8000	0.2000	0.4000	0.6000	0.6000
320	0.2000	0.0000	0.2000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5			1	25
56	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	17.00	0	25
100	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	17.00	0	25
*180	0.5200	0.5417	0.8055	0.4636	1.1071	30.117	5	15.50	17.00	12	25
*320	0.0800	0.0833	0.3208	0.2255	0.4636	40.662	5	15.00	17.00	23	25

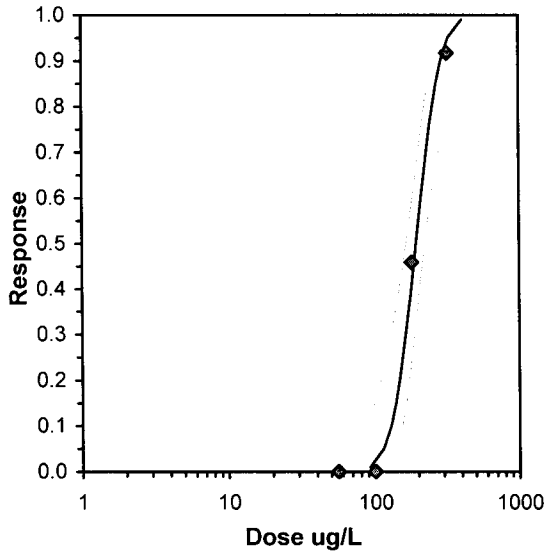
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.90709	0.918	-0.426	2.83085
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	
Treatments vs D-Control				

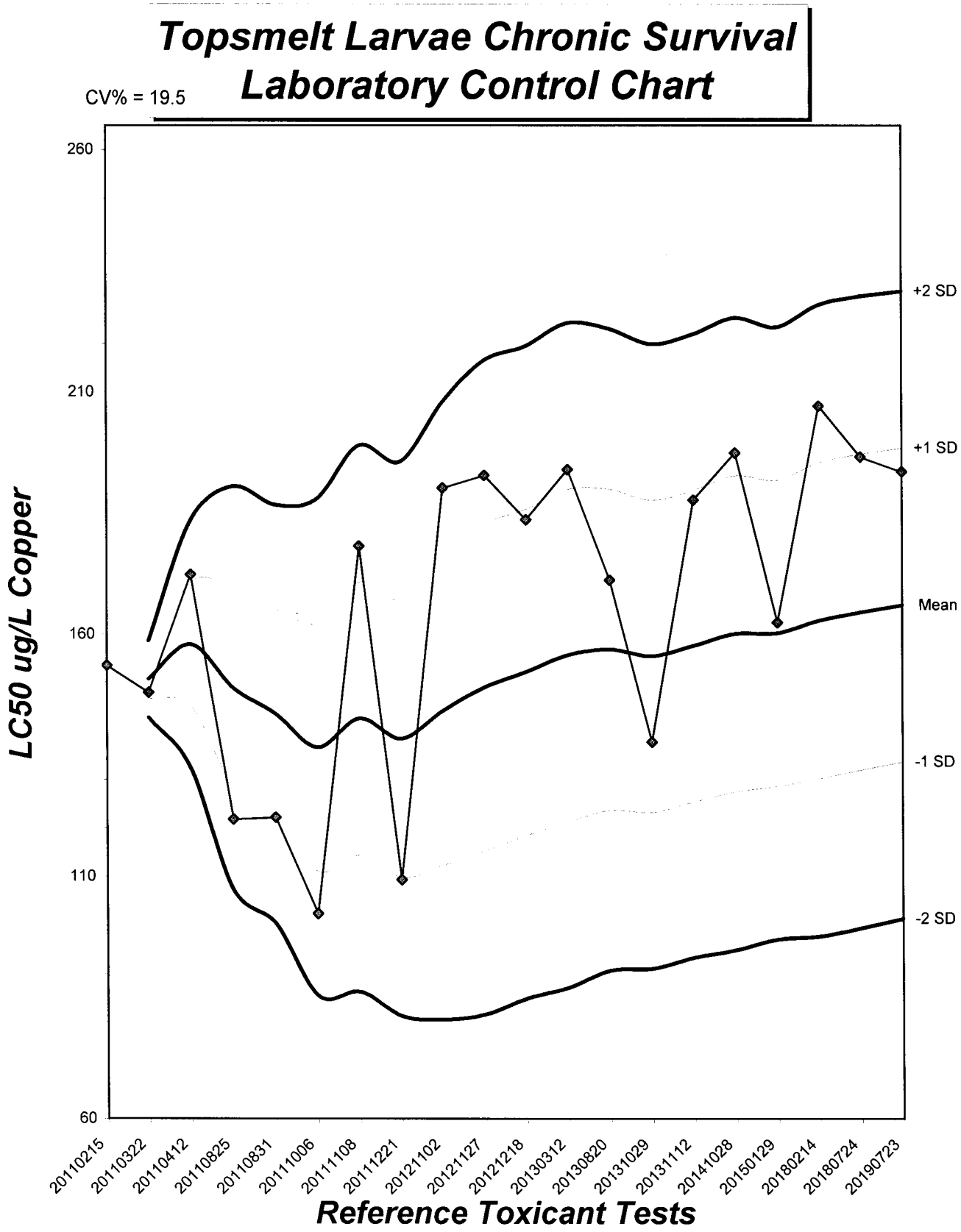
Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	7.2139	1.57257	4.13168	10.2961	0.04	1.84716	5.99146	0.4	2.28679	0.13862	13
Intercept	-11.497	3.62733	-18.606	-4.3871							
TSCR	0.0139	0.01589	-0.0173	0.04505							

Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	92.1111	49.5906	119.906
EC05	3.355	114.494	71.8718	140.868
EC10	3.718	128.571	87.352	153.927
EC15	3.964	139.034	99.448	163.729
EC20	4.158	147.954	110.063	172.247
EC25	4.326	156.061	119.873	180.2
EC40	4.747	178.515	147.106	204.023
EC50	5.000	193.55	164.561	222.284
EC60	5.253	209.852	182.02	244.929
EC75	5.674	240.044	209.921	295.078
EC80	5.842	253.198	220.643	319.879
EC85	6.036	269.442	233.061	352.597
EC90	6.282	291.369	248.779	400.007
EC95	6.645	327.193	272.731	484.578
EC99	7.326	406.7	321.388	700.166



Topsmelt Larvae Chronic Survival Laboratory Control Chart



Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID: RT190723t	Sample ID: REF-Ref Toxicant
End Date:	7/30/2019 16:30	Lab ID: CAATL-Aquatic Testing Labs	Sample Type: CUCL-Copper chloride
Sample Date:	7/23/2019	Protocol: EPAW 95-EPA/600/R-95/136	Test Species: AA-Atherinops affinis
Comments:			

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	0.8000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000
180	0.8000	0.2000	0.4000	0.6000	0.6000
320	0.2000	0.0000	0.2000	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5			
56	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	-0.570	2.300	0.1921
100	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	-0.570	2.300	0.1921
*180	0.5200	0.5417	0.8055	0.4636	1.1071	30.117	5	5.892	2.300	0.1921
*320	0.0800	0.0833	0.3208	0.2255	0.4636	40.662	5	11.695	2.300	0.1921

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.90709	0.918	-0.426	2.83085
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	180	134.164		0.12852	0.1386	1.02949	0.01744	8.6E-11	4, 20
Treatments vs D-Control										

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	RT190723t	Sample ID:	REF-Ref Toxicant
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	1.9540	1.9120	1.9460	2.2480	2.2280
56	2.5340	2.6660	2.3200	3.5980	2.8320
100	2.6520	2.6260	2.7240	2.1900	2.1740
180	1.3320	0.5900	0.9380	1.4580	1.8440
320	0.3480	0.0000	0.5380	0.0000	0.0000

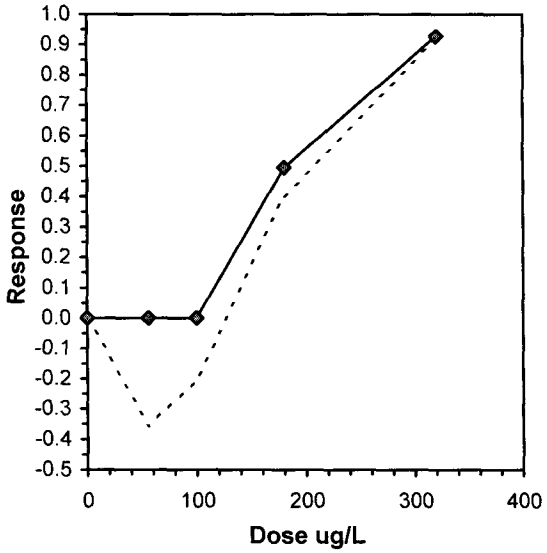
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	2.0576	1.0000	2.0576	1.9120	2.2480	8.048	5				2.4403	1.0000
56	2.7900	1.3559	2.7900	2.3200	3.5980	17.526	5	-3.447	2.110	0.4483	2.4403	1.0000
100	2.4732	1.2020	2.4732	2.1740	2.7240	10.848	5	-1.956	2.110	0.4483	2.4403	1.0000
180	1.2324	0.5990	1.2324	0.5900	1.8440	39.214	5				1.2324	0.5050
320	0.1772	0.0861	0.1772	0.0000	0.5380	142.081	5				0.1772	0.0726

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.91582	0.881	1.06013	2.13277
Bartlett's Test indicates equal variances (p = 0.13)	4.00769	9.21034		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	100	>100			0.44827	0.21786	0.67458	0.11284	0.0158	2, 12

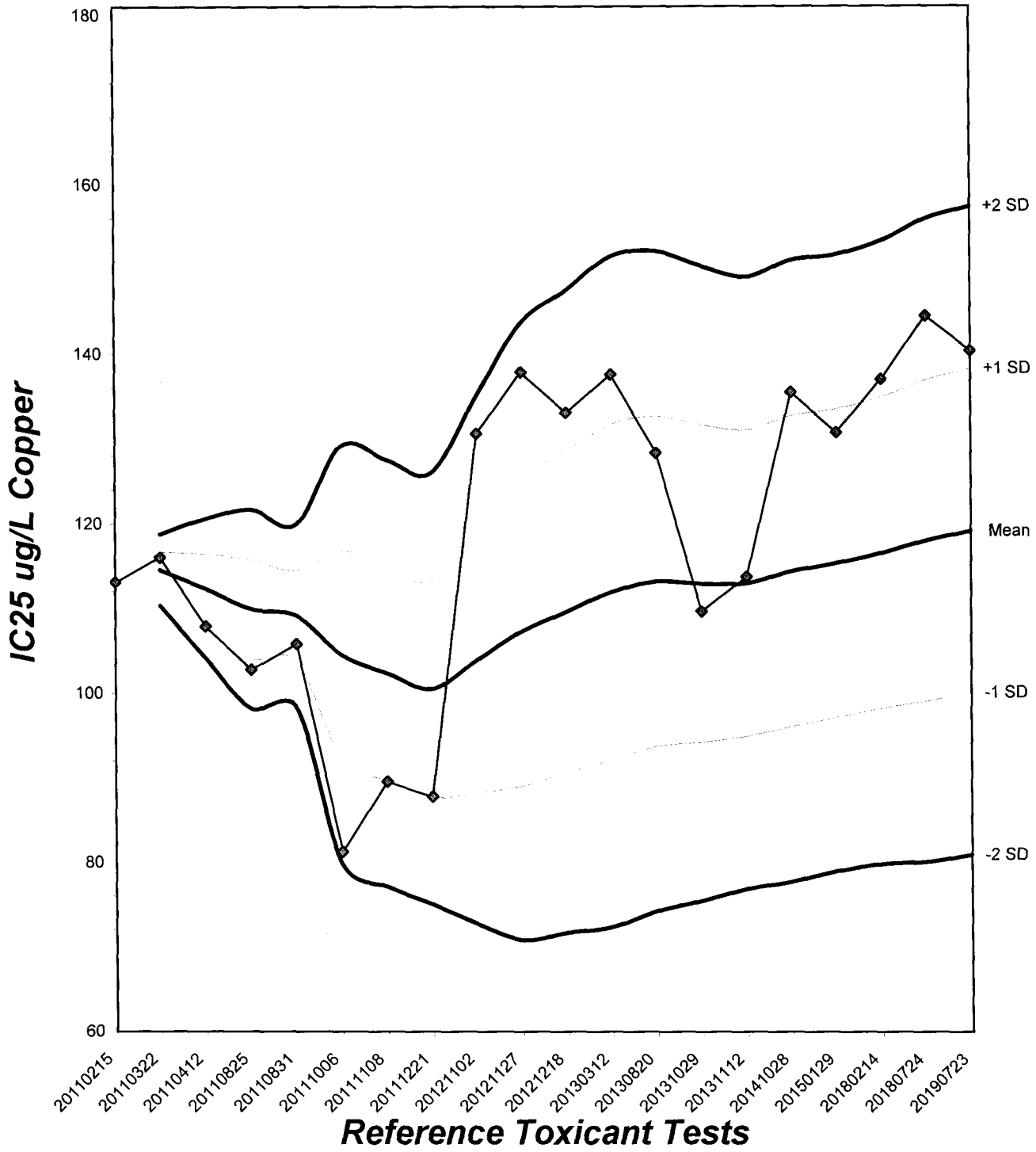
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	108.08	7.42	69.82	111.78	-2.3359
IC10	116.16	5.35	96.89	123.55	-1.9763
IC15	124.24	5.65	105.29	135.46	-0.7100
IC20	132.32	6.35	113.25	148.66	0.2003
IC25	140.41	7.31	120.71	162.08	0.7088
IC40	164.65	10.91	141.22	207.67	0.9064
IC50	181.63	15.24	153.64	233.22	0.6417



Topsmelt Larvae Chronic Growth Laboratory Control Chart

CV% = 16.1



TOPSMELT CHRONIC BIOASSAY
Reference Toxicant - Copper
Survival and Growth Raw Data Sheet

Aquatic Testing Laboratories

QA/QC No.: RT-190723

Start Date:07/23/2019

Sample	Rep	Number of Live Larvae / Day							Final Results		Dry Weight (mg)		
		1	2	3	4	5	6	7	# Tested	# Dead	Total Wt.	Tare Wt.	
Control	A	5	5	5	5	5	5	5	5	0	376.76	366.99	1
	B	5	5	5	5	5	4	4	5	1	377.81	368.25	
	C	5	5	5	5	5	5	5	5	0	376.27	366.54	
	D	5	5	5	5	5	5	5	5	0	369.89	358.65	
	E	5	5	5	5	5	5	5	5	0	366.50	355.16	
56 µg/l	A	5	5	5	5	5	5	5	5	0	369.51	356.84	
	B	5	5	5	5	5	5	5	5	0	381.13	367.80	
	C	5	5	5	5	5	5	5	5	0	373.29	361.69	
	D	5	5	5	5	5	5	5	5	0	377.02	359.03	
	E	5	5	5	5	5	5	5	5	0	374.22	360.07	
100 µg/l	A	5	5	5	5	5	5	5	5	0	375.00	361.74	11
	B	5	5	5	5	5	5	5	5	0	378.38	365.25	
	C	5	5	5	5	5	5	5	5	0	373.93	360.31	
	D	5	5	5	5	5	5	5	5	0	360.04	349.09	
	E	5	5	5	5	5	5	5	5	0	372.40	361.53	
180 µg/l	A	5	5	5	5	5	5	4	5	1	370.75	364.09	
	B	5	5	5	5	5	2	1	5	4	364.09	361.14	
	C	5	5	5	5	5	3	2	5	3	351.42	346.73	
	D	5	5	5	5	5	5	3	5	2	343.24	336.05	
	E	5	5	5	5	5	4	3	5	2	325.30	316.08	
320 µg/l	A	5	5	5	5 &L	4	2	1	5	4	354.24	352.56	21
	B	5	5	2	1	0	0	0	5	5	—	—	
	C	5	5	3	2	2	2	1	5	4	345.47	342.78	22
	D	5	5	4	2	1	0	0	5	5	—	—	
	E	5	5	3	3	2	0	0	5	5	—	—	

Time placed in drying oven: 17W Temperature of drying oven: 60 °C (dry for 24 hr at 60°C)

Time placed in desiccator: 17W Analyst: [signature] Date/Time: 7-30-19 17W

Blank: 314.47 314.49

TOPSMELT CHRONIC BIOASSAY
Reference Toxicant - Copper
Water Chemistries Raw Data Sheet

Aquatic Testing Laboratories

QA/QC No.: RT-190723

Start Date:07/23/2019

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Analyst Initials:		J	J	J	J	J	J	J	J	J	J	J	M	M	J
Time of Readings:		1630	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1550	1600	1630
Control	DO	7.6	7.0	7.4	6.9	7.0	6.1	6.6	5.9	6.9	6.2	7.0	6.4	7.3	6.1
	pH	8.1	7.9	8.0	7.8	8.0	7.6	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9
	Temp	20.5	19.9	20.0	20.1	20.2	20.0	20.1	20.2	20.2	20.0	20.1	19.9	20.1	20.2
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
56 µg/l	DO	7.6	6.8	7.3	6.9	7.1	6.3	6.6	6.0	6.9	6.7	6.9	6.3	7.2	6.0
	pH	8.1	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.1	7.9	8.1	7.8
	Temp	20.7	19.9	20.0	19.9	20.1	20.0	20.1	20.1	20.2	20.0	20.1	20.0	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 µg/l	DO	7.6	6.8	7.3	6.7	6.9	6.0	6.2	5.9	6.3	6.1	6.9	6.3	7.1	5.9
	pH	8.1	7.9	8.0	7.9	8.0	7.8	8.0	7.9	7.9	7.8	8.0	7.9	8.1	7.8
	Temp	20.8	19.9	20.0	19.9	20.2	20.0	20.1	20.2	20.2	20.0	20.3	20.0	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
180 µg/l	DO	7.5	6.9	7.4	6.6	7.0	6.1	6.7	5.9	6.5	6.3	6.9	6.5	7.1	5.9
	pH	8.1	7.9	8.0	7.8	8.0	7.9	8.0	7.9	8.0	8.0	8.1	7.9	8.1	7.9
	Temp	20.8	19.8	19.9	19.9	20.1	20.0	20.1	20.1	20.2	20.0	20.1	20.1	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
320 µg/l	DO	7.6	6.9	7.3	6.5	7.0	6.0	6.7	5.9	6.6	6.8	6.9	6.5	7.2	6.1
	pH	8.1	8.0	8.0	7.9	8.0	7.9	8.0	7.8	8.0	8.0	8.0	7.9	8.1	8.0
	Temp	20.8	19.9	20.0	19.9	20.1	20.0	20.1	20.1	20.2	20.0	20.1	20.1	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33

Comments:

Dissolved Oxygen (DO) readings in mg/l O_2.
Temperature (Temp) readings in °C.
Salinity (Sal.) readings in ppt.

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel: 970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 7/22/2019

SPECIES: *Atherinops affinis*

AGE: 10 day

LIFE STAGE: Larvae

HATCH DATE: 7/12/2019

BEGAN FEEDING: Immediately

FOOD: *Artemia* sp.

Water Chemistry Record:	**Current**	**Range**
TEMPERATURE:	21°C	18-21°C
SALINITY/CONDUCTIVITY:	32 ppt	28-32 ppt
TOTAL HARDNESS (as $CaCO_3$):	--	--
TOTAL ALKALINITY (as $CaCO_3$):	165 mg/l	140-170 mg/l
pH:	7.73	7.60-8.20

Comments:

Facility Supervisor

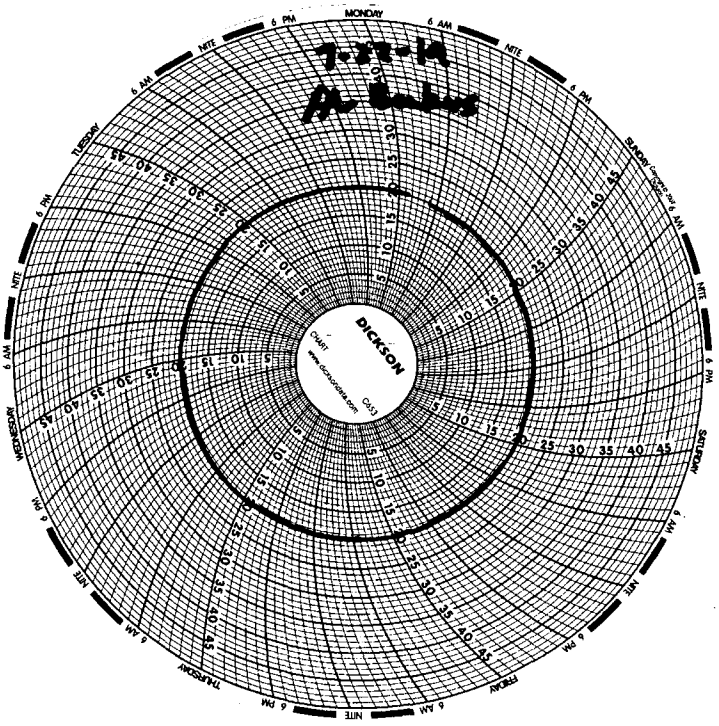
Aquatic Testing Laboratories

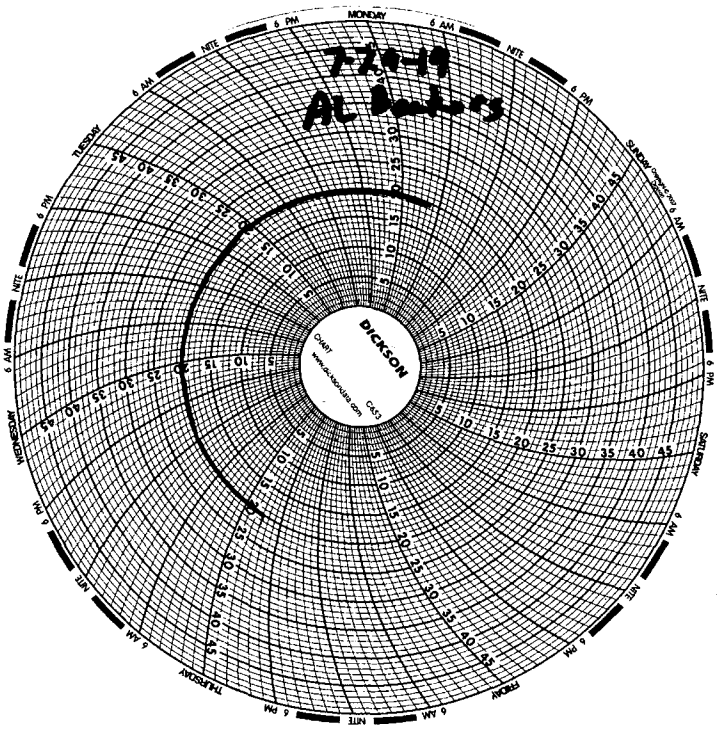
Test Temperature Chart

Test No: RT-190723

Date Tested: 07/23/19 to 07/30/19

Acceptable Range: 20 +/- 1°C





LABORATORY REPORT

Aquatic Testing Laboratories
"dedicated to providing quality aquatic toxicity testing"
4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 FAX (805) 650-0756
CA ELAP Cert. No.: 1775

Date: August 1, 2019

Client: City of Morro Bay Public Works
Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442
Attn: John Gunderlock

Laboratory No.: A-19072303-001/003
Sample I.D.: Comp ARS (receiving water used for dilution and control)

Sample Control: The samples were received by ATL within the recommended hold time, in a chilled state and with the chain of custody record attached. Client supplied receiving water was sampled during a red tide and filtered prior to use. Testing conducted with additional side-by-side testing using lab seawater as dilution/control per client instruction.

Date Sampled:	07/22/19	07/23/19	07/25/19
Date Received:	07/23/19	07/23/19	07/26/19
Temp. Received:	1.3°C	1.3°C	1.0°C
Chlorine (TRC):	0.0 mg/l	0.0 mg/l	0.0 mg/l
Date Tested:	07/23/19 to 07/30/19		

Sample Analysis: The following analyses were performed on your sample:

Abalone Larval Development Short-Term Toxicity Test (EPA/600/R-95-136);
Giant Kelp Germination and Growth Short-Term Toxicity Test (EPA/600/R-95-136);
Topsmelt Larval Survival and Growth Test (EPA/600/R-95-136).

Result Summary:

Test	NOEC	TUc
Abalone Development:	*	*
Kelp Spore Germination:	10%	10.0
Kelp Germ Tube Growth:	10%	10.0
Topsmelt Larval Survival:	32%	3.12
Topsmelt Larval Growth:	32%	3.12

* Testing invalid due to significant toxicity observed in the client supplied red tide receiving water used as dilution and control. Please refer to report of side-by-side testing using laboratory seawater as dilution water for additional information.

Quality Control: Reviewed and approved by:

Joseph A. LeMay
Laboratory Director

Aquatic
Testing
Laboratories

Abalone Larval Development Short-Term Toxicity Test

1. Test and Results Summary

2. Raw Data

3. Statistical Analyses

ABALONE LARVAL DEVELOPMENT
SHORT-TERM TOXICITY TEST

Lab No.: A-19072303-002
Client/ID: Morro Bay WWTP

Date tested: 07/24/19 - 07/26/19

TEST SUMMARY

Species: *Haliotis rufescens*.
Protocol: EPA/600/R-95/136.
Test type: Static.
Test chamber: glass beakers.
Temperature: 15 +/- 1°C.
Number of embryos per chamber: 1600 (approx.).
QA/QC Batch No.: RT-190724 (ran concurrently)

Source: Cultured Abalone Farms.
Dilution water: Client supplied receiving water.
Endpoints: NOEC.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.

RESULTS SUMMARY

Sample Concentration	Percent Normal Development	
Control-Brine (Receiving Water)	27.5%	**
Control-Dilution (Receiving Water)	17.8%	**
Control-Culture (Lab Seawater)	95.3%	
1.8%	2.3%	*
3.2%	0%	*
5.6%	0%	*
10.0%	0%	*
18.0%	0%	*
32.0%	0%	*

* Statistically significantly less than control at P = 0.05 level

** Dilution and brine control Statistically significantly less than culture water control at P = 0.05 level

Dilution water is client supplied receiving water – collected during red tide.

Culture water control obtained from The Cultured Abalone Farm.

CHRONIC TOXICITY

NOEC	< 1.8%*
TUc	> 56*

* Testing invalid due to insufficient control normality

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control normality ≥ 80%	FAIL (17.8%)
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-190724 report for additional test acceptability criteria.	

Abalone Larval Development Test-Proportion Normal

Start Date:	7/24/2019 16:00	Test ID:	19072303rw	Sample ID:	Morro Bay - Recieving Water
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:35	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	HR-Haliotis rufescens

Comments:

Conc-%	1	2	3	4	5
B-Control	0.3922	0.0769	0.1048	0.3619	0.4381
D-Control	0.2054	0.1538	0.0648	0.0943	0.3704
1.8	0.0000	0.0000	0.0194	0.0550	0.0385
3.2	0.0000	0.0000	0.0000	0.0000	0.0000
5.6	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	0.2748	1.5459	0.5312	0.2810	0.7233	39.303	5					
D-Control	0.1777	1.0000	0.4195	0.2574	0.6543	36.886	5	*			0.1784	1.0000
*1.8	0.0226	0.1271	0.1348	0.0500	0.2368	62.862	5	3.608	1.860	0.1467	0.0233	0.1303
3.2	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
5.6	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
10	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
18	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
32	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000

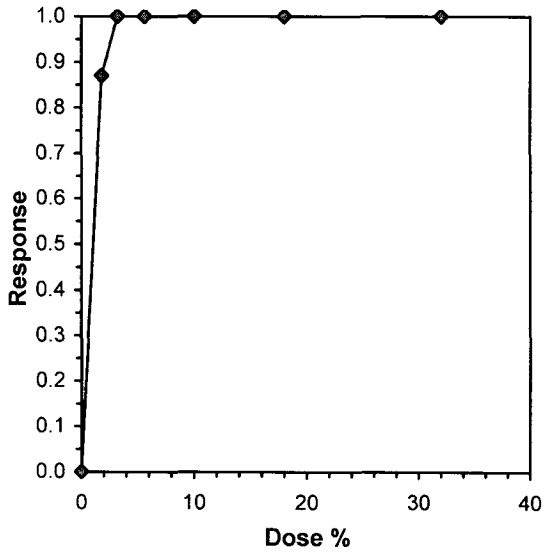
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.95968	0.842	0.65533	0.33358
F-Test indicates equal variances (p = 0.27)	3.33315	23.1545		
The control means are not significantly different (p = 0.36)	0.96184	2.306		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs D-Control	0.0933	0.5625	0.20255	0.01556	0.0069	1, 8

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.1035	0.0105	0.0860	0.1285	3.0379
IC10*	0.2070	0.0210	0.1719	0.2570	3.0379
IC15*	0.3105	0.0315	0.2579	0.3854	3.0379
IC20*	0.4139	0.0420	0.3438	0.5139	3.0379
IC25*	0.5174	0.0525	0.4298	0.6424	3.0379
IC40*	0.8279	0.0841	0.6876	1.0278	3.0379
IC50*	1.0349	0.1051	0.8595	1.2848	3.0370

* indicates IC estimate less than the lowest concentration



Reviewed by:

Abalone Larval Development Test-Proportion Normal

Start Date:	7/24/2019 16:00	Test ID:	Controls	Sample ID:	Morro Bay
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:35	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	HR-Haliotis rufescens
Comments:					

Conc-%	1	2	3	4	5
Lab-Control	0.9806	0.9439	0.9386	0.9717	0.9292
RW-Control	0.2054	0.1538	0.0648	0.0943	0.3704
RW - Brine	0.3922	0.0769	0.1048	0.3619	0.4381

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Lab-Control	0.9528	5.3605	1.3573	1.3015	1.4310	4.125	5	*		
RW-Control	0.1777	1.0000	0.4195	0.2574	0.6543	36.886	5			
*RW - Brine	0.2748	1.5459	0.5312	0.2810	0.7233	39.303	5	8.545	1.860	0.1798

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94738		0.842		-0.5546	-0.4951
F-Test indicates equal variances (p = 0.03)	13.9046		23.1545			
The control means are significantly different (p = 1.35E-06)	12.7448		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences Treatments vs Lab-Control	0.10196	0.10676	1.70584	0.02336	2.7E-05	1, 8

ABALONE CHRONIC BIOASSAY

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay Effluent

Start Date: 07/24/2019

WATER QUALITY READINGS

Sample	Initial Readings				24 Hrs		Final Readings			
	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Control (brine)	15.1	7.9	8.0	34	14.8	8.0	14.8	8.2	8.1	34
Control (dilution)	15.1	8.0	8.0	34	14.8	8.0	14.6	8.0	8.0	34
1.8%	15.0	8.0	8.1	34	14.8	8.0	14.7	8.0	8.0	34
3.2%	14.9	7.9	8.1	34	14.8	8.0	14.8	7.8	8.0	34
5.6%	14.9	8.0	8.0	34	14.9	8.0	14.9	7.6	8.0	34
10%	14.9	8.1	8.1	34	14.7	8.0	14.6	7.5	8.0	34
18%	14.7	8.0	8.1	34	14.8	8.0	14.8	7.2	8.0	34
32%	14.7	7.8	8.1	34	14.7	8.0	14.6	7.0	8.0	34

Sample as received: Chlorine: 0 mg/l; pH: 7.7; Salinity: 0 ppt; Temp: 1.3 °C; DO: 5.9 mg/l; NH_3-N: 30 mg/l

Dilution water is client supplied receiving water. 1.8% test conc. added after random start form

Initial readings: [signature] Date/Time: 7-24-19 1600 Final readings: [signature] Date/Time: 7-26-19 1600

MICROSCOPIC EXAMINATION

Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal
1	10	0	100	15	3.2	0	100	29	10	0	100
2	BC	40	62	16	BC	38	67	30	5.6	0	100
3	3.2	0	100	17	3.2	0	100	31	32	0	100
4	5.6	0	100	18	5.6	0	100	32	18	0	100
5	C	23	84	19	32	0	100	33	5.6	0	100
6	C	16	88	20	C	10	96	34	18	0	100
7	3.2	0	100	21	18	0	100	35	32	0	100
8	BC	8	96	22	10	0	100	1.8%A	1.8	0	100
9	10	0	100	23	32	0	100	1.8%B	1.8	0	100
10	3.2	0	100	24	BC	46	59	1.8%C	1.8	2	101
11	C	7	101	25	C	40	68	1.8%D	1.8	6	103
12	18	0	100	26	32	0	100	1.8%E	1.8	4	100
13	18	0	100	27	5.6	0	100				
14	BC	11	94	28	10	0	100				

Microscopic examination: Analyst: [signature] Date: 7-27-19 Time: 0800

Aquatic Testing Laboratories

ABALONE CHRONIC BIOASSAY

Lab No.: A-19072303-002
Client ID: Morro Bay Effluent

Start Date: 07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	10	13	18	25	C	✓
2	BC	14	BC	26	32	
3	3.2	15	3.2	27	5.6	
4	5.6	16	BC	28	10	
5	C	17	3.2	29	10	
6	C	18	5.6	30	5.6	Add 1600 fertilized eggs per 200 ml test volume.
7	3.2	19	32	31	32	
8	BC	20	C	32	18	
9*	10	21	18	33	5.6	
10	3.2	22	10	34	18	
11	C	23	32	35	32	
12	18	24	BC			

Analyst: _____ Date: 7-24 Time: 0820

GIANT KELP GERMINATION AND AND GROWTH SHORT-TERM TOXICITY TEST

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client/ID: MRS - Morro Bay Comp. Effluent

Date Tested: 07/24/19 - 07/26/19

TEST SUMMARY

Species: *Macrocystis pyrifera.*
Protocol: EPA Method 1009.0.
Test type: Static.
Test chamber: glass beaker.
Temperature: 15 +/- 1°C.
Number of spores per ml: 7,500 (approx.).
QA/QC Batch No.: RT-190724 (ran concurrently).

Source: Field collected.
Dilution water: Client supplied receiving water.
Endpoints: NOEC, IC25 at 48 hrs.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.

RESULTS SUMMARY

Sample Concentration	Percent Germination		Mean Germ Tube Length (μm)	
Control-Brine (Receiving Water)	83.8%		15.10	
Control-Dilution (Receiving Water)	86.0%		15.70	
Control-Culture (Lab Water)	82.4%		15.70	
3.2%	83.0%		15.60	
5.6%	82.8%		15.00	
10%	82.2%		15.55	
18%	71.2%	*	13.30	*
32%	62.9%	*	11.45	*

* Statistically significantly less than control at P = 0.05 level
Controls not statistically significantly different from each other.
Dilution water is client supplied receiving water.
Culture water control obtained from The Cultured Abalone Farm.

CHRONIC TOXICITY

END POINT	GERMINATION	GERM TUBE LENGTH
NOEC	10%	10%
TUc (100/NOEC)	10.0	10.0

QA/QC TEST ACCEPTABILITY

Parameter	Result
Mean control germination ≥ 70%	PASS (86.0%)
Mean control germination tube length >10 μm	PASS (15.70 μm)
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-190724 report for additional test acceptability criteria.	

Macrocystis Germination and Growth Test-Proportion Germinated

Start Date:	7/24/2019 16:00	Test ID:	19072303kr	Sample ID:	MORRO BAY - RW
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera

Comments:

Conc-%	1	2	3	4	5
B-Control	0.8317	0.7981	0.8462	0.8416	0.8713
D-Control	0.8932	0.8614	0.7921	0.8614	0.8932
3.2	0.8519	0.8462	0.8020	0.8505	0.7981
5.6	0.7961	0.8073	0.7850	0.8627	0.8868
10	0.7822	0.8113	0.8627	0.8037	0.8515
18	0.6990	0.7547	0.6699	0.7524	0.6857
32	0.6765	0.5825	0.5043	0.6827	0.6972

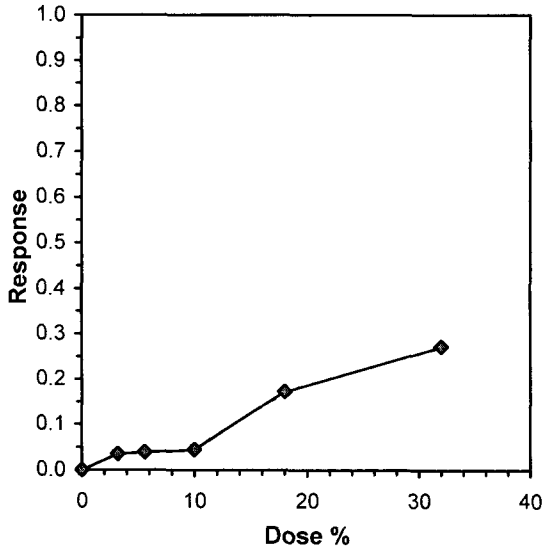
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	0.8378	0.9739	1.1572	1.1047	1.2039	3.098	5					
D-Control	0.8603	1.0000	1.1903	1.0973	1.2379	4.822	5	*			0.8605	1.0000
3.2	0.8297	0.9645	1.1463	1.1047	1.1757	3.130	5	1.224	2.360	0.0849	0.8302	0.9647
5.6	0.8276	0.9621	1.1453	1.0887	1.2276	5.308	5	1.253	2.360	0.0849	0.8273	0.9614
10	0.8223	0.9559	1.1370	1.0852	1.1913	3.923	5	1.483	2.360	0.0849	0.8221	0.9553
*18	0.7123	0.8281	1.0054	0.9588	1.0527	4.310	5	5.139	2.360	0.0849	0.7126	0.8282
*32	0.6286	0.7308	0.9169	0.7897	0.9882	9.302	5	7.601	2.360	0.0849	0.6262	0.7277

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94164	0.927	-0.4492	-0.3951
Bartlett's Test indicates equal variances (p = 0.61)	3.61845	15.0863		
The control means are not significantly different (p = 0.30)	1.09611	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	10	18	13.4164	10	0.06348	0.07364	0.05563	0.00324	3.0E-07	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	10.334	3.741	0.000	13.399	-0.4686
IC10	13.480	1.389	9.793	16.615	-0.0031
IC15	16.626	1.800	13.356	22.523	1.2367
IC20	21.924				
IC25	28.889				
IC40	>32				
IC50	>32				



Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	19072303kr	Sample ID:	MORRO BAY - RW
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera

Comments:

Conc-%	1	2	3	4	5
B-Control	16.000	14.750	14.750	15.000	15.000
D-Control	15.500	15.000	14.750	16.000	17.250
3.2	15.500	16.500	15.000	15.500	15.500
5.6	15.000	15.000	14.750	14.500	15.750
10	15.750	15.250	16.000	15.500	15.250
18	11.500	15.500	13.500	13.750	12.250
32	12.000	10.500	10.500	12.000	12.250

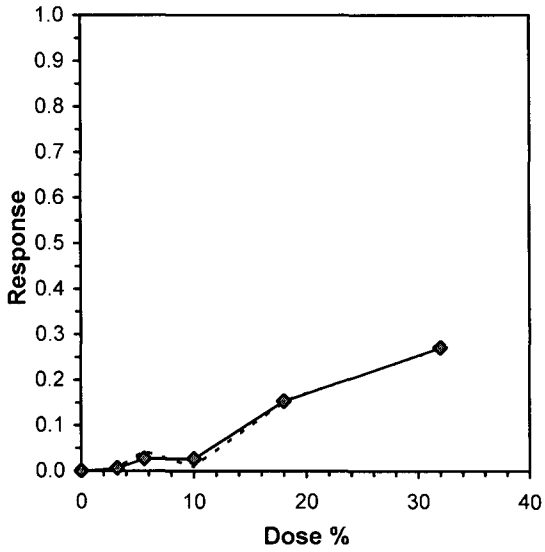
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	15.100	0.9618	15.100	14.750	16.000	3.433	5					
D-Control	15.700	1.0000	15.700	14.750	17.250	6.309	5	*			15.700	1.0000
3.2	15.600	0.9936	15.600	15.000	16.500	3.511	5	0.178	2.360	1.325	15.600	0.9936
5.6	15.000	0.9554	15.000	14.500	15.750	3.118	5	1.247	2.360	1.325	15.275	0.9729
10	15.550	0.9904	15.550	15.250	16.000	2.096	5	0.267	2.360	1.325	15.275	0.9729
*18	13.300	0.8471	13.300	11.500	15.500	11.541	5	4.276	2.360	1.325	13.300	0.8471
*32	11.450	0.7293	11.450	10.500	12.250	7.626	5	7.572	2.360	1.325	11.450	0.7293

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.97464	0.927	0.44002	1.20348
Bartlett's Test indicates equal variances (p = 0.06)	10.8106	15.0863		
The control means are not significantly different (p = 0.26)	1.2	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	10	18	13.4164	10	1.32455	0.08437	14.7183	0.7875	1.4E-07	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	11.458	3.330	0.163	15.559	-1.2622
IC10	14.638	2.305	10.203	21.294	-0.1147
IC15	17.818	2.788	12.635	25.545	0.3566
IC20	23.600	3.514	13.861	30.255	-0.3059
IC25	29.541				
IC40	>32				
IC50	>32				



Macrocystis Germination and Growth Test-Proportion Germinated

Start Date:	7/24/2019 16:00	Test ID:	KelpConRW2	Sample ID:	MORRO BAY
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-%	1	2	3	4	5
Lab-Control	0.8738	0.8462	0.8077	0.8519	0.7387
RW-Control	0.8932	0.8614	0.7921	0.8614	0.8932
RW-Brine	0.8317	0.7981	0.8462	0.8416	0.8713

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Lab-Control	0.8236	0.9574	1.1404	1.0343	1.2076	5.935	5	*		
RW-Control	0.8603	1.0000	1.1903	1.0973	1.2379	4.822	5			
RW-Brine	0.8378	0.9739	1.1572	1.1047	1.2039	3.098	5	-0.489	1.860	0.0637

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.95111	0.842	-0.9218	0.86302
F-Test indicates equal variances (p = 0.25)	3.56481	23.1545		
The control means are not significantly different (p = 0.24)	1.25753	2.306		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs Lab-Control	0.05081	0.06152	0.0007	0.00293	0.63823	1, 8

Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	KelpConRW2	Sample ID:	MORRO BAY
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-%	1	2	3	4	5
Lab-Control	15.750	15.500	16.000	15.750	15.500
RW-Control	15.500	15.000	14.750	16.000	17.250
RW-Brine	16.000	14.750	14.750	15.000	15.000

			Transform: Untransformed					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Lab-Control	15.700	1.0000	15.700	15.500	16.000	1.332	5	*	
RW-Control	15.700	1.0000	15.700	14.750	17.250	6.309	5		
RW-Brine	15.100	0.9618	15.100	14.750	16.000	3.433	5	19.50	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.82485	0.842	1.75084	3.55384
F-Test indicates equal variances (p = 0.11)	6.14286	23.1545		
The control means are not significantly different (p = 1.00)	0	2.306		
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates no significant differences				
Treatments vs Lab-Control				

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002

Client ID: Morro Bay – RW

Start Date: 07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
1	5.6	103	82	21	6	7	5	7	6	4	7	5	6	7
2	C	103	92	11	6	5	7	6	7	7	6	7	5	6
3	1.8	103	72	31	7	4	4	5	3	4	6	6	4	3
4	3.2	108	92	16	6	5	7	6	6	7	5	7	6	7
5	10	101	79	22	5	7	6	7	6	7	7	6	5	7
6	BC	101	84	17	5	7	6	7	8	7	6	5	7	6
7	3.2	102	69	33	4	5	5	3	4	6	7	7	3	4
8	C	101	87	14	7	6	7	5	3	7	6	7	6	6
9	5.6	109	88	21	6	7	7	6	5	7	7	4	4	7
10	3.2	103	60	43	5	4	3	7	3	7	3	3	4	3
11	3.2	104	88	16	6	7	7	5	7	8	7	6	6	7
12	1.8	106	80	26	6	7	6	5	7	7	6	5	7	6
13	BC	104	83	21	6	5	6	7	7	5	4	7	6	6
14	10	106	86	20	6	7	5	6	7	7	6	5	5	7
15	C	101	80	21	5	6	5	6	7	7	6	5	6	6
16	5.6	107	84	23	6	7	5	4	7	6	7	6	6	5
17	1.8	103	69	34	5	7	6	6	7	5	4	4	4	6
18	10	102	88	14	7	6	7	5	7	6	6	7	6	7
19	3.2	101	81	20	3	7	8	7	6	6	3	5	7	8
20	1.8	105	79	26	5	4	7	6	4	6	5	6	6	6

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay – RW

Start Date: 07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
21	BC	104	88	16	7	5	7	4	7	6	6	5	6	6
22	C	101	87	14	6	7	6	7	5	7	6	7	6	7
23	5.6	102	88	14	6	4	5	7	7	6	5	7	5	6
24	32	117	59	58	3	7	3	2	6	2	3	4	6	6
25	3.2	107	91	16	7	6	7	5	7	6	6	7	5	6
26	10	107	86	21	6	7	7	6	5	7	6	5	7	6
27	BC	101	85	16	7	6	5	7	3	7	6	7	6	6
28	32	104	71	33	5	5	6	7	4	4	3	7	4	3
29	3.2	104	83	21	7	6	6	5	6	7	7	5	6	7
30	18	105	72	33	6	4	7	7	5	4	3	6	3	4
31	C	103	92	11	7	8	7	6	7	8	7	7	6	6
32	10	101	86	15	6	7	7	6	5	4	7	6	6	7
33	BC	101	88	13	6	6	6	5	7	6	5	7	6	6
34	5.6	106	94	12	6	7	7	6	5	7	6	7	5	7
35	32	109	76	33	4	7	6	5	5	4	4	5	4	5
36														
37														
38														
39														
40														

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A-19072303-002
Client ID: Morro Bay - RW

Start Date: 07/24/2019

WATER QUALITY READINGS

	Initial Readings				24 Hr		Final Readings			
Sample	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Brine Control	15.1	7.9	8.0	34	15.3	8.0	15.4	8.1	8.0	34
Control	15.2	8.0	8.0	34	15.2	8.0	15.4	8.0	8.0	34
3.2%	15.1	7.9	8.0	34	15.2	8.0	15.1	8.1	8.0	34
5.6%	15.0	7.8	8.0	34	15.2	8.0	15.4	8.0	8.0	34
10%	14.9	7.7	8.1	34	15.1	8.0	15.1	8.0	8.0	34
18%	14.9	7.7	8.1	33	15.1	8.0	15.7	8.0	8.1	34
32%	14.8	8.2	8.0	33	15.0	8.1	15.6	8.1	8.1	34

Sample as received: Chlorine: 0 mg/l; pH: 7.7; Salinity: 0 ppt; Temp: 13 °C; DO: 5.9 mg/l; NH_3-N: 30 mg/l

Control/dilution water is client supplied receiving water.

Illumination (16 hr light / 8 hr dark at 50 ± 10 uE/m^2/s) at 5 locations in incubator: (four corners and center): 44, 40, 42, 41, 45 uE/m^2/s.

Initial readings: Analyst: [signature] Date: 7-24-19 Time: 1600

Final readings: Analyst: [signature] Date: 7-26-19 Time: 1600

Aquatic Testing Laboratories

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Lab No.: A-19072303-002
Client ID: Morro Bay - RW

Start Date: 07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	5.6	13	BL	25	3.2	~
2	C	14	10	26	10	
3	18	15	C	27	BL	
4	3.2	16	5.6	28	32	
5	10	17	18	29	3.2	Need 7500/ml x 200 ml = 1,500,000 spores.
6	BL	18	10	30	18	
7	32	19	3.2	31	C	Add 1.0 ml spore stock of 6 spores per 5x5 hemacytometer grid
8	C	20	18	32	10	
9	5.6	21	BL	33	BL	
10	32	22	C	34	5.6	
11	3.2	23	5.6	35	32	
12	18	24	32			

Analyst: _____ Date: 7-24-19 Time: 0830

Aquatic
Testing
Laboratories

Topsmelt Larvae Survival and Growth Short-Term Toxicity Test

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

TOPSMELT LARVAE CHRONIC BIOASSAY
SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

Lab No.: A19072303-001/003
Client/ID: Morro Bay WWTP

Date Tested: 07/23/19 - 07/30/19

TEST SUMMARY

Species: *Atherinops affinis*.
Protocol: EPA/600/R-95/136.
Test type: Static renewal (90% daily).
Food: 40 b.s. nauplii per larvae 2X daily.
Test solution volume: 200 ml.
Number of larvae per chamber: 5.
Photoperiod: 16hr light / 8hr dark.
Dil. water: Client supplied receiving water.

Source: Aquatic BioSystems.
Endpoints: NOEC, TUc.
Age: 11 days (9-15 days).
Test chamber size: 600 ml.
Number of replicates: 5.
Temperature: 20 +/- 1°C.
Salinity: 33 +/- 2 o/oo.
QA/QC Batch No.: RT-190723

RESULTS SUMMARY

Sample Concentration	Percent Survival		Mean Weight of Larvae (Biomass)	
Control-Brine (Receiving Water)	100%		2.078 mg	
Control-Dilution (Receiving Water)	100%		2.388 mg	
Control-Culture (Aquatic BioSystems)	96%		2.386 mg	
3.2%	96%		2.531 mg	
5.6%	92%		2.676 mg	
10.0%	100%		3.028 mg	
18.0%	100%		2.562 mg	
32.0%	92%		2.415 mg	

* No concentration statistically significantly less than control at P = 0.05 level.
Controls not statistically significantly different from each other.
Culture water control obtained from organism supplier Aquatic BioSystems.

CHRONIC TOXICITY

END POINT	SURVIVAL	GROWTH
NOEC	32%	32%
TUc (100/NOEC)	3.125	3.125

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control survival ≥80%	PASS (100%)
Average dry weight of control ≥0.85 mg (when starting with 9 day old larvae)	PASS (average control dry weight = 2.388 mg (11 day old))
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-190723 report for additional QA Information	

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	19072303tr	Sample ID:	Morro Bay - Receiving Water
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/22/2019 07:30	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
B-Control	1.0000	1.0000	1.0000	1.0000	1.0000
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
3.2	1.0000	1.0000	1.0000	1.0000	0.8000
5.6	1.0000	0.8000	1.0000	0.8000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000	1.0000
32	1.0000	0.8000	1.0000	0.8000	1.0000

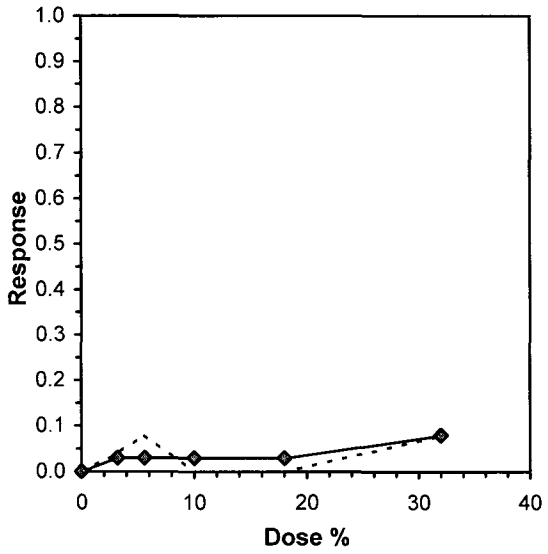
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
B-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5				
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	*		1.0000	1.0000
3.2	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5	25.00	16.00	0.9700	0.9700
5.6	0.9200	0.9200	1.2500	1.1071	1.3453	10.434	5	22.50	16.00	0.9700	0.9700
10	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00	0.9700	0.9700
18	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00	0.9700	0.9700
32	0.9200	0.9200	1.2500	1.1071	1.3453	10.434	5	22.50	16.00	0.9200	0.9200

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.81126	0.927	-0.9676	0.45312
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	32	>32		3.125
Treatments vs D-Control				

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	23.600			
IC10	>32			
IC15	>32			
IC20	>32			
IC25	>32			
IC40	>32			
IC50	>32			



Reviewed by:

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	19072303tr	Sample ID:	Morro Bay - Receiving Water
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/22/2019 07:30	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis

Comments:

Conc-%	1	2	3	4	5
B-Control	1.5860	2.1740	2.2600	2.0720	2.2960
D-Control	2.5420	2.3180	2.4420	1.9360	2.7040
3.2	2.7580	2.7720	2.8820	2.1380	2.1040
5.6	2.7500	3.5860	2.3500	2.4220	2.2700
10	3.4600	3.2100	2.7340	2.9680	2.7680
18	2.5420	2.7820	2.2980	2.7840	2.4060
32	2.4840	2.6440	2.2860	2.2200	2.4400

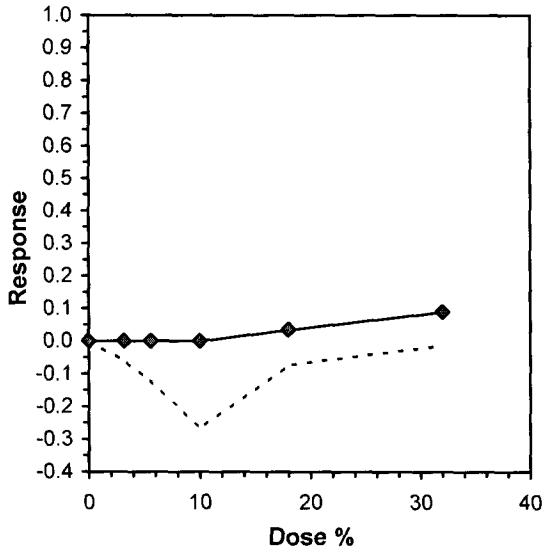
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	2.0776	0.8699	2.0776	1.5860	2.2960	13.866	5					
D-Control	2.3884	1.0000	2.3884	1.9360	2.7040	12.129	5	*			2.6557	1.0000
3.2	2.5308	1.0596	2.5308	2.1040	2.8820	14.911	5	-0.664	2.360	0.5058	2.6557	1.0000
5.6	2.6756	1.1202	2.6756	2.2700	3.5860	20.207	5	-1.340	2.360	0.5058	2.6557	1.0000
10	3.0280	1.2678	3.0280	2.7340	3.4600	10.144	5	-2.984	2.360	0.5058	2.6557	1.0000
18	2.5624	1.0729	2.5624	2.2980	2.7840	8.553	5	-0.812	2.360	0.5058	2.5624	0.9649
32	2.4148	1.0111	2.4148	2.2200	2.6440	6.945	5	-0.123	2.360	0.5058	2.4148	0.9093

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94593	0.927	0.70083	0.99528
Bartlett's Test indicates equal variances (p = 0.31)	5.97968	15.0863		
The control means are not significantly different (p = 0.13)	1.70106	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	32	>32		3.125	0.50584	0.21179	0.27418	0.11485	0.0682	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	21.745			
IC10	>32			
IC15	>32			
IC20	>32			
IC25	>32			
IC40	>32			
IC50	>32			



Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	Topsmelt-r	Sample ID:	CONTROLS-RW
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	AMB1-Ambient water
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
Control-RW	1.0000	1.0000	1.0000	1.0000	1.0000
ine Control-rw	1.0000	1.0000	1.0000	1.0000	1.0000
Culture Water	0.8000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Control-RW	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	*	
ine Control-rw	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5		
Culture Water	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5	25.00	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.62485	0.842	-2.5156	7.15179
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.306		
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates no significant differences				
Treatments vs Control-RW				

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	Topsmelt-r	Sample ID:	CONTROLS-RW
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	AMB1-Ambient water
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
Control-RW	2.5420	2.3180	2.4420	1.9360	2.7040
ine Control-rw	1.5860	2.1740	2.2600	2.0720	2.2960
Culture Water	2.0220	2.5180	2.2120	2.4120	2.7680

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control-RW	2.3884	1.1496	2.3884	1.9360	2.7040	12.129	5	*		
ine Control-rw	2.0776	1.0000	2.0776	1.5860	2.2960	13.866	5			
Culture Water	2.3864	1.1486	2.3864	2.0220	2.7680	11.977	5	0.011	1.860	0.3384

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96241		0.842		-0.3724	-0.6149
F-Test indicates equal variances (p = 0.98)	1.02722		23.1545			
The control means are not significantly different (p = 0.13)	1.70106		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs Control-RW	0.33844	0.1417	1E-05	0.08281	0.9915	1, 8

TOPSMELT CHRONIC BIOASSAY
Survival and Growth Raw Data Sheet

Aquatic Testing Laboratories

Lab No.: A-19072303-001/003 Start Date:07/23/2019

Client ID: Morro Bay -RW

Sample	Rep	Number of Live Larvae / Day							Final Results		Dry Weight (mg)		
		1	2	3	4	5	6	7	# Tested	# Dead	Total Wt.	Tare Wt.	
Control	A	5	5	5	5	5	5	5	5	0	375.81	363.10	33
	B	5	5	5	5	5	5	5	5	0	373.98	362.34	
	C	5	5	5	5	5	5	5	5	0	371.69	359.48	
	D	5	5	5	5	5	5	5	5	0	368.99	359.31	
	E	5	5	5	5	5	5	5	5	0	383.01	369.49	
3.2%	A	5	5	5	5	5	5	5	5	0	377.87	364.08	
	B	5	5	5	5	5	5	5	5	0	378.29	364.43	
	C	5	5	5	5	5	5	5	5	0	373.07	358.66	
	D	5	5	5	5	5	5	5	5	0	361.71	350.62	
	E	5	5	5	5	5	4	4	5	1	364.66	354.14	
5.6%	A	5	5	5	5	5	5	5	5	0	379.02	365.27	43
	B	5	5	5	5	4	4	4	5	1	382.09	364.16	
	C	5	5	5	5	5	5	5	5	0	374.23	362.48	
	D	5	5	5	5	5	4	4	5	1	376.27	364.16	
	E	5	5	5	5	5	5	5	5	0	370.38	359.03	
10%	A	5	5	5	5	5	5	5	5	0	384.92	367.62	
	B	5	5	5	5	5	5	5	5	0	374.70	358.65	49
	C	5	5	5	5	5	5	4~~5~~	5	0	378.59	364.92	
	D	5	5	5	5	5	5	5	5	0	371.53	356.69	
	E	5	5	5	5	5	5	5	5	0	375.19	361.35	
18%	A	5	5	5	5	5	5	5	5	0	374.17	361.46	
	B	5	5	5	5	5	5	5	5	0	375.84	361.93	
	C	5	5	5	5	5	5	5	5	0	376.86	365.37	
	D	5	5	5	5	5	5	5	5	0	378.95	365.03	
	E	5	5	5	5	5	5	5	5	0	360.17	348.14	
32%	A	5	5	5	5	5	5	5	5	0	361.30	348.88	58
	B	5	5	5	5	5	4	4	5	1	353.86	340.64	
	C	5	5	5	5	5	5	5	5	0	348.47	337.04	
	D	5	5	5	5	4	4	4	5	1	367.50	356.40	
	E	5	5	5	5	5	5	5	5	0	368.92	356.72	62

TOPSMELT CHRONIC BIOASSAY
Water Chemistries Raw Data Sheet

Aquatic Testing Laboratories

Lab No.: A-19072303-001/003 Start Date:07/23/2019

Client ID: Morro Bay – Receiving Water

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Analyst Initials:		2	2	2	2	2	2	2	2	2	2	2	2	2	2
Time of Readings:		1630	1530	1520	1520	1520	1530	1530	1530	1530	1530	1530	1545	1600	1630
Control	DO	8.5	7.2	7.4	7.1	7.0	6.3	6.9	5.9	6.7	6.4	7.0	6.1	7.3	5.8
	pH	8.0	7.9	8.0	7.9	7.9	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.5
	°C	19.9	19.7	19.9	20.2	20.1	20.1	20.1	20.2	20.2	20.1	20.2	20.0	20.1	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
3.2%	DO	8.8	7.1	7.3	6.6	7.0	6.1	6.7	5.9	6.4	6.0	6.6	6.2	7.1	5.6
	pH	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.8	7.9	7.8	7.9	7.8	8.0	7.9
	°C	20.0	19.8	20.0	20.1	20.1	20.1	20.1	20.2	20.2	20.2	20.2	20.0	20.2	20.3
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
5.6%	DO	8.8	6.9	7.2	6.5	7.0	6.0	6.7	5.9	6.3	5.8	6.9	5.8	7.1	5.7
	pH	8.1	8.0	8.1	7.9	8.0	7.9	8.0	7.8	7.9	7.8	8.0	7.9	8.0	7.8
	°C	19.9	19.9	19.9	20.1	20.1	20.1	20.0	20.1	20.2	20.2	20.2	20.0	20.2	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
10%	DO	8.7	6.9	7.1	6.6	7.1	6.1	6.5	5.8	6.3	6.1	6.8	5.9	7.1	5.6
	pH	8.1	8.0	8.1	7.9	8.0	7.9	8.0	7.9	7.9	8.0	8.0	7.9	8.1	7.9
	°C	20.0	19.8	19.9	20.1	20.1	20.1	20.0	20.2	20.2	20.1	20.2	20.0	20.1	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
18%	DO	8.6	6.7	7.1	6.7	6.8	6.0	6.4	5.7	6.3	5.8	6.8	5.4	7.0	5.5
	pH	8.1	8.0	8.1	8.0	8.1	7.9	8.0	7.8	8.0	7.9	8.0	7.9	8.1	7.9
	°C	20.1	19.7	19.9	20.0	20.1	20.0	20.0	20.1	20.2	20.1	20.2	20.1	20.2	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
32%	DO	8.5	6.6	6.9	6.4	6.7	5.9	6.2	5.6	6.1	5.5	6.5	5.2	6.9	5.4
	pH	8.1	8.0	8.1	8.0	8.1	8.0	8.1	7.9	8.0	8.0	8.1	8.0	8.1	8.0
	°C	20.2	19.7	19.8	20.0	20.1	20.0	20.0	20.2	20.2	20.1	20.2	20.1	20.2	20.3
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33

Comments:

Dissolved Oxygen (DO) readings in mg/l O_2; Salinity (Sal.) readings in ppt. **Sample 001** used for initial on Day 1; **Sample 002** used for initial (renewals) on Day 2 and Day 3; **Sample 003** used for initial (renewals) on Day 4, Day 5, Day 6, and Day 7.

TOPSMELT CHRONIC BIOASSAY

Aquatic Testing Laboratories

Lab No.: A-19072303-additional controls
Client ID: Morro Bay - RW

Start Date: 07/23/2019

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr	0 hr	24hr
Analyst Initials:		JZ	JZ	JZ	JZ	JZ	JZ	JZ	JZ	JZ	JZ	JZ	JM	JM	JZ
Time of Readings:		1650	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1600	1630
Receiving water Brine Control	DO	7.8	6.9	7.3	6.7	7.2	6.1	7.0	6.0	6.5	6.2	7.0	6.8	7.0	6.0
	pH	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.6	7.8	7.8	7.9	7.9	7.9	7.6
	°C	20.6	19.9	19.9	20.1	20.1	20.0	20.1	20.2	20.1	19.9	20.0	20.0	20.0	20.3
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33
Culture Water Control	DO	7.3	6.9	7.2	6.9	7.1	6.2	6.7	5.8	6.4	6.0	6.8	5.8	6.8	5.6
	pH	7.9	8.0	8.0	8.0	8.0	8.0	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.8
	°C	20.9	19.9	20.0	20.1	20.1	20.1	20.1	20.2	20.2	20.1	20.1	20.1	20.1	20.2
	Sal.	32	32	32	32	32	32	32	32	32	32	32	33	33	33

Comments: Brine Control made with similar amount of sea salts used to adjust salinity of highest concentration of effluent in test (32%). Culture Water Control supplied by test organism provider.
Dissolved Oxygen (DO) readings in mg/l O_2. Salinity (Sal.) in ppt.
Original sample used for all renewals. No ammonia (< 0.1 mg/L NH_3-N) detected in either sample. (control)

Sample	Rep	Number of Live Larvae / Day							Final Results		Dry Weight (mg)		
		1	2	3	4	5	6	7	# Tested	# Dead	Total Wt.	Tare Wt.	
RW Brine Control	A	5	5	5	5	5	5	5	5	0	360.71	352.78	63
	B	5	5	5	5	5	5	5	5	0	378.65	367.78	
	C	5	5	5	5	5	5	5	5	0	371.06	359.76	
	D	5	5	5	5	5	5	5	5	0	373.33	362.97	
	E	5	5	5	5	5	5	5	5	0	363.59	352.11	
Culture Water Control	A	5	5	5	5	5	5	4	5	0	370.13	360.02	28
	B	5	5	5	5	5	5	5	5	0	381.39	368.80	
	C	5	5	5	5	5	5	5	5	0	370.34	359.33	
	D	5	5	5	5	5	5	5	5	0	372.31	360.25	
	E	5	5	5	5	5	5	5	5	0	367.59	353.75	32

Additional Water Quality Parameters for 100% Effluent Samples as Received	Sample 001	Sample 002	Sample 003
DO (mg/L O_2)	4.7	5.9	4.7
pH	7.7	7.7	7.6
Salinity (ppt) - sample adjusted with sea salts	0	0	0
Ammonia (mg/l NH_3-N)	21	30	43

Aquatic
Testing
Laboratories

CHAIN OF CUSTODY

CHAIN OF CUSTODY

Client: City of Morro Bay Public Works

Address: Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442

Project Manager: John Gunderlock

Phone: (805) 772-6272

Fax:

Email: jgunderlock@morrobayca.gov

Purchase Order No:

Aquatic Testing Laboratories

4350 Transport St., Unit 107
Ventura, CA 93003
(805) 650-0546 Fax (805) 650-0756

Sample ID	Sample Date	Sample Time	Sample Type *	Chlorine (TRC)**	Number of Containers	Testing Requested
Comp ARS	07/22/19	0730	E	<.05	1 (2.5 gallon)	3 Species Marine Chronic
Comp ARS	07/23/19	0730	E	<.05	1 (2.5 gallon)	3 Species Marine Chronic
Sea Water	07/23/19	0745	RW	—	20 gallons	3 Species Marine Chronic

Special Instructions:

**** Note: Total residual chlorine must be taken immediately after sample collection if sample is a chlorinated effluent.**

* L - Liquid, S - Solid, SS - Semi-Solid/sludge, RW - Receiving Water, GW - Ground Water, E - Effluent

CUSTODY TRANSFERS

Relinquished by (signature)	Received by (signature)	Date (mm/dd/yy)	Time (hh:mm)	Custody Seals Intact? (Yes, No, NA)	Temperature Received (°C)
	—	7/23/19	1005	N/A	—
—		7.23.19	1105	N/A	—
		7.23.19	3pm	N/A	1.3°C
				N/A	

CHAIN OF CUSTODY

Client: City of Morro Bay Public Works

Address: Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442

Project Manager: John Gunderlock

Phone: (805) 772-6272

Email: jgunderlock@morrobayca.gov

Purchase Order No:

Aquatic Testing Laboratories

4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 Fax (805) 650-0756

Sample ID	Sample Date	Sample Time	Sample Type *	Chlorine (TRC)**	Number of Containers	Testing Requested
Comp ARS	7/25/19	0745	E	<.05	1 (2.5 gallon)	3 Species Marine Chronic

Special Instructions:

**** Note: Total residual chlorine must be taken immediately after sample collection if sample is a chlorinated effluent.**

* **L** - Liquid, **S** - Solid, **SS** - Semi-Solid/sludge, **RW** - Receiving Water, **GW** - Ground Water, **E** - Effluent

CUSTODY TRANSFERS

Relinquished by (signature)	Received by (signature)	Date (mm/dd/yy)	Time (hh:mm)	Sample Intact? (Yes, No)	Temperature Received (°C)
		7/25/19	1340	—	—
		7-26-19	1000	Yes	1.0°

Aquatic
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REFERENCE TOXICANT DATA

Aquatic
Testing
Laboratories

Abalone Larval Development Short-Term Toxicity Test

1. Test and Results Summary

2. Raw Data

3. Statistical Analyses

ABALONE LARVAL DEVELOPMENT
SHORT-TERM TOXICITY TEST
* REFERENCE TOXICANT *

Aquatic Testing Laboratories

QA/QC Batch No.: RT-190724

Date tested: 07/24/19 – 07/26/19

TEST SUMMARY

Species: *Haliotis rufescens*.
Protocol: EPA/600/R-95/136.
Test type: Static.
Test chamber: Plastic beakers.
Temperature: 15 +/- 1°C.
Number of embryos per chamber: 1600 (approx.).
Reference Toxicant: $ZnSO_4(7H_2O)$.

Source: Cultured Abalone Farm.
Dilution water: Lab seawater.
Endpoints: NOEC, IC25 at 48 hrs.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.
Ref. Tox. source: VWR.
Lot No.: 3357C295.

RESULTS SUMMARY

SAMPLE CONCENTRATION	PERCENT NORMAL DEVELOPMENT
Control	95.5%
10 µg/l	95.9%
18 µg/l	93.4%
32 µg/l	11.0% *
56 µg/l	0% *
100 µg/l	0% *
* Statistically significantly less than control at P = 0.05 level	

CHRONIC TOXICITY

NOEC	18 µg/l
IC25	21.7 µg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control normality ≥80%	Yes (95.5%)
56 µg/l treatment response significantly less than control response	Yes (NOEC = 18 µg/l)
%MSD <20% relative to control	Yes (%MSD = 6.2%)

Abalone Larval Development Test-Proportion Normal

Start Date:	7/24/2019 16:00	Test ID:	RT190724ab	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	ZNSO-Zinc sulfate
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	HR-Haliotis rufescens
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	0.9346	0.9266	0.9717	0.9537	0.9902
10	0.9903	0.9474	0.9316	0.9550	0.9717
18	0.9810	0.9115	0.9434	0.9375	0.8957
32	0.0714	0.1391	0.1682	0.0196	0.1509
56	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000

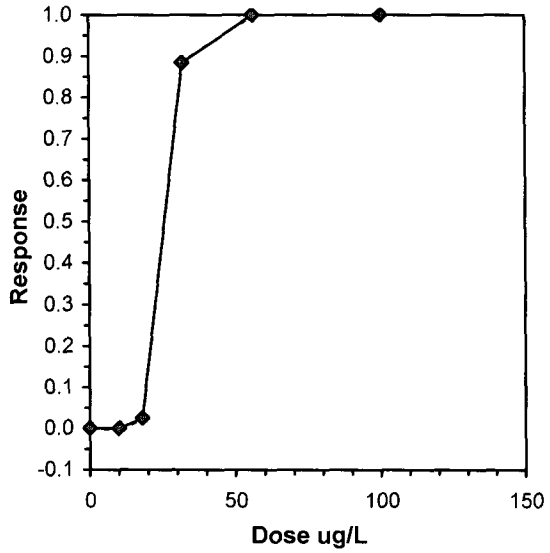
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9554	1.0000	1.3672	1.2965	1.4716	5.212	5				0.9566	1.0000
10	0.9592	1.0040	1.3753	1.3062	1.4721	4.666	5	-0.152	2.230	0.1188	0.9566	1.0000
18	0.9338	0.9774	1.3183	1.2419	1.4323	5.555	5	0.917	2.230	0.1188	0.9328	0.9752
*32	0.1099	0.1150	0.3230	0.1405	0.4226	36.396	5	19.602	2.230	0.1188	0.1107	0.1157
56	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94878	0.905	-0.3125	-0.022
Bartlett's Test indicates equal variances (p = 0.62)	1.78003	11.3449		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		0.05951	0.06204	1.33086	0.00709	1.1E-12	3, 16

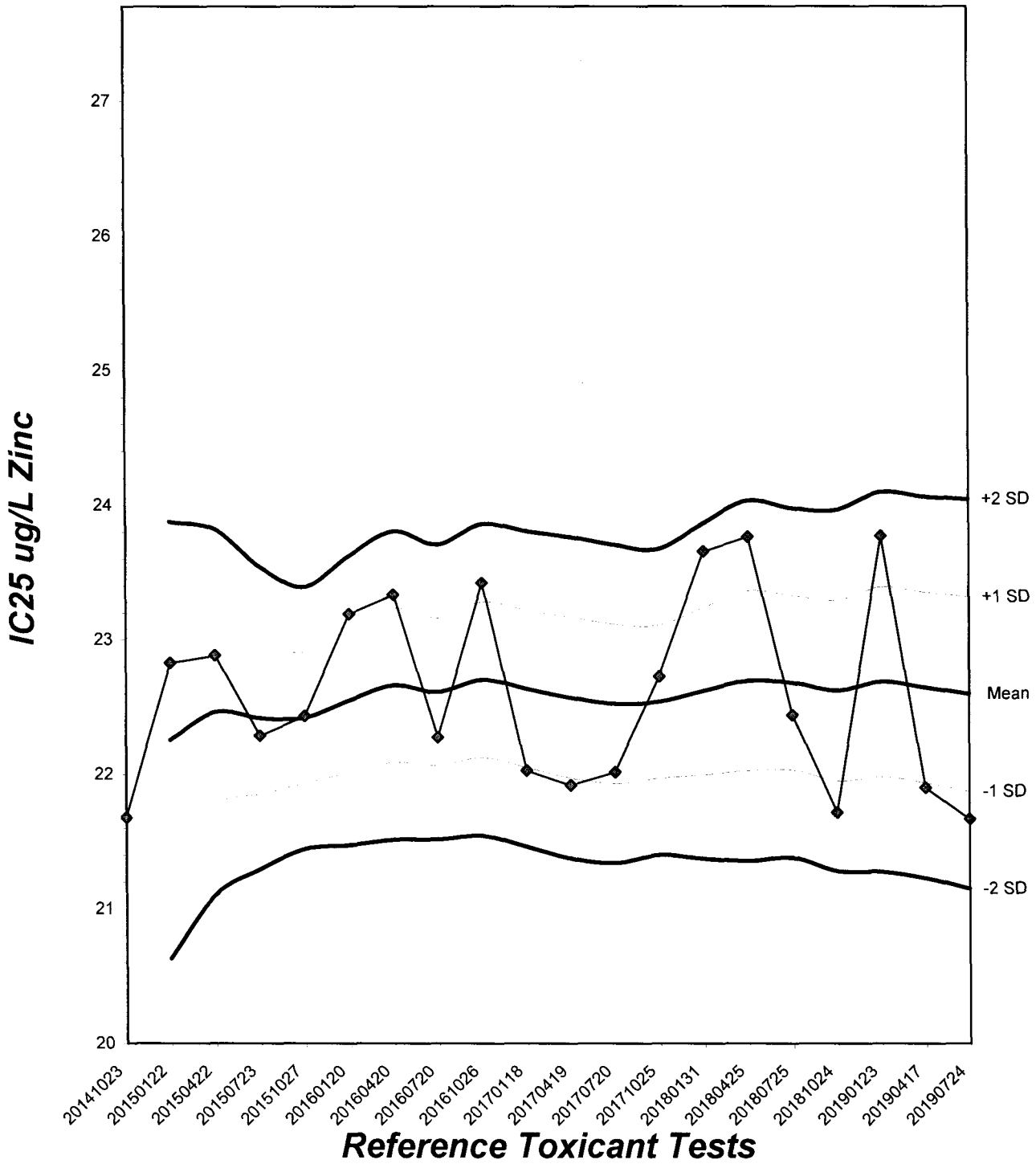
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	18.410	0.451	15.908	18.931	-3.5468
IC10	19.225	0.220	18.479	19.697	-0.2538
IC15	20.039	0.212	19.338	20.495	-0.2494
IC20	20.854	0.208	20.173	21.325	-0.2307
IC25	21.668	0.208	20.990	22.149	-0.2011
IC40	24.112	0.228	23.390	24.668	-0.1106
IC50	25.741	0.257	24.987	26.401	-0.0860



Abalone Larval Development Laboratory Control Chart

CV% = 3.2



ABALONE CHRONIC BIOASSAY
Reference Toxicant - Zinc Sulfate

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date: 07/24/2019

WATER QUALITY READINGS

	Initial Readings				24 Hr		Final Readings			
Sample	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Control	15.4	8.4	8.0	34	15.6	8.0	14.9	8.1	8.0	34
10 µg/l Zn	15.2	8.2	8.0	34	15.5	8.0	14.7	8.2	8.0	34
18 µg/l Zn	15.0	8.4	8.0	34	15.6	8.0	14.8	8.2	8.0	34
32 µg/l Zn	14.6	8.4	8.0	34	15.2	8.0	14.7	8.2	8.0	34
56 µg/l Zn	14.4	8.5	8.0	34	15.3	8.0	14.8	8.2	8.0	34
100 µg/l Zn	14.7	8.4	8.0	34	15.1	8.0	14.6	8.2	8.0	34

Control and dilutions made with laboratory reference seawater filtered to 0.2 µm.

Initial readings: [signature] Date/Time: 7-24-19 1600 Final readings: [signature] Date/Time: 7-26-19 1600

MICROSCOPIC EXAMINATION

Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal	Beaker No.	Sample Conc.	Number Normal	Number Abnormal
1	32	8	104	11	10	108	6	21	10	106	5
2	56	0	100	12	C	101	8	22	100	0	100
3	10	102	1	13	56	0	100	23	32	2	100
4	100	0	100	14	10	109	8	24	C	103	5
5	18	103	2	15	32	18	89	25	32	16	90
6	C	100	7	16	100	0	100	26	C	101	1
7	56	0	100	17	18	100	6	27	18	103	12
8	32	16	99	18	C	103	3	28	100	0	100
9	100	0	100	19	56	0	100	29	56	0	100
10	18	103	10	20	18	105	7	30	10	103	3

Microscopic examination: Analyst: [signature] Date: 7-27-19 Time: 0900

ABALONE CHRONIC BIOASSAY
Reference Toxicant - Zinc Sulfate

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date: 07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.
1	32	11	10	21	10
2	56	12	C	22	1W
3	10	13	56	23	32
4	1W	14	10	24	C
5	18	15	32	25	32
6	C	16	1W	26	C
7	56	17	18	27	18
8	32	18	C	28	1W
9	1W	19	56	29	56
10	18	20	18	30	10

Notes

Number Males used: 4

Number females used: 6

Time H_2O_2 added: 12:30

Time water changed: 15:00

Time spawned: ♂ 1505 ♀ 1523

Time placed in test: 1600

Add 1600 fertilized eggs per 200 ml..

Time glutaraldehyde added: 1600

Analyst: [signature] Date: 7-24-19 Time: 0800

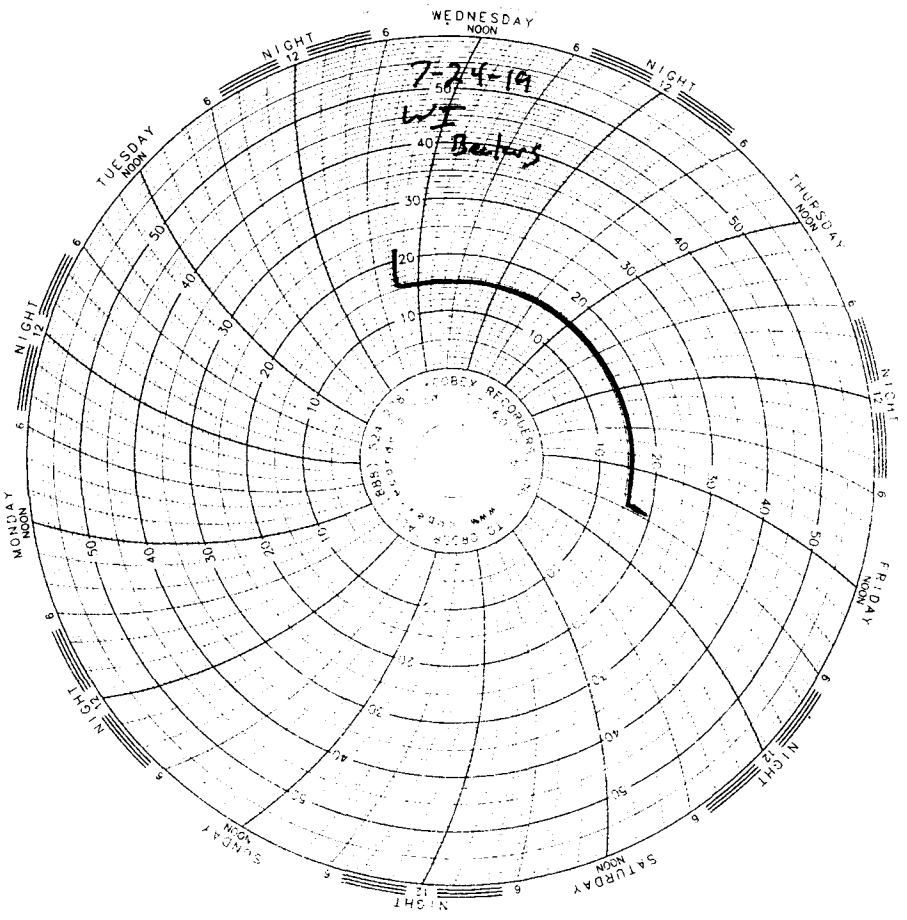
Aquatic Testing Laboratories

Test Temperature Chart

Test No: RT-190724

Date Tested: 07/24/19 to 07/26/19

Acceptable Range: 15 +/- 1°C



GIANT KELP GERMINATION AND AND GROWTH SHORT-TERM TOXICITY TEST

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

GIANT KELP GERMINATION AND GROWTH TEST
REFERENCE TOXICANT - COPPER

Aquatic Testing Laboratories

QA/QC Batch No.: RT-190724

Date Tested: 07/24/19 - 07/26/19

TEST SUMMARY

Species: *Macrocystis pyrifera.*
Protocol: EPA/600/R-95/136.
Test type: Static.
Test chamber: Plastic beakers.
Temperature: 15 +/- 1°C.
Number of spores per ml: 7,500 (approx.).
Standard toxicant: Copper chloride.
Lab seawater: 0.2 um filtered seawater.

Source: Field collected.
Dilution water: Lab seawater.
Endpoints: NOEC, IC25 at 48 hrs.
Test volume: 200 ml.
Aeration: None.
Number of replicates: 5.
Ref. tox. source: Mallinckrodt.

RESULTS SUMMARY

Sample Concentration	Percent Germination		Mean Germ Tube Length (μm)	
Control	84.6%		15.75	
10 μg/l	85.6%		16.10	
18 μg/l	82.3%		15.35	*
32 μg/l	64.3%	*	12.85	*
56 μg/l	54.8%	*	10.75	*
100 μg/l	16.9%	*	6.40	*
180 μg/l	5.2%	*	5.45	*
* Statistically significantly less than control at P = 0.05 level				

CHRONIC TOXICITY

Germination NOEC	18 μg/l
Germination IC25	33.2 μg/l
Germ Tube Growth NOEC	10 μg/l
Germ Tube Growth IC25	42.4 μg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Mean control germination ≥70%	Yes (84.6%)
Mean control germination tube length >10 μm	Yes (15.75 μm)
Germination tube growth NOEC <35 μg/l Copper	Yes (10 μg/l)
%MSD <20% relative to control (germination & growth)	Yes (germ = 10.1%, growth = 7.5%)

Macrocystis Germination and Growth Test-Proportion Germinated

Start Date:	7/24/2019 16:00	Test ID:	RT190724k	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	0.8532	0.8058	0.8679	0.8058	0.8952
10	0.8544	0.7921	0.8641	0.8962	0.8725
18	0.8611	0.7885	0.8039	0.8137	0.8491
32	0.7103	0.6106	0.6481	0.6422	0.6058
56	0.4571	0.6321	0.6239	0.5487	0.4771
100	0.3010	0.0962	0.2037	0.0962	0.1485
180	0.0648	0.0545	0.0192	0.1009	0.0190

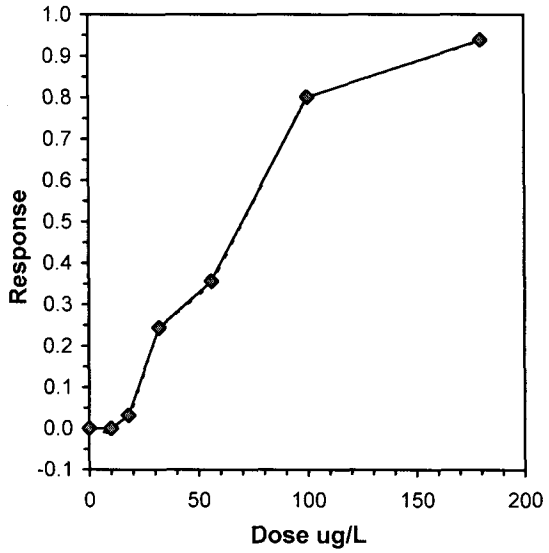
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8456	1.0000	1.1693	1.1145	1.2412	4.708	5				0.8512	1.0000
10	0.8559	1.0121	1.1837	1.0973	1.2428	4.540	5	-0.320	2.409	0.1080	0.8512	1.0000
18	0.8233	0.9736	1.1380	1.0929	1.1889	3.575	5	0.698	2.409	0.1080	0.8238	0.9678
*32	0.6434	0.7609	0.9313	0.8920	1.0024	4.744	5	5.307	2.409	0.1080	0.6433	0.7557
*56	0.5478	0.6478	0.8337	0.7425	0.9191	9.779	5	7.484	2.409	0.1080	0.5480	0.6438
*100	0.1691	0.2000	0.4150	0.3153	0.5807	27.088	5	16.822	2.409	0.1080	0.1692	0.1988
*180	0.0517	0.0612	0.2188	0.1385	0.3233	36.489	5	21.198	2.409	0.1080	0.0522	0.0614

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96961	0.934	0.32724	-0.2093
Bartlett's Test indicates equal variances (p = 0.41)	6.12675	16.8119		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		0.08517	0.10051	0.74187	0.00503	7.3E-20	6, 28

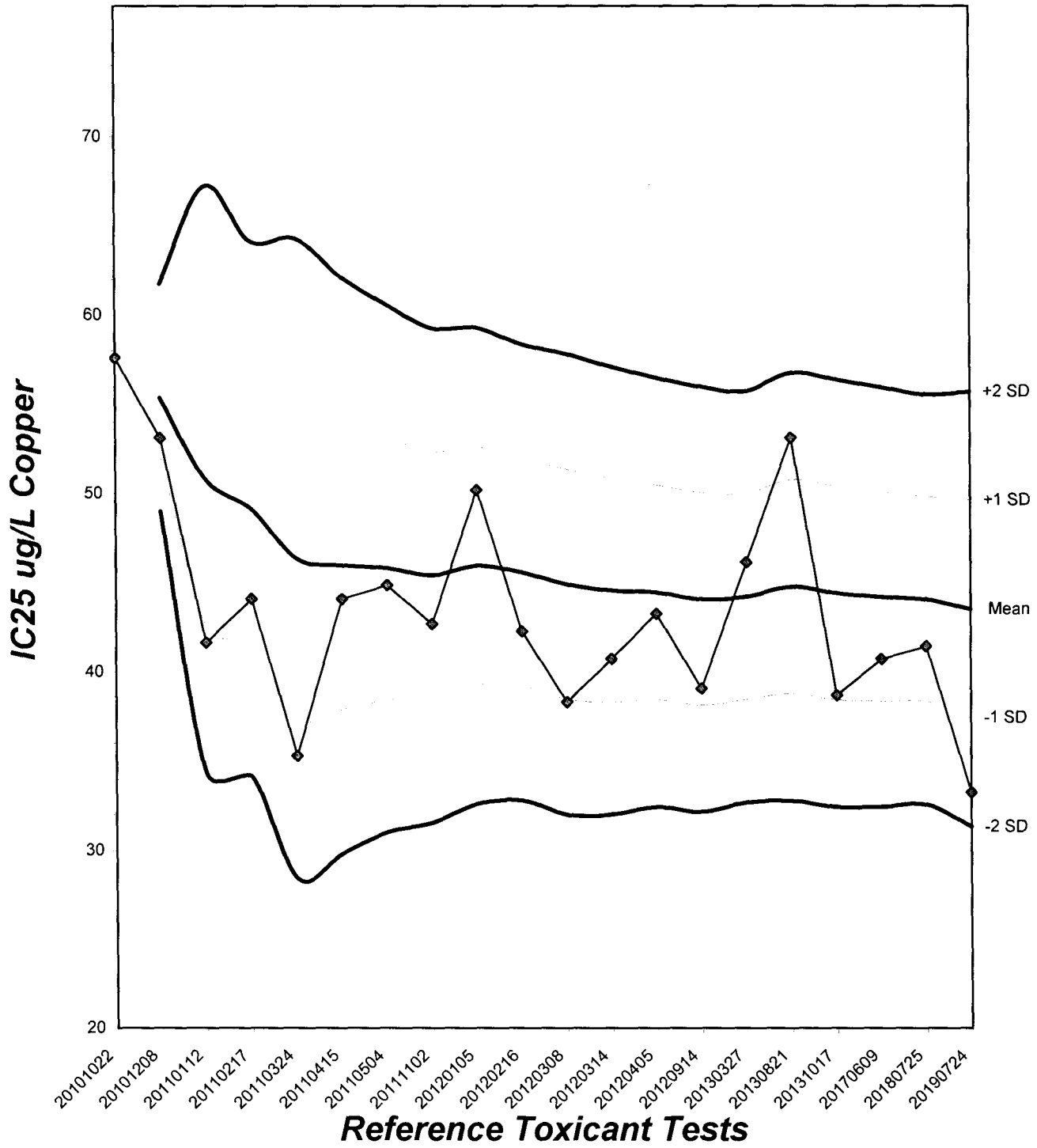
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	19.175	1.442	13.337	21.730	-0.9505
IC10	22.476	1.095	19.013	25.164	-0.2591
IC15	25.777	1.151	22.630	29.335	0.1008
IC20	29.078	1.371	25.715	33.934	0.6395
IC25	33.230	3.111	28.573	45.127	0.7887
IC40	60.330	3.511	46.908	67.900	-0.3820
IC50	70.219	2.925	60.314	77.603	-0.0422



Giant Kelp Germination Laboratory Control Chart

CV% = 14



Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	RT190724k	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	15.750	15.500	15.750	15.750	16.000
10	15.750	15.000	17.250	15.750	16.750
18	15.500	15.250	15.250	15.500	15.250
32	13.000	12.500	11.750	12.500	14.500
56	10.500	9.250	11.250	9.750	13.000
100	6.250	6.250	6.750	6.500	6.250
180	5.250	5.500	5.250	6.000	5.250

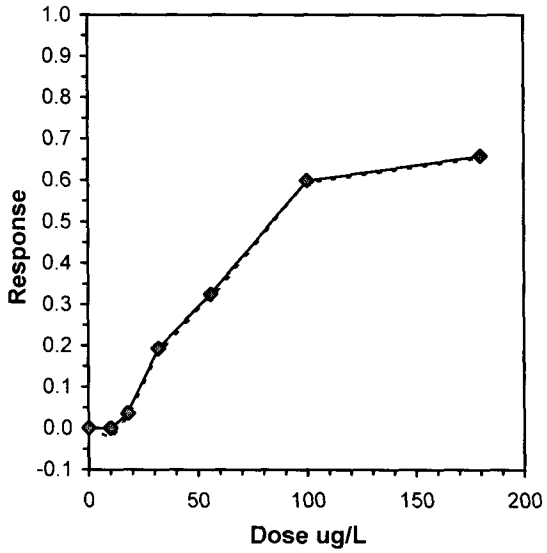
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
D-Control	15.750	1.0000	15.750	15.500	16.000	1.122	5			15.925	1.0000
10	16.100	1.0222	16.100	15.000	17.250	5.555	5	30.00	16.00	15.925	1.0000
*18	15.350	0.9746	15.350	15.250	15.500	0.892	5	16.00	16.00	15.350	0.9639
*32	12.850	0.8159	12.850	11.750	14.500	7.974	5	15.00	16.00	12.850	0.8069
*56	10.750	0.6825	10.750	9.250	13.000	13.660	5	15.00	16.00	10.750	0.6750
*100	6.400	0.4063	6.400	6.250	6.750	3.494	5	15.00	16.00	6.400	0.4019
*180	5.450	0.3460	5.450	5.250	6.000	5.981	5	15.00	16.00	5.450	0.3422

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.89266	0.934	0.96229	3.03257
Bartlett's Test indicates unequal variances (p = 2.37E-05)	31.1567	16.8119		

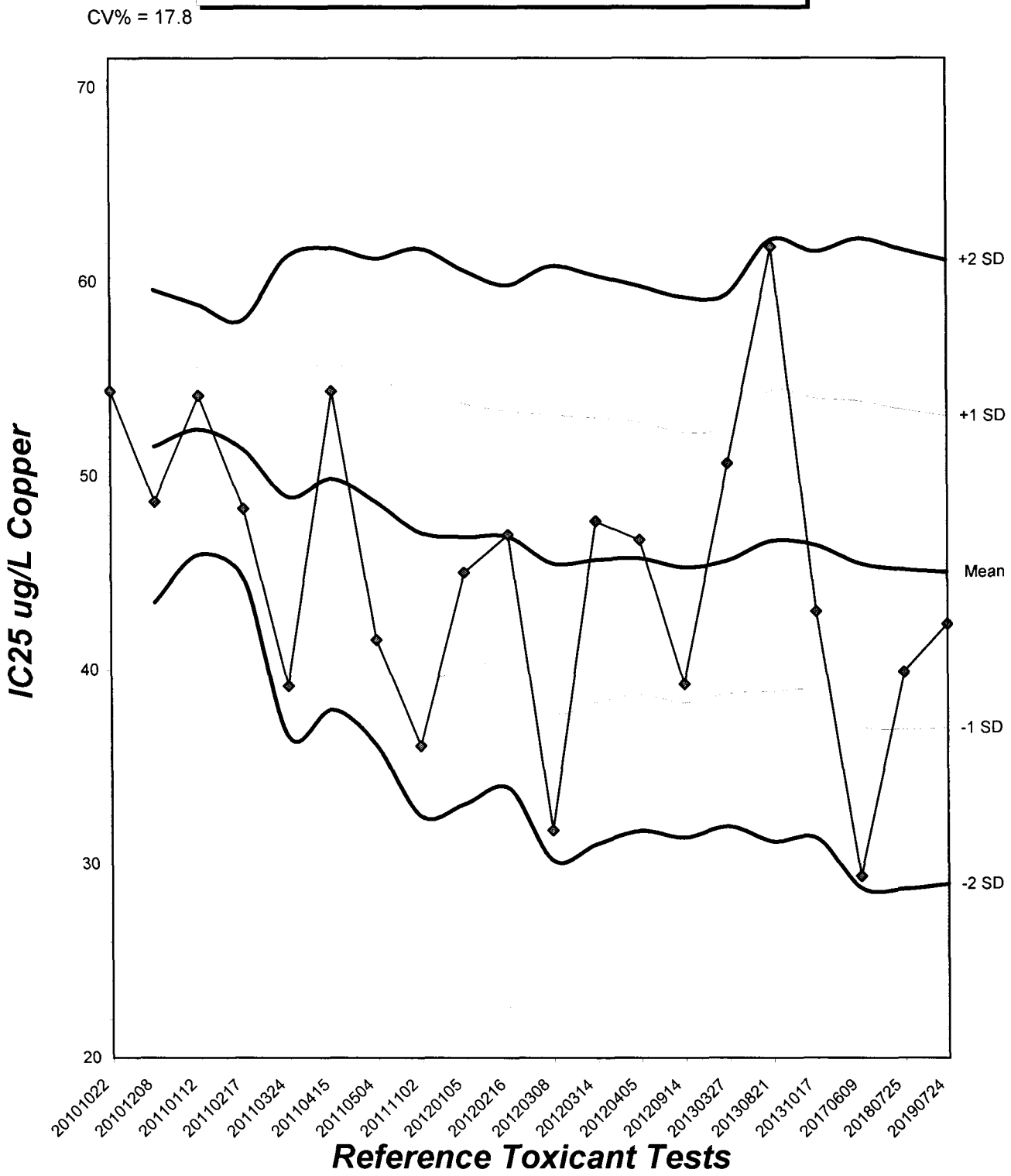
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	10	18	13.4164	
Treatments vs D-Control				

Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	19.239	1.062	15.395	21.835	-0.5169
IC10	23.698	1.426	20.266	29.327	1.0198
IC15	28.157	2.101	24.219	36.376	1.2592
IC20	33.257	3.624	27.369	44.982	1.1424
IC25	42.357	5.210	31.308	64.364	1.0226
IC40	68.087	4.881	51.601	79.496	-0.3272
IC50	84.195	2.573	75.129	90.016	-0.3930



Giant Kelp Germ Tube Length Laboratory Control Chart



Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	RT190724k	Sample ID:	REF-Ref Toxicant
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/24/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	15.750	15.500	15.750	15.750	16.000
10	15.750	15.000	17.250	15.750	16.750
18	15.500	15.250	15.250	15.500	15.250
32	13.000	12.500	11.750	12.500	14.500
56	10.500	9.250	11.250	9.750	13.000
100	6.250	6.250	6.750	6.500	6.250
180	5.250	5.500	5.250	6.000	5.250

			Transform: Untransformed					1-Tailed		
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	15.750	1.0000	15.750	15.500	16.000	1.122	5			
10	16.100	1.0222	16.100	15.000	17.250	5.555	5	-0.713	2.409	1.182
18	15.350	0.9746	15.350	15.250	15.500	0.892	5	0.815	2.409	1.182
*32	12.850	0.8159	12.850	11.750	14.500	7.974	5	5.911	2.409	1.182
*56	10.750	0.6825	10.750	9.250	13.000	13.660	5	10.191	2.409	1.182
*100	6.400	0.4063	6.400	6.250	6.750	3.494	5	19.057	2.409	1.182
*180	5.450	0.3460	5.450	5.250	6.000	5.981	5	20.994	2.409	1.182

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.89266	0.934	0.96229	3.03257
Bartlett's Test indicates unequal variances (p = 2.37E-05)	31.1567	16.8119		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		1.18171	0.07503	98.6518	0.60179	1.8E-20	6, 28

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date:07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
1	32	107	76	31	4	6	5	6	4	6	5	6	6	4
2	16	108	93	15	4	7	7	6	5	7	7	6	7	6
3	56	105	48	57	3	4	3	7	3	6	6	3	4	3
4	10	103	88	15	7	6	5	7	8	7	4	6	6	7
5	100	103	31	72	2	3	2	2	3	2	2	3	3	3
6	C	109	93	16	6	7	7	6	8	7	5	4	6	7
7	180	108	7	101	2	2	2	2	3	2	2	2	2	2
8	10	101	80	21	6	7	7	5	7	6	6	5	5	6
9	56	106	67	39	3	4	3	4	5	3	3	4	5	3
10	C	103	83	20	6	4	6	7	7	6	7	6	7	6
11	32	113	69	44	6	5	6	4	4	5	4	6	6	4
12	18	104	82	22	6	7	6	5	7	7	6	5	6	6
13	100	104	10	94	3	2	2	4	3	2	2	2	3	2
14	180	110	6	104	2	2	3	2	2	2	2	3	2	2
15	10	103	89	14	7	8	7	6	7	7	6	8	7	6
16	100	108	22	86	3	2	2	3	4	3	3	2	2	3
17	32	108	70	38	6	4	5	4	5	4	6	6	3	4
18	56	109	68	41	5	4	3	6	6	7	4	3	3	4
19	C	106	92	14	4	7	7	6	7	8	6	4	7	7
20	18	102	82	20	6	4	7	7	5	7	6	7	6	6

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date:07/24/2019

Dish No.	Sample Conc.	Total Number Counted	Number Germin.	Number Non-Germin.	Germ Tube Lengths (micrometer units)									
					A	B	C	D	E	F	G	H	I	J
21	180	104	2	102	2	2	2	2	3	2	2	2	2	2
22	100	104	10	94	3	2	2	4	2	2	3	3	3	2
23	32	109	70	39	4	6	6	7	4	5	4	4	6	4
24	10	106	95	11	6	7	6	5	4	8	7	7	6	7
25	C	103	83	20	6	7	7	6	5	7	6	6	7	6
26	56	113	62	51	4	5	3	3	4	7	3	4	3	3
27	180	109	11	98	2	3	3	2	3	2	2	3	2	2
28	18	102	83	19	6	7	7	6	5	7	4	6	7	7
29	C	105	94	11	7	6	8	5	7	6	6	7	6	6
30	100	101	15	86	3	2	2	3	2	2	3	3	2	3
31	18	106	90	16	5	7	6	6	5	7	6	7	6	6
32	56	109	52	57	4	6	7	4	6	6	8	4	4	3
33	180	105	2	103	2	2	2	2	2	3	2	2	2	2
34	32	104	63	41	6	5	7	6	7	6	4	5	6	6
35	10	102	89	13	7	6	7	8	7	7	6	5	7	7
36														
37														
38														
39														
40														

Comments:

Micrometer conversion factor: 1 unit = 2.5 um at 400X power

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

Aquatic Testing Laboratories

QA/QC No.: RT-190724

Start Date:07/24/2019

WATER QUALITY READINGS

	Initial Readings				24 Hrs		Final Readings			
Sample	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)	Temp (°C)	pH	Temp (°C)	DO (mg/l)	pH	Salinity (o/oo)
Control	15.5	8.2	8.0	34	15.5	8.0	15.8	7.9	8.0	34
10 µg/l	15.5	8.4	8.0	34	15.4	8.0	15.6	7.9	8.0	34
18 µg/l	15.6	8.4	8.0	34	15.4	8.0	15.4	8.0	8.0	34
32µg/l	15.5	8.5	8.0	34	15.4	8.0	15.7	8.1	8.0	34
56 µg/l	15.6	8.4	8.0	34	15.3	8.0	15.6	8.1	8.0	34
100 µg/l	15.5	8.4	7.9	34	15.3	7.9	15.2	8.1	8.0	34
180 µg/l	15.5	8.4	7.9	34	15.3	7.9	15.1	8.0	8.0	34

Comments:

Reference toxicant: Copper chloride.

All dilutions made with reference lab seawater.

Illumination (16 hr light / 8 hr dark at 50 ± 10 uE/m^2/s) at 5 locations in incubator:
(four corners and center): 44, 40, 42, 41, 45 uE/m^2/s.

Initial readings: Analyst: [signature] Date: 7-24-19 Time: 1600

Final readings: Analyst: [signature] Date: 7-26-19 Time: 1600

Aquatic Testing Laboratories

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST

QA/QC No.: RT-190724

Start Date:07/24/2019

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	32	11	32	21	180	31	18	Need 7500/ml x 200 ml = 1,500,000 spores. Add 1.0 ml spore stock of 6 spores per 5x5 hemacytometer grid
2	18	12	18	22	1W	32	56	
3	56	13	1W	23	32	33	180	
4	10	14	180	24	10	34	32	
5	1W	15	10	25	C	35	10	
6	C	16	1W	26	56			
7	180	17	32	27	180			
8	10	18	56	28	18			
9	56	19	C	29	C			
10	C	20	18	30	1W			

Analyst: _____ Date: 7-24-19 Time: 0800

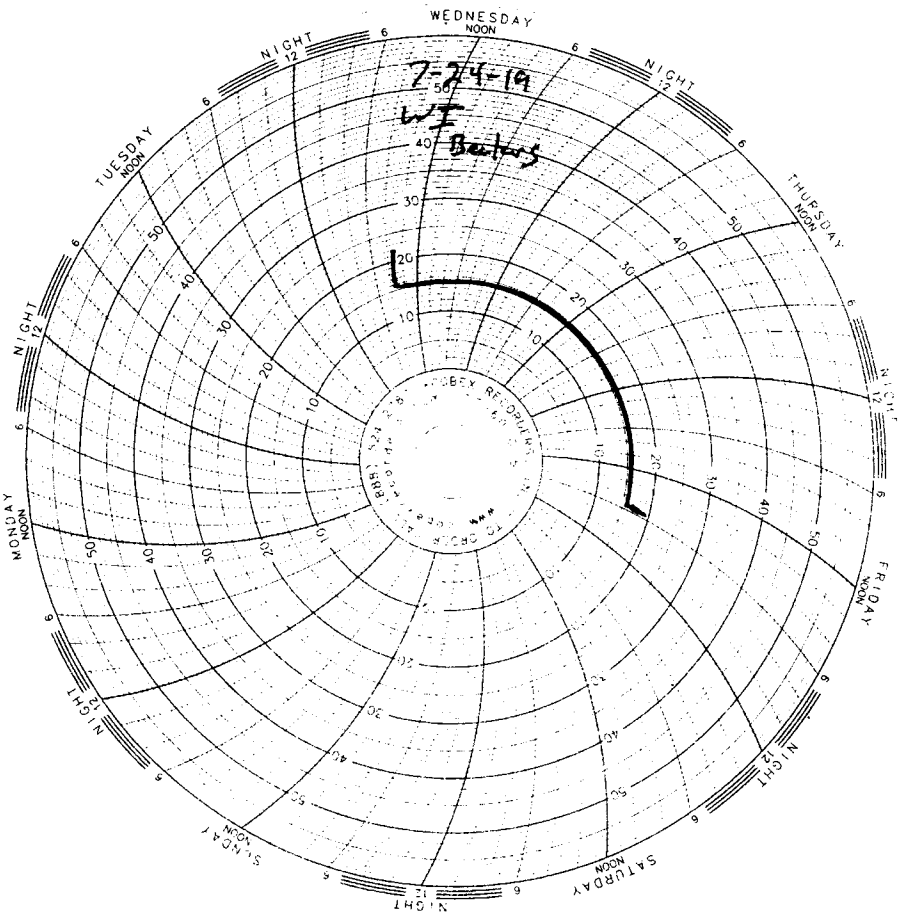
Aquatic Testing Laboratories

Test Temperature Chart

Test No: RT-190724

Date Tested: 07/24/19 to 07/26/19

Acceptable Range: 15 +/- 1°C



Aquatic
Testing
Laboratories

Topsmelt Larvae Survival and Growth Short-Term Toxicity Test

- *Test and Result Summary*
- *Data Summary and Statistical Analysis*
- *Raw Test Data: Water Quality & Test Organism Measurements*

TOPSMELT LARVAE CHRONIC BIOASSAY
REFERENCE TOXICANT - Copper

Aquatic Testing Laboratories

QA/QC Batch No.: RT-190723

Date Tested: 07/23/19 - 07/30/19

TEST SUMMARY

Species: *Atherinops affinis*.
Protocol: EPA/600/R-95/136.
Test type: Static renewal (90% daily).
Food: 40 b.s. nauplii per larvae 2X daily.
Test solution volume: 200 ml.
Number of larvae per chamber: 5.
Photoperiod: 16hr light / 8hr dark.
Dil. water: Laboratory sea water.

Source: Aquatic BioSystems.
Endpoints: LC50, IC25.
Age: 11 days (9-15 days).
Test chamber size: 600 ml.
Number of replicates: 5.
Temperature: 20 +/- 1°C.
Salinity: 33 +/- 2 o/oo.

RESULTS SUMMARY

Sample Concentration	Percent Survival		Mean Weight of Larvae (Biomass)	
Control	96%		2.058 mg	
56 µg/l	100%		2.790 mg	
100 µg/l	100%		2.473 mg	
180 µg/l	52%	*	1.232 mg	**
320 µg/l	8%	*	0.177 mg	**

* Statistically significantly less than control at P = 0.05 level.
** Concentrations with significantly less than control survival rates are not used in ANOVA comparisons.

CHRONIC TOXICITY

Survival LC50	193.6 µg/l
Biomass IC25	140.4 µg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control survival ≥80%	PASS (96%)
Average dry weight of control ≥0.85 mg (when starting with 9 day old larvae)	PASS (average control dry weight = 2.153 mg (11 day old))
Survival LC50 ≤2 SD of control chart mean	PASS (see chart)
Survival LC50 <205 µg/l Copper	PASS (LC50 = 193.6 µg/l Copper)
%MSD of <25% relative to control survival	PASS (%MSD = 13.9%)
%MSD of <50% relative to control growth	PASS (%MSD = 21.8%)
Concentration response relationship acceptable	PASS (Response curve normal)

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	RT190723t	Sample ID:	REF-Ref Toxicant
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	0.8000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000
180	0.8000	0.2000	0.4000	0.6000	0.6000
320	0.2000	0.0000	0.2000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5			1	25
56	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	17.00	0	25
100	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	17.00	0	25
*180	0.5200	0.5417	0.8055	0.4636	1.1071	30.117	5	15.50	17.00	12	25
*320	0.0800	0.0833	0.3208	0.2255	0.4636	40.662	5	15.00	17.00	23	25

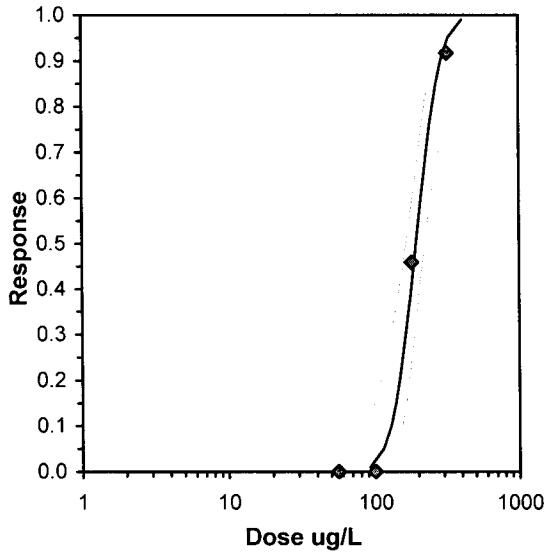
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.90709	0.918	-0.426	2.83085
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	
Treatments vs D-Control				

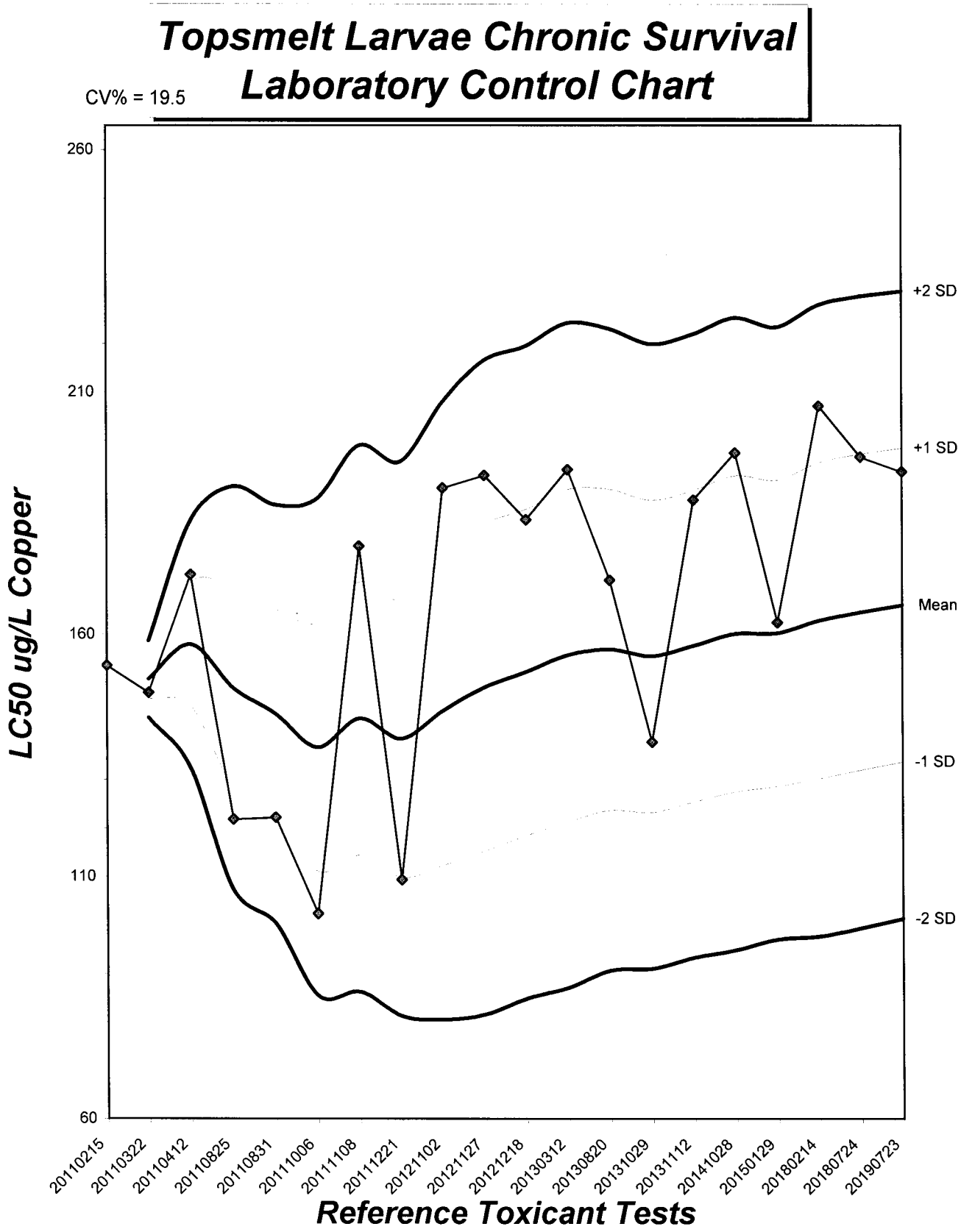
Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	7.2139	1.57257	4.13168	10.2961	0.04	1.84716	5.99146	0.4	2.28679	0.13862	13
Intercept	-11.497	3.62733	-18.606	-4.3871							
TSCR	0.0139	0.01589	-0.0173	0.04505							

Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	92.1111	49.5906	119.906
EC05	3.355	114.494	71.8718	140.868
EC10	3.718	128.571	87.352	153.927
EC15	3.964	139.034	99.448	163.729
EC20	4.158	147.954	110.063	172.247
EC25	4.326	156.061	119.873	180.2
EC40	4.747	178.515	147.106	204.023
EC50	5.000	193.55	164.561	222.284
EC60	5.253	209.852	182.02	244.929
EC75	5.674	240.044	209.921	295.078
EC80	5.842	253.198	220.643	319.879
EC85	6.036	269.442	233.061	352.597
EC90	6.282	291.369	248.779	400.007
EC95	6.645	327.193	272.731	484.578
EC99	7.326	406.7	321.388	700.166



Topsmelt Larvae Chronic Survival Laboratory Control Chart



Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID: RT190723t	Sample ID: REF-Ref Toxicant
End Date:	7/30/2019 16:30	Lab ID: CAATL-Aquatic Testing Labs	Sample Type: CUCL-Copper chloride
Sample Date:	7/23/2019	Protocol: EPAW 95-EPA/600/R-95/136	Test Species: AA-Atherinops affinis
Comments:			

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	0.8000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000
180	0.8000	0.2000	0.4000	0.6000	0.6000
320	0.2000	0.0000	0.2000	0.0000	0.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
D-Control	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5			
56	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	-0.570	2.300	0.1921
100	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	-0.570	2.300	0.1921
*180	0.5200	0.5417	0.8055	0.4636	1.1071	30.117	5	5.892	2.300	0.1921
*320	0.0800	0.0833	0.3208	0.2255	0.4636	40.662	5	11.695	2.300	0.1921

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.90709	0.918	-0.426	2.83085
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	180	134.164		0.12852	0.1386	1.02949	0.01744	8.6E-11	4, 20
Treatments vs D-Control										

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	RT190723t	Sample ID:	REF-Ref Toxicant
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	CUCL-Copper chloride
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	1.9540	1.9120	1.9460	2.2480	2.2280
56	2.5340	2.6660	2.3200	3.5980	2.8320
100	2.6520	2.6260	2.7240	2.1900	2.1740
180	1.3320	0.5900	0.9380	1.4580	1.8440
320	0.3480	0.0000	0.5380	0.0000	0.0000

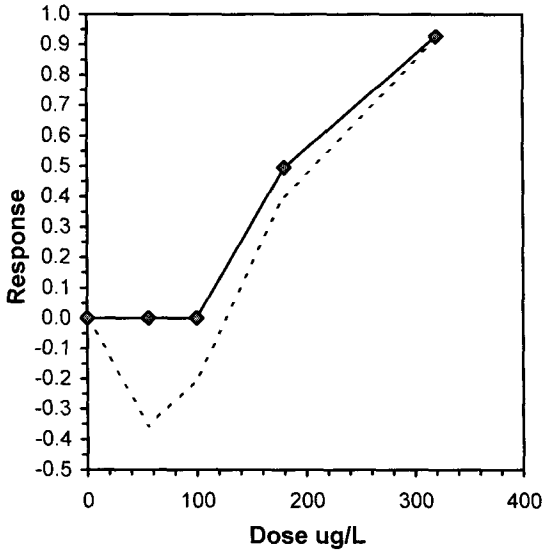
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	2.0576	1.0000	2.0576	1.9120	2.2480	8.048	5				2.4403	1.0000
56	2.7900	1.3559	2.7900	2.3200	3.5980	17.526	5	-3.447	2.110	0.4483	2.4403	1.0000
100	2.4732	1.2020	2.4732	2.1740	2.7240	10.848	5	-1.956	2.110	0.4483	2.4403	1.0000
180	1.2324	0.5990	1.2324	0.5900	1.8440	39.214	5				1.2324	0.5050
320	0.1772	0.0861	0.1772	0.0000	0.5380	142.081	5				0.1772	0.0726

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.91582	0.881	1.06013	2.13277
Bartlett's Test indicates equal variances (p = 0.13)	4.00769	9.21034		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	100	>100			0.44827	0.21786	0.67458	0.11284	0.0158	2, 12

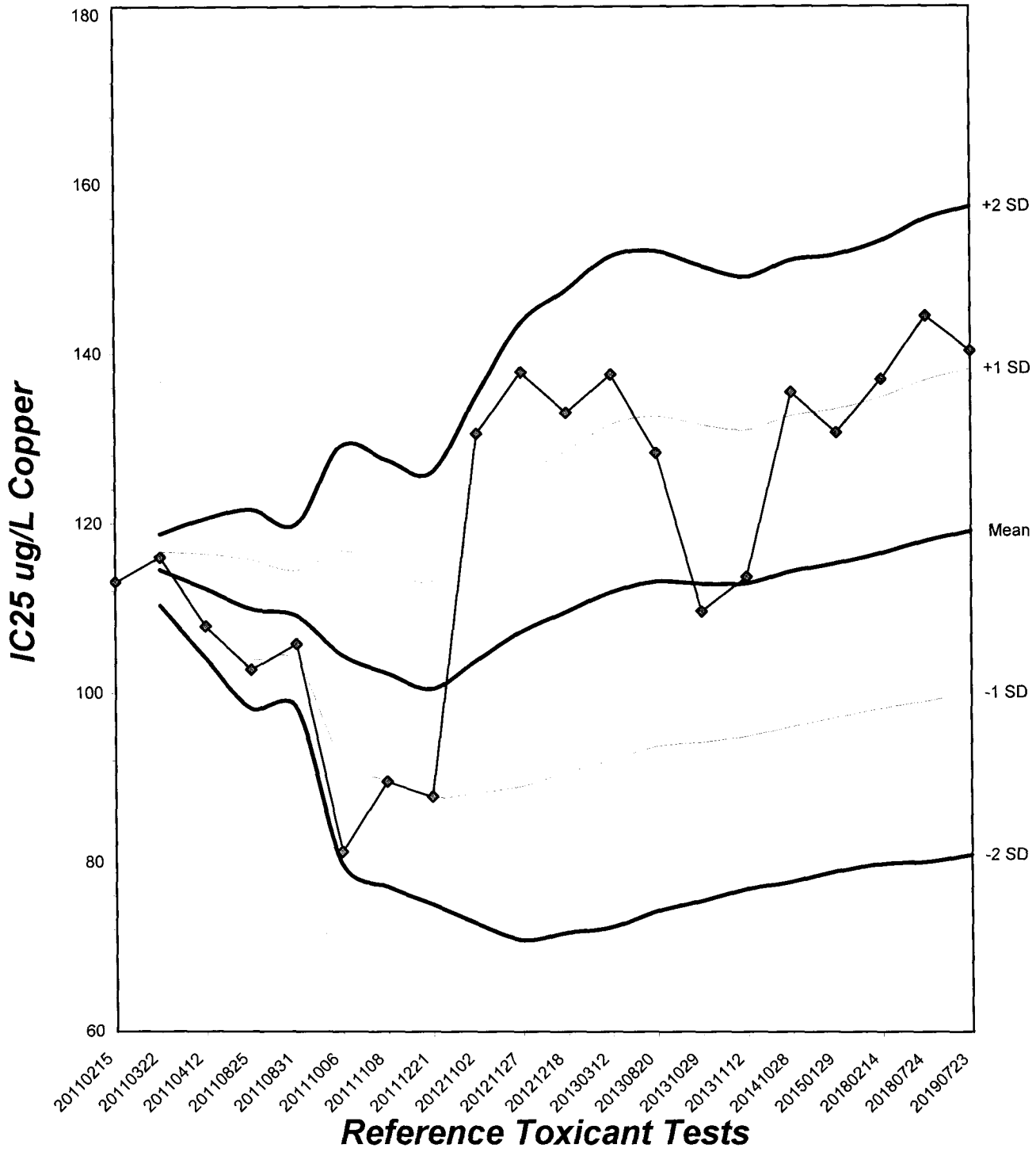
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05	108.08	7.42	69.82	111.78	-2.3359
IC10	116.16	5.35	96.89	123.55	-1.9763
IC15	124.24	5.65	105.29	135.46	-0.7100
IC20	132.32	6.35	113.25	148.66	0.2003
IC25	140.41	7.31	120.71	162.08	0.7088
IC40	164.65	10.91	141.22	207.67	0.9064
IC50	181.63	15.24	153.64	233.22	0.6417



Topsmelt Larvae Chronic Growth Laboratory Control Chart

CV% = 16.1



TOPSMELT CHRONIC BIOASSAY
Reference Toxicant - Copper
Survival and Growth Raw Data Sheet

Aquatic Testing Laboratories

QA/QC No.: RT-190723

Start Date:07/23/2019

Sample	Rep	Number of Live Larvae / Day							Final Results		Dry Weight (mg)		
		1	2	3	4	5	6	7	# Tested	# Dead	Total Wt.	Tare Wt.	
Control	A	5	5	5	5	5	5	5	5	0	376.76	366.99	1
	B	5	5	5	5	5	4	4	5	1	377.81	368.25	
	C	5	5	5	5	5	5	5	5	0	376.27	366.54	
	D	5	5	5	5	5	5	5	5	0	369.89	358.65	
	E	5	5	5	5	5	5	5	5	0	366.50	355.16	
56 µg/l	A	5	5	5	5	5	5	5	5	0	369.51	356.84	
	B	5	5	5	5	5	5	5	5	0	381.13	367.80	
	C	5	5	5	5	5	5	5	5	0	373.29	361.69	
	D	5	5	5	5	5	5	5	5	0	377.02	359.03	
	E	5	5	5	5	5	5	5	5	0	374.22	360.07	
100 µg/l	A	5	5	5	5	5	5	5	5	0	375.00	361.74	11
	B	5	5	5	5	5	5	5	5	0	378.38	365.25	
	C	5	5	5	5	5	5	5	5	0	373.93	360.31	
	D	5	5	5	5	5	5	5	5	0	360.04	349.09	
	E	5	5	5	5	5	5	5	5	0	372.40	361.53	
180 µg/l	A	5	5	5	5	5	5	4	5	1	370.75	364.09	
	B	5	5	5	5	5	2	1	5	4	364.09	361.14	
	C	5	5	5	5	5	3	2	5	3	351.42	346.73	
	D	5	5	5	5	5	5	3	5	2	343.24	336.05	
	E	5	5	5	5	5	4	3	5	2	325.30	316.08	
320 µg/l	A	5	5	5	5 &L	4	2	1	5	4	354.24	352.56	21
	B	5	5	2	1	0	0	0	5	5	—	—	
	C	5	5	3	2	2	2	1	5	4	345.47	342.78	22
	D	5	5	4	2	1	0	0	5	5	—	—	
	E	5	5	3	3	2	0	0	5	5	—	—	

Time placed in drying oven: 17W Temperature of drying oven: 60 °C (dry for 24 hr at 60°C)

Time placed in desiccator: 17W Analyst: [signature] Date/Time: 7-30-19 17W

Blank: 314.47 314.49

TOPSMELT CHRONIC BIOASSAY
Reference Toxicant - Copper
Water Chemistries Raw Data Sheet

Aquatic Testing Laboratories

QA/QC No.: RT-190723

Start Date:07/23/2019

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Analyst Initials:		J	J	J	J	J	J	J	J	J	J	J	M	M	J
Time of Readings:		1630	1530	1530	1530	1530	1530	1530	1530	1530	1530	1530	1550	1600	1630
Control	DO	7.6	7.0	7.4	6.9	7.0	6.1	6.6	5.9	6.9	6.2	7.0	6.4	7.3	6.1
	pH	8.1	7.9	8.0	7.8	8.0	7.6	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9
	Temp	20.5	19.9	20.0	20.1	20.2	20.0	20.1	20.2	20.2	20.0	20.1	19.9	20.1	20.2
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
56 µg/l	DO	7.6	6.8	7.3	6.9	7.1	6.3	6.6	6.0	6.9	6.7	6.9	6.3	7.2	6.0
	pH	8.1	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.1	7.9	8.1	7.8
	Temp	20.7	19.9	20.0	19.9	20.1	20.0	20.1	20.1	20.2	20.0	20.1	20.0	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 µg/l	DO	7.6	6.8	7.3	6.7	6.9	6.0	6.2	5.9	6.3	6.1	6.9	6.3	7.1	5.9
	pH	8.1	7.9	8.0	7.9	8.0	7.8	8.0	7.9	7.9	7.8	8.0	7.9	8.1	7.8
	Temp	20.8	19.9	20.0	19.9	20.2	20.0	20.1	20.2	20.2	20.0	20.3	20.0	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
180 µg/l	DO	7.5	6.9	7.4	6.6	7.0	6.1	6.7	5.9	6.5	6.3	6.9	6.5	7.1	5.9
	pH	8.1	7.9	8.0	7.8	8.0	7.9	8.0	7.9	8.0	8.0	8.1	7.9	8.1	7.9
	Temp	20.8	19.8	19.9	19.9	20.1	20.0	20.1	20.1	20.2	20.0	20.1	20.1	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
320 µg/l	DO	7.6	6.9	7.3	6.5	7.0	6.0	6.7	5.9	6.6	6.8	6.9	6.5	7.2	6.1
	pH	8.1	8.0	8.0	7.9	8.0	7.9	8.0	7.8	8.0	8.0	8.0	7.9	8.1	8.0
	Temp	20.8	19.9	20.0	19.9	20.1	20.0	20.1	20.1	20.2	20.0	20.1	20.1	20.2	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33

Comments:

Dissolved Oxygen (DO) readings in mg/l O_2.
Temperature (Temp) readings in °C.
Salinity (Sal.) readings in ppt.

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel: 970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 7/22/2019

SPECIES: *Atherinops affinis*

AGE: 10 day

LIFE STAGE: Larvae

HATCH DATE: 7/12/2019

BEGAN FEEDING: Immediately

FOOD: *Artemia* sp.

Water Chemistry Record:	**Current**	**Range**
TEMPERATURE:	21°C	18-21°C
SALINITY/CONDUCTIVITY:	32 ppt	28-32 ppt
TOTAL HARDNESS (as $CaCO_3$):	--	--
TOTAL ALKALINITY (as $CaCO_3$):	165 mg/l	140-170 mg/l
pH:	7.73	7.60-8.20

Comments:

Facility Supervisor

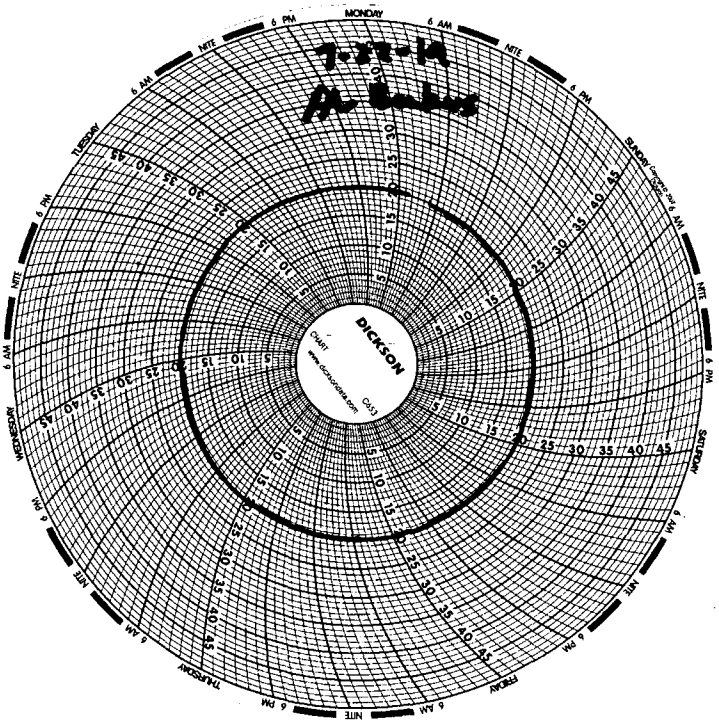
Aquatic Testing Laboratories

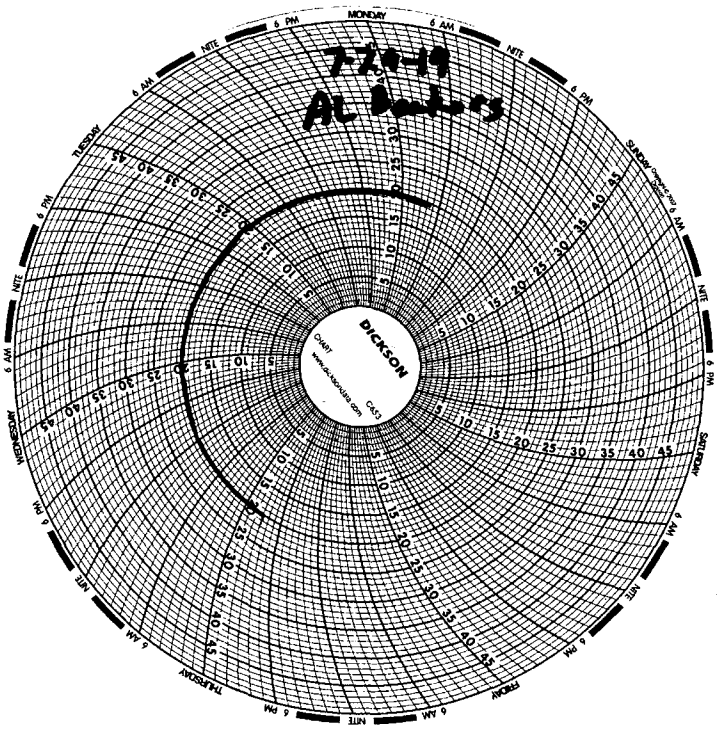
Test Temperature Chart

Test No: RT-190723

Date Tested: 07/23/19 to 07/30/19

Acceptable Range: 20 +/- 1°C





LABORATORY REPORT

Aquatic Testing Laboratories
"dedicated to providing quality aquatic toxicity testing"
4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 FAX (805) 650-0756
CA ELAP Cert. No.: 1775

Date: August 2, 2019

Client: City of Morro Bay Public Works
Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442
Attn: John Gunderlock

Laboratory No.: A-19072303-001/003
Sample I.D.: Comp ARS (control comparison)

Sample Control: The samples were received by ATL within the recommended hold time, in a chilled state and with the chain of custody record attached. Client supplied receiving water was sampled during a red tide and filtered prior to use. Testing conducted with additional side-by-side testing using lab seawater as dilution/control per client instruction. This is a comparison of the test controls.

Date Sampled:	07/22/19	07/23/19	07/25/19
Date Received:	07/23/19	07/23/19	07/26/19
Temp. Received:	1.3°C	1.3°C	1.0°C
Chlorine (TRC):	0.0 mg/l	0.0 mg/l	0.0 mg/l
Date Tested:	07/23/19 to 07/30/19		

Sample Analysis: The following analyses were performed on your sample:

Abalone Larval Development Short-Term Toxicity Test (EPA/600/R-95-136);
Giant Kelp Germination and Growth Short-Term Toxicity Test (EPA/600/R-95-136);
Topsmelt Larval Survival and Growth Test (EPA/600/R-95-136).

Result Summary:

Comparison of Controls Used in Tests

Control Source	Abalone Development (percent normal)	Kelp Spore Germination (percent germination)	Kelp Germ Tube Growth (length in µm)	Topsmelt Survival (percent survival)	Topsmelt Growth (weight in mg)
Laboratory Water	95.3%	82.4%	15.70	96%	2.058
Culture Water	95.5%	84.6%	15.75	96%	2.386
Receiving Water	**17.8%***	86.0%	15.70	100%	2.388

* Value statistically significantly less than laboratory control and unacceptable according to quality control test criteria (≥80%).
Note: Laboratory and culture water are the same for the abalone and kelp tests and obtained from the abalone test organism supplier the Culture Abalone Farm. Additional data from reference toxicant tests. Topsmelt culture water obtained from Topsmelt test organism supplier Aquatic BioSystems.
Please see individual effluent reports for additional information and statistical analysis.

Quality Control: Reviewed and approved by:

Joseph A. LeMay
Laboratory Director

Abalone Larval Development Test-Proportion Normal

Start Date:	7/24/2019 16:00	Test ID:	Control 2	Sample ID:	MORRO BAY
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:35	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	HR-Haliotis rufescens

Comments:

Conc-%	1	2	3	4	5
Lab-Control	0.9806	0.9439	0.9386	0.9717	0.9292
Culture-Control	0.9346	0.9266	0.9717	0.9537	0.9902
RW-Control	0.2054	0.1538	0.0648	0.0943	0.3704

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Lab-Control	0.9528	0.9973	1.3573	1.3015	1.4310	4.125	5	*		
Culture-Control	0.9554	1.0000	1.3672	1.2965	1.4716	5.212	5			
*RW-Control	0.1777	0.1861	0.4195	0.2574	0.6543	36.886	5	12.745	1.860	0.1368

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94837		0.842		0.82453	1.56119
F-Test indicates equal variances (p = 0.07)	7.63559		23.1545			
The control means are not significantly different (p = 0.81)	0.24462		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences Treatments vs Lab-Control	0.07291	0.07633	2.19876	0.01354	1.4E-06	1, 8

Macrocystis Germination and Growth Test-Proportion Germinated

Start Date:	7/24/2019 16:00	Test ID: Kelp Con 2	Sample ID: MORRO BAY
End Date:	7/26/2019 16:00	Lab ID: CAATL-Aquatic Testing Labs	Sample Type: EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol: EPAW 95-EPA/600/R-95/136	Test Species: MP-Macrocystis pyrifera
Comments:			

Conc-%	1	2	3	4	5
Lab-Control	0.8738	0.8462	0.8077	0.8519	0.7387
Culture-Cont	0.8532	0.8058	0.8679	0.8058	0.8952
RW-Control	0.8932	0.8614	0.7921	0.8614	0.8932

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Lab-Control	0.8236	0.9740	1.1404	1.0343	1.2076	5.935	5	*		
Culture-Cont	0.8456	1.0000	1.1693	1.1145	1.2412	4.708	5			
RW-Control	0.8603	1.0173	1.1903	1.0973	1.2379	4.822	5	-1.258	1.860	0.0738

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.88038	0.842	-0.9603	-0.1562
F-Test indicates equal variances (p = 0.76)	1.39071	23.1545		
The control means are not significantly different (p = 0.48)	0.74041	2.306		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs Lab-Control	0.0593	0.0718	0.00623	0.00394	0.24403	1, 8

Macrocystis Germination and Growth Test-Growth-Length

Start Date:	7/24/2019 16:00	Test ID:	Kelp Con 2	Sample ID:	MORRO BAY
End Date:	7/26/2019 16:00	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	EFF1-POTW
Sample Date:	7/23/2019 07:45	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	MP-Macrocystis pyrifera

Comments:

Conc-%	1	2	3	4	5
Lab-Control	15.750	15.500	16.000	15.750	15.500
Culture-Cont	15.750	15.500	15.750	15.750	16.000
RW-Control	15.500	15.000	14.750	16.000	17.250

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Lab-Control	15.700	0.9968	15.700	15.500	16.000	1.332	5	*		
Culture-Cont	15.750	1.0000	15.750	15.500	16.000	1.122	5			
RW-Control	15.700	0.9968	15.700	14.750	17.250	6.309	5	0.000	1.860	0.842

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.89116		0.842		1.15354	2.86216
F-Test indicates equal variances (p = 0.01)	22.4286		23.1545			
The control means are not significantly different (p = 0.69)	0.40825		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs Lab-Control	0.84195	0.05363	0	0.5125	1	1, 8

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/23/2019 16:30	Test ID:	Topsmelt	Sample ID:	CONTROLS
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	AMB1-Ambient water
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
Lab Seawater	1.0000	0.8000	1.0000	1.0000	1.0000
Culture Water	0.8000	1.0000	1.0000	1.0000	1.0000
ɔceiving Water	1.0000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Lab Seawater	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	*	
Culture Water	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5		
ɔceiving Water	1.0000	1.0417	1.3453	1.3453	1.3453	0.000	5	30.00	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.62485	0.842	-2.5156	7.15179
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.306		
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates no significant differences				
Treatments vs Lab Seawater				

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	7/23/2019 16:30	Test ID:	Topsmelt	Sample ID:	CONTROLS
End Date:	7/30/2019 16:30	Lab ID:	CAATL-Aquatic Testing Labs	Sample Type:	AMB1-Ambient water
Sample Date:	7/23/2019	Protocol:	EPAW 95-EPA/600/R-95/136	Test Species:	AA-Atherinops affinis
Comments:					

Conc-%	1	2	3	4	5
Lab Seawater	1.9540	1.9120	1.9460	2.2480	2.2280
Culture Water	2.0220	2.5180	2.2120	2.4120	2.7680
ɔceiving Water	2.5420	2.3180	2.4420	1.9360	2.7040

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Lab Seawater	2.0576	0.8622	2.0576	1.9120	2.2480	8.048	5	*		
Culture Water	2.3864	1.0000	2.3864	2.0220	2.7680	11.977	5			
ɔceiving Water	2.3884	1.0008	2.3884	1.9360	2.7040	12.129	5	-2.217	1.860	0.2775

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94323		0.842		-0.6493	0.58728
F-Test indicates equal variances (p = 0.30)	3.06078		23.1545			
The control means are not significantly different (p = 0.06)	2.22571		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs Lab Seawater	0.27749	0.13486	0.27357	0.05567	0.05747	1, 8