

**City of Morro Bay and
Cayucos Sanitary District**

**MONITORING AND
REPORTING PROGRAM**

EFFLUENT SAMPLING

**CHEMICAL AND BIOASSAY
ANALYSIS RESULTS**

JULY 2020



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 2020

Prepared by
Douglas A. Coats

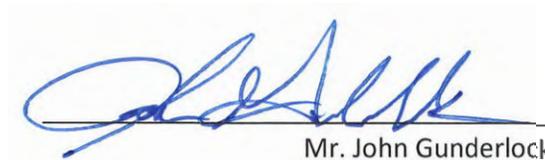
Marine Research Specialists

4744 Telephone Rd Ste 3 PMB 315
Ventura California 93003

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

August 2020

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: 8/17/2020

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 August 2020

Reference: Annual Effluent Self-Monitoring Report for January through December 2020

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 21st;
- Nutrient and ammonia concentrations within grab samples collected on July 21st; and
- Chronic bioassays conducted on composite samples collected on July 20th, 21st, and 23rd.

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 reported results with 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 2020 augment a comprehensive dataset spanning nearly three decades. Together, these measurements demonstrate the consistently benign character of the discharge from the MBSCD³ 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 2020 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 2020 composite and grab samples. Of those, nine had concentrations high enough to be quantified above their respective MLs. Three were nutrients whose discharge is not limited in the permit.⁴ The six remaining substances with quantifiable concentrations consist of ammonia, four trace metals, and the metalloid selenium. All of these substances are common wastewater constituents. Ammonia derives from its domestic

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 MBSCD discharge permit requires reporting of nitrate, urea, orthophosphate, and silica concentrations, they have no bearing on the compliance assessment of effluent quality.

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. The occurrence of a quantifiable selenium concentration within the July effluent sample is similar to that of the commonly occurring metals because it too occurs naturally in the mineralogy of the central California coast.

Regardless of their source, these five 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 2020 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, their presence is not indicative of 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 2020 effluent samples. At 0.27 µg/L, its concentration was three-orders of magnitude smaller than the 270-µg/L threshold deemed deleterious to marine organisms. Nevertheless, its sudden measurable presence in the July 2019 and 2020 effluent samples 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 recent chromium concentrations 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, a more costly and sensitive EPA Method 218.6 was required to specifically determine hexavalent chromium concentrations in the July 2019 and 2020 chemical assays. 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 0.27-µg/L chromium concentration found in the July 2020 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-2020 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 the: 1) Development of larval red abalone (*Haliotis rufescens*); 2) Germination of kelp (*Macrocystis pyrifera*) spores and the growth of kelp germ tubes; and 3) 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 seven- 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 2020

Bioassay Test	End Point (%)	Concentration (TU)	Limit (TU)
Topsmelt (<i>A. affinis</i>)			
Survival	32.0	3.12	134
Growth	32.0	3.12	134
Giant Kelp (<i>M. pyrifera</i>)			
Germination	32.0	3.12	134
Growth	18.0	5.56	134
Red Abalone (<i>H. rufescens</i>)			
Development	5.6	17.9	134

Future bioassays should be evaluated using red abalone test specimens alone. Red abalone is unequivocally the species most sensitive to MBCSD effluent exposure as demonstrated by the toxicity test results reported during 2020, and during prior eleven years (Table 2). In accordance with the toxicity-screening requirements of the current NPDES discharge permit, three-species bioassays were required during the first three years to identify the organism most sensitive to MBCSD effluent. Those studies are now complete and bioassays in future years can focus exclusively on the most sensitive species.

The other two test species (giant kelp and topsmelt) are consistently and measurably less sensitive. Red abalone was found to have seventeen of the highest 18 reported toxicity levels (≥ 17.9 TUc). Giant kelp was the next most-sensitive species. Kelp's 17.9 TUc measured in the July-2009 sample represents the only occasion when giant kelp toxicity ranged into the group of higher reported levels that was otherwise exclusively populated by red abalone. Moreover, red abalone toxicity in that particular sample was also higher-than-normal (31.2 TUc, third entry in Table 2), and exceeded the kelp toxicity. Topsmelt consistently exhibited the lowest sensitivity with all three of its tests at the bottom of the list (3.125 TUc).

Even with the clearly delineated hierarchy of species sensitivity, the highest reported toxicities of 31.2 TUc were well below the 134 TUc level deemed to be of concern for marine organisms. Adverse effects were not observed within effluent-seawater mixtures that were more than four-times more concentrated than allowed by the discharge permit. In 25 of the 28 test results listed in Table 2, adverse effects were not observed within effluent-seawater mixtures that were more than seven-times more concentrated than the compliance threshold.

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

Sincerely,

Douglas A. Coats
Program Manager

Table 2. Rank-Ordered Toxicity Results in Samples Collected over the past 12 Years

Year	Month	Test Species	Concentration (TU)
2019	7	Red Abalone	31.2
2013	7	Red Abalone	31.2
2009	7	Red Abalone	31.2
2020	7	Red Abalone	17.9
2018	7	Red Abalone	17.9
2017	7	Red Abalone	17.9
2017	1	Red Abalone	17.9
2016	7	Red Abalone	17.9
2016	1	Red Abalone	17.9
2015	7	Red Abalone	17.9
2015	1	Red Abalone	17.9
2014	7	Red Abalone	17.9
2014	1	Red Abalone	17.9
2013	1	Red Abalone	17.9
2012	7	Red Abalone	17.9
2011	7	Red Abalone	17.9
2010	7	Red Abalone	17.9
2009	7	Giant Kelp	17.9
2012	1	Red Abalone	10
2011	1	Red Abalone	10
2010	1	Red Abalone	10
2019	7	Giant Kelp	10
2018	7	Giant Kelp	10
2010	1	Giant Kelp	10
2020	7	Giant Kelp	5.56
2020	7	Topsmelt	3.125
2019	7	Topsmelt	3.125
2018	7	Topsmelt	3.125

ATTACHMENT A
MINIMUM LEVEL REPORTING

ATTACHMENT A
Analytical Results for Effluent Samples Collected during July 2020

Chemical Compound or Parameter	Units	Method	Detection Limit ^a	Practical ^b Quantification Limit	Minimum Level ^c	Permit ^d Limit	Reported Value
Nutrients							
Nitrate (as N)	mg/L	300.0	0.01	0.1	— ^e	— ^f	DNQ 0.03 Est. Conc.
Urea (as N)	mg/L	Mulvenna & Savidge	0.008	0.01	— ^e	— ^f	0.106 as measured
Ortho-Phosphate (as P)	mg/L	365.1	0.02	0.04	— ^e	— ^f	2.31 as measured
Dissolved Silica (SiO ₂)	mg/L	200.7	0.14	0.5	— ^e	— ^f	12. as measured
Objectives for the Protection of Marine Aquatic Life							
Ammonia (as N)	mg/L	350.1	1.4	4.1	— ^e	— ^g	43. as measured ^h
Arsenic	µg/L	200.8	0.7	2.	2.	670.	DNQ 0.91 Est. Conc.
Cadmium	µg/L	200.7	1.1	10.	10.	130.	ND
Chromium VI ⁱ	µg/L	218.6	0.02	0.2	— ^e	270.	0.27 as measured
Copper	µg/L	200.7	1.2	10.	10.	— ^g	10. as measured
Lead	µg/L	200.8	0.1	1.	0.5	— ^g	0.57 as measured ^j

^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 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.

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

ⁱ 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.

^j Because the reported lead concentration (0.57 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).

Analytical Results for Effluent Samples Collected during July 2020

Chemical Compound or Parameter	Units	Method	Detection Limit ^a	Practical ^b Quantification Limit	Minimum Level ^c	Permit ^d Limit	Reported Value
Mercury	µg/L	245.1	0.022	0.2	0.2	5.29	ND
Nickel	µg/L	200.7	2.3	10.	20.	670.	DNQ 3.6 Est. Conc.
Selenium	µg/L	200.8	0.19	2.	2.	— ^g	3.5 as measured
Silver	µg/L	200.7	1.3	10.	10.	70.	ND
Zinc	µg/L	200.7	9.5	50.	20.	— ^g	47. as measured ^k
Toxicity-Chronic: <i>M. pyrifer</i>	TUc	600/R-95/136	—	—	—	134.	5.56 as measured ^l
Toxicity-Chronic: <i>H. Rufescens</i>	TUc	600/R-95/136	—	—	—	134.	17.9 as measured
Toxicity-Chronic: <i>A. affinis</i>	TUc	600/R-95/136	—	—	—	134.	3.125 as measured

^k Because the reported zinc concentration (47. µg/L) was below the PQL (50. 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 (20. µg/L).

^l The higher (5.56 TUc) of the two values (3.12 TUc and 5.56 TUc) determined for spore-germination and germ-tube-growth end points is reported here.

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: 01/01/2020 - 12/31/2020							
Loc	Sea	Param	Param Text	Q1	Q2	C1	C2	C3	Excur Count	Analy Freq	Sample Type
1	0	00610	Nitrogen, ammonia total (as N)					43.0 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)					12.0 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					3.5 ug/L Daily Maximum	0	Annual	COMP24
1	0	01032	Chromium, hexavalent (as Cr)	0.0026 lb/d 6 Month Median	0.0026 lb/d Daily Maximum	0.27 ug/L 6 Month Median	0.27 ug/L Daily Maximum	0.27 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					47.0 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: 01/01/2020 - 12/31/2020							
Loc	Sea	Param	Param Text	Q1	Q2	C1	C2	C3	Excur Count	Analy Freq	Sample Type
1	0	01114	Lead, total recoverable					0.57 ug/L Daily Maximum	0	Annual	COMP24
1	0	01119	Copper, total recoverable					10.0 ug/L Daily Maximum	0	Annual	COMP24
1	0	04175	Phosphate, ortho (as P)					2.31 mg/L Daily Maximum	0	Annual	GRAB
1	0	71800	Urea					1.06 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					5.56 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					17.9 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: 01/01/2020 - 12/31/2020							
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					3.125 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: 08/05/2020

John Gunderlock

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

Client Project: [none]
BCL Project: Annual Effluent Sampling
BCL Work Order: 2021049
Invoice ID: B387862

Enclosed are the results of analyses for samples received by the laboratory on 7/22/2020. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Contact Person: Tina Green
Client Services

Stuart Buttram
Technical Director

Certifications: CA ELAP #1186; NV #CA00014; OR ELAP #4032-001; AK UST101

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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BC Laboratories, Inc.
Environmental Testing Laboratory Since 1949

Chain of Custody and Cooler Receipt Form for 2021049 Page 1 of 2

BC LABORATORIES

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

20-21049

Chain of Custody

* Required Fields

Client/Company Name *: **City of Morro Bay** Report Attention *: **John Gunderlock** Phone #: **805-772-6272** FAX #: _____

Address *: **160 Alascadero Road, Morro Bay, CA** City *: _____ State *: _____ Zip *: **93442** E-mail: **jgunderlock@morrobayca.gov**

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

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

QC Request: STD Level II Result Request ** Surcharge: STD 5 Day** 2 Day** 1 Day**

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

Matrix Types: RSW - Raw Surface Water CPW - 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

Sample #	# Bottles	Sampled		Sample Description / Location *	Matrix *	Comments / Station Code	Ammonia (as N)	Hexavalent Chromium VI	Arsenic (As)	Cadmium (Cd)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Nickel (Ni)	Silver (Ag)	Selenium (Se)	Zinc (Zn)	
		Date	Time															
-1	1	7/21/20	0808	Grab Effluent ARS	WW													
-2	2	7/21/20	0808	Comp Effluent ARS	WW													

Relinquished by: (Signature and Printed Name) **John Gunderlock** Company **City of Morro Bay** Date **7/21/20** Time **1340** Received by: (Signature and Print Name) **McGill** Company **BCE**

Relinquished by: (Signature and Printed Name) **McGill** Company **BCE** Date **7/21/20** Time **1710** Received by: (Signature and Print Name) _____ Company _____

Received for Lab by: (Signature and Printed Name) **Gundh** Date **7/21/20** Time **1710** Payment Received at Delivery: _____

Shipping Method: **CAO UPS GSO WALK-IN SJVC FED EX OTHER** Cooling Method: **WET BLUE NONE** Packing Material: _____

CHK BY **MS** DISTRIBUTION
SUB OUT

286
PORT HOLDING TIME
NO₂ NO₃ OP SS
DO O₂ BOD MBAS COT

SNFL0012 9/19/04/03

Report ID: 1001057530
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BC LABORATORIES INC. COOLER RECEIPT FORM

Submission #: 20-21049 Page 1 of 1

SHIPPING INFORMATION
 Fed Ex UPS Ontrac Hand Delivery
 BC Lab Field Service Other (Specify) _____

SHIPPING CONTAINER
 Ice Chest None Box
 Other (Specify) _____

FREE LIQUID
 YES NO
 W / S _____

Refrigerant: Ice Blue Ice None Other Comments: _____

Custody Seals: Ice Chest Containers: None Comments: _____

Intact? Yes No Intact? Yes No

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

COC Received YES NO

Emissivity: 95 Container: PR Thermometer ID: 208
 Temperature: (A) 1.6 °C / (C) 1.4 °C Date/Time 7/22/20 1710
 Analyst Init JM

SAMPLE CONTAINERS	SAMPLE NUMBERS									
	1	2	3	4	5	6	7	8	9	10
QT PE UNPRES										
4oz / Box / 16oz PE UNPRES										
2oz Cr ⁶										
QT INORGANIC CHEMICAL METALS		A								
INORGANIC CHEMICAL METALS 4oz / Box / 16oz		B								
PT CYANIDE										
PT NITROGEN FORMS										
PT TOTAL SULFIDE		A								
2oz NITRATE / NITRITE										
PT TOTAL ORGANIC CARBON										
PT CHEMICAL OXYGEN DEMAND										
PIA PHENOLICS										
40ml VOA VIAL TRAVEL BLANK										
40ml VOA VIAL										
QT EPA 1664										
PT ODOR										
RADIOLOGICAL										
BACTERIOLOGICAL										
40 ml VOA VIAL- 504										
QT EPA 508/603/8260										
QT EPA 515.1/8150										
QT EPA 525										
QT EPA 525 TRAVEL BLANK										
40ml EPA 547										
40ml EPA 531.1										
5oz EPA 548										
QT EPA 549										
QT EPA 8915M										
QT EPA 8270										
oz / 16oz / 32oz AMBER										
oz / 16oz / 32oz JAR										
OIL SLEEVE										
CB VIAL										
LASTIC BAG										
EDLAR BAG										
ERROUS IRON										
SCORE										
IART KIT										
MMA CANISTER										

Comments: _____

Sample Numbering Completed By: JM Date/Time: 7/22/20 1710

Actual / C = Corrected

Rev 21 05/23/2016
 (S:\WPDoc\Work\Perf\cc\LAB_DOC\FORMS\SAZ\RF...)

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.



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

Reported: 08/05/2020 17:29
Project: Annual Effluent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Laboratory / Client Sample Cross Reference

Laboratory	Client Sample Information			
2021049-01	COC Number:	---	Receive Date:	07/22/2020 17:10
	Project Number:	---	Sampling Date:	07/21/2020 08:08
	Sampling Location:	---	Sample Depth:	---
	Sampling Point:	Grab EFF A.R.S.	Lab Matrix:	Water
	Sampled By:	---	Sample Type:	Wastewater
2021049-02	COC Number:	---	Receive Date:	07/22/2020 17:10
	Project Number:	---	Sampling Date:	07/21/2020 08:08
	Sampling Location:	---	Sample Depth:	---
	Sampling Point:	Comp EFF A.R.S.	Lab Matrix:	Water
	Sampled By:	---	Sample Type:	Wastewater

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

Reported: 08/05/2020 17:29
Project: Annual Effluent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Water Analysis (General Chemistry)

BCL Sample ID: 2021049-01	Client Sample Name: Grab EFF A.R.S., 7/21/2020 8:08:00AM
----------------------------------	---

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Ammonia as N	43	mg/L	4.1	1.4	EPA-350.1	1.5	A07	1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID	Prep Method
1	EPA-350.1	07/28/20 08:30	07/30/20 13:51	JMH2	SC-2	20.408	B083428	No Prep

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

Reported: 08/05/2020 17:29
Project: Annual Effluent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Metals Analysis

BCL Sample ID: 2021049-02		Client Sample Name: Comp EFF A.R.S., 7/21/2020 8:08:00AM							
Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #	
Hexavalent Chromium	0.27	ug/L	0.20	0.020	EPA-218.6	ND		1	
Total Recoverable Arsenic	0.91	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	10	ug/L	10	1.2	EPA-200.7	ND		3	
Total Recoverable Lead	0.57	ug/L	1.0	0.10	EPA-200.8	ND	J	4	
Total Recoverable Mercury	ND	ug/L	0.20	0.022	EPA-245.1	ND		5	
Total Recoverable Nickel	3.6	ug/L	10	2.3	EPA-200.7	ND	J	3	
Total Recoverable Selenium	3.5	ug/L	2.0	0.19	EPA-200.8	0.22		2	
Total Recoverable Silver	ND	ug/L	10	1.3	EPA-200.7	ND		3	
Total Recoverable Zinc	47	ug/L	50	9.5	EPA-200.7	ND	J	3	

Run #	Method	Prep Date	Run		Analyst	Instrument	Dilution	QC	
			Date/Time					Batch ID	Prep Method
1	EPA-218.6	07/27/20 19:00	07/27/20	21:38	CMM	IC-4	1	B083418	No Prep
2	EPA-200.8	07/23/20 19:50	07/24/20	10:53	JNC	PE-EL2	1	B083142	EPA 200.2
3	EPA-200.7	07/27/20 19:45	07/28/20	12:54	JRG	PE-OP4	1	B083413	EPA 200.2
4	EPA-200.8	07/24/20 20:40	07/27/20	10:20	JNC	PE-EL2	1	B083260	EPA 200.2
5	EPA-245.1	07/30/20 11:45	07/30/20	17:43	TMT	CETAC3	1	B083638	EPA 245.1

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

Reported: 08/05/2020 17:29
Project: Annual Effluent 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: B083428						
Ammonia as N	B083428-BLK1	0.073400	mg/L	0.20	0.067	J

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

Reported: 08/05/2020 17:29
Project: Annual Effluent 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		Lab
								Percent Recovery	RPD	
QC Batch ID: B083428										
Ammonia as N	B083428-BS1	LCS	2.0528	2.0000	mg/L	103		90 - 110		

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

Reported: 08/05/2020 17:29
Project: Annual Effluent 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	Control Limits		Lab Quals
								Percent Recovery	RPD	
QC Batch ID: B083428		Used client sample: N								
Ammonia as N	DUP	2021046-19	0.12304	0.12178		mg/L	1.0		10	J
	MS	2021046-19	0.12304	2.5714	2.3301	mg/L		105	90 - 110	
	MSD	2021046-19	0.12304	2.4828	2.3301	mg/L	3.5	101	10 90 - 110	

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

Reported: 08/05/2020 17:29
Project: Annual Effluent 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: B083142						
Total Recoverable Arsenic	B083142-BLK1	ND	ug/L	2.0	0.70	
Total Recoverable Selenium	B083142-BLK1	0.21700	ug/L	2.0	0.19	J
QC Batch ID: B083260						
Total Recoverable Lead	B083260-BLK1	ND	ug/L	1.0	0.10	
QC Batch ID: B083413						
Total Recoverable Cadmium	B083413-BLK1	ND	ug/L	10	1.1	
Total Recoverable Copper	B083413-BLK1	ND	ug/L	10	1.2	
Total Recoverable Nickel	B083413-BLK1	ND	ug/L	10	2.3	
Total Recoverable Silver	B083413-BLK1	ND	ug/L	10	1.3	
Total Recoverable Zinc	B083413-BLK1	ND	ug/L	50	9.5	
QC Batch ID: B083418						
Hexavalent Chromium	B083418-BLK1	ND	ug/L	0.20	0.020	
QC Batch ID: B083638						
Total Recoverable Mercury	B083638-BLK1	ND	ug/L	0.20	0.022	

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

Reported: 08/05/2020 17:29
Project: Annual Effluent 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		Lab Quals
								Percent Recovery	RPD	
QC Batch ID: B083142										
Total Recoverable Arsenic	B083142-BS1	LCS	101.78	100.00	ug/L	102		85 - 115		
Total Recoverable Selenium	B083142-BS1	LCS	102.03	100.00	ug/L	102		85 - 115		
QC Batch ID: B083260										
Total Recoverable Lead	B083260-BS1	LCS	106.34	100.00	ug/L	106		85 - 115		
QC Batch ID: B083413										
Total Recoverable Cadmium	B083413-BS1	LCS	191.79	200.00	ug/L	95.9		85 - 115		
Total Recoverable Copper	B083413-BS1	LCS	386.02	400.00	ug/L	96.5		85 - 115		
Total Recoverable Nickel	B083413-BS1	LCS	387.27	400.00	ug/L	96.8		85 - 115		
Total Recoverable Silver	B083413-BS1	LCS	97.118	100.00	ug/L	97.1		85 - 115		
Total Recoverable Zinc	B083413-BS1	LCS	517.88	500.00	ug/L	104		85 - 115		
QC Batch ID: B083418										
Hexavalent Chromium	B083418-BS1	LCS	20.381	20.000	ug/L	102		90 - 110		
QC Batch ID: B083638										
Total Recoverable Mercury	B083638-BS1	LCS	1.0050	1.0000	ug/L	100		85 - 115		

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

Reported: 08/05/2020 17:29
Project: Annual Effluent Sampling
Project Number: [none]
Project Manager: John Gunderlock

Metals Analysis

Quality Control Report - Precision & Accuracy

Constituent	Source Type	Source Sample ID	Source Result	Result	Spike Added	Units	RPD	Control Limits		Lab Quals
								Percent Recovery	Percent Recovery	
QC Batch ID: B083142		Used client sample: N								
Total Recoverable Arsenic	DUP	2020946-01	ND	ND		ug/L			20	
	MS	2020946-01	ND	113.39	100.00	ug/L		113		70 - 130
	MSD	2020946-01	ND	104.28	100.00	ug/L	8.4	104	20	70 - 130
Total Recoverable Selenium	DUP	2020946-01	0.84100	ND		ug/L			20	
	MS	2020946-01	0.84100	115.27	100.00	ug/L		114		70 - 130
	MSD	2020946-01	0.84100	107.31	100.00	ug/L	7.2	106	20	70 - 130
QC Batch ID: B083260		Used client sample: N								
Total Recoverable Lead	DUP	2021032-01	ND	0.41200		ug/L			20	J
	MS	2021032-01	ND	99.592	100.00	ug/L		99.6		70 - 130
	MSD	2021032-01	ND	101.56	100.00	ug/L	2.0	102	20	70 - 130
QC Batch ID: B083413		Used client sample: N								
Total Recoverable Cadmium	DUP	2021084-02	ND	ND		ug/L			20	
	MS	2021084-02	ND	215.87	200.00	ug/L		108		75 - 125
	MSD	2021084-02	ND	215.27	200.00	ug/L	0.3	108	20	75 - 125
Total Recoverable Copper	DUP	2021084-02	ND	ND		ug/L			20	
	MS	2021084-02	ND	434.60	400.00	ug/L		109		75 - 125
	MSD	2021084-02	ND	438.68	400.00	ug/L	0.9	110	20	75 - 125
Total Recoverable Nickel	DUP	2021084-02	5.2705	4.5519		ug/L	14.6		20	J
	MS	2021084-02	5.2705	405.41	400.00	ug/L		100		75 - 125
	MSD	2021084-02	5.2705	409.83	400.00	ug/L	1.1	101	20	75 - 125
Total Recoverable Silver	DUP	2021084-02	ND	ND		ug/L			20	
	MS	2021084-02	ND	113.92	100.00	ug/L		114		75 - 125
	MSD	2021084-02	ND	113.83	100.00	ug/L	0.1	114	20	75 - 125
Total Recoverable Zinc	DUP	2021084-02	ND	ND		ug/L			20	
	MS	2021084-02	ND	523.55	500.00	ug/L		105		75 - 125
	MSD	2021084-02	ND	519.86	500.00	ug/L	0.7	104	20	75 - 125
QC Batch ID: B083418		Used client sample: N								
Hexavalent Chromium	DUP	2020946-01	0.10500	0.10500		ug/L	0		10	J
	MS	2020946-01	0.10500	19.986	20.202	ug/L		98.4		90 - 110
	MSD	2020946-01	0.10500	20.138	20.202	ug/L	0.8	99.2	10	90 - 110
QC Batch ID: B083638		Used client sample: N								
Total Recoverable Mercury	DUP	2021531-01	0.16500	0.14500		ug/L	12.9		20	J
	MS	2021531-01	0.16500	1.1425	1.0000	ug/L		97.8		70 - 130
	MSD	2021531-01	0.16500	1.1375	1.0000	ug/L	0.4	97.2	20	70 - 130

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

Reported: 08/05/2020 17:29
Project: Annual Effluent 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
- A07 Detection and quantitation limits were raised due to sample dilution caused by high analyte concentration or matrix interference.

Report Amendments Date: 8/10/20 Initials: SS
 This amended report supersedes any previous versions of this report issued by the laboratory. Amendments to this report are as follows: Revised to report NITRATE AS N result to the hundredths decimal place, as indicated by J-qualifier.



City of Morro Bay Public Works/WWTP

John Gunderlock
 955 Shasta Ave.
 Morro Bay, CA 93442

4 Justin Court Suite D, Monterey, CA 93940

831.375.MBAS (6227)

www.MBASinc.com

ELAP Certification Number: 2385

Thursday, August 6, 2020

Lab Number: 200722_08-01 Sample Description: Morro Bay WWTP Annual Effluent, ARS Effluent Grab

Collection Date/Time: 7/21/2020 8:08 Sample Collector: Gunderlock J Client Sample #:

Submittal Date/Time: 7/22/2020 11:50 System ID: WW

Analyte	Method	Unit	Result	Dil.	Qual	PQL	MDL	Analysis Date / Time	Analyst
Silica SiO ₂ , Dissolved	EPA200.7	mg/L	12.0	1		0.5 0.14		7/27/2020 13:06	MW
Nitrate as N	EPA300.0	mg/L	0.0H	1	J	0.1 0.01		7/22/2020 18:22	BS
Orthophosphate as P	EPA365.1	mg/L	2.31	4		0.04 0.02		7/22/2020 15:57	HC
Urea-N	Mulvenna&Savidge	µg/L	106	1		10 8		8/5/2020 15:11	OW

Report Approved by:

A handwritten signature in black ink, appearing to read "David Holland".

David Holland, Laboratory Director

mg/L : Milligrams per liter (=ppm)

H = Analyzed outside of hold time

MDL = Method Detection Limit

µg/L : Micrograms per liter (=ppb)

E = Analysis performed by External Laboratory; See Report attachments

J = Result is less than PQL

PQL : Practical Quantitation Limit

ND = Non Detect

MCL : Maximum Contamination Level

T = Temperature Exceedance



Monterey Bay Analytical Services

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ELAP Certification Number: 2385

Thursday, August 6, 2020

City of Morro Bay Public Works/WWTP

John Gunderlock

955 Shasta Ave.

Morro Bay, CA 93442

QC Results

QC Batch ID	QC ID	Parameter	Results	Units	% Rec	% RPD	Control Limits
QC20072303	200721_52-02: MS 1	Nitrate as N	16.2	mg/L	98		80 - 120
	200721_52-02: MSD 1	Nitrate as N	16.2	mg/L	98	0.4	0 - 10
	CCVB 1	Nitrate as N	ND	mg/L		< 0.1	
	LCS 1	Nitrate as N	9.7	mg/L	97		90 - 110
	LCSD 1	Nitrate as N	10.0	mg/L	100	2.3	0 - 10
	LCSL 1	Nitrate as N	0.1	mg/L	78		50 - 150
	Method Blank 1	Nitrate as N	ND	mg/L		< 0.1	
QC20072301	200722_09-03: MS 1	Orthophosphate as P	0.6	mg/L	105		80 - 120
	200722_09-03: MSD 1	Orthophosphate as P	0.6	mg/L	107	1.9	0 - 10
	CCVB 1	Orthophosphate as P	ND	mg/L		< 0.1	
	LCS 1	Orthophosphate as P	0.3	mg/L	107		90 - 110
	LCSD 1	Orthophosphate as P	0.3	mg/L	110	2.5	0 - 10
	LCSL 1	Orthophosphate as P	0.0	mg/L	75		50 - 150
	LCSL 2	Orthophosphate as P	0.0	mg/L	75		50 - 150
	Method Blank 1	Orthophosphate as P	ND	mg/L		< 0.1	
	Method Blank 2	Orthophosphate as P	ND	mg/L		< 0.1	
	QCS 1	Orthophosphate as P	0.3	mg/L	97		90 - 110
QC20072712	200722_57-01: MS 1	Silica (SiO ₂), Total	67.0	mg/L	91		70 - 130
	200722_57-01: MSD 1	Silica (SiO ₂), Total	64.9	mg/L	87	4.7	0 - 20
	CCVB 1	Silica (SiO ₂), Total	ND	mg/L		< 0.1	
	LCB 1	Silica (SiO ₂), Total	ND	mg/L		< 0.1	
	LCS 1	Silica (SiO ₂), Total	51.3	mg/L	103		95 - 105
	LCSD 1	Silica (SiO ₂), Total	46.3	mg/L	93	10.3	0 - 10
	LFB 1	Silica (SiO ₂), Total	53.3	mg/L	107		85 - 115
	LFBD 1	Silica (SiO ₂), Total	52.4	mg/L	105	1.7	0 - 20
	Method Blank 1	Silica (SiO ₂), Total	ND	mg/L		< 0.1	
	QCS 1	Silica (SiO ₂), Total	50.7	mg/L	101		95 - 105
QC20080513	200722_08-01: MS 1	Urea-N	214.0	ug/L	108		85 - 115
	200722_08-01: MSD 1	Urea-N	211.0	ug/L	105	2.8	0 - 20
	LFB 1	Urea-N	106.0	ug/L	106		85 - 115
	LFBD 1	Urea-N	104.0	ug/L	104	1.9	0 - 25
	LFBL 1	Urea-N	11.0	ug/L	110		70 - 130

mg/L : Milligrams per liter (=ppm)

ug/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



Monterey Bay Analytical Services

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ELAP Certification Number: 2385

Thursday, August 6, 2020

City of Morro Bay Public Works/WWTP

John Gunderlock

955 Shasta Ave.

Morro Bay, CA 93442

QC Results

QCBatch ID	QC ID	Parameter	Results	Units	% Rec	% RPD	Control Limits
	LFBLD 1	Urea-N	12.0	ug/L	120	8.7	0 - 25
	Method Blank 1	Urea-N	ND	µg/L		< 0.1	
	QCS 1	Urea-N	48.0	ug/L	102		85 - 115
	QCSD 1	Urea-N	49.0	ug/L	104	2.1	0 - 25

mg/L : Milligrams per liter (=ppm)

H = Analyzed outside of hold time

MDL = Method Detection Limit

µg/L : Micrograms per liter (=ppb)

E = Analysis performed by External Laboratory; See Report attachments

J = Result is less than PQL

PQL : Practical Quantitation Limit

ND = Non Detect

MCL : Maximum Contamination Level

T = Temperature Exceedance



Monterey Bay Analytical Services

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ELAP Certification Number: 2385

Thursday, August 6, 2020

City of Morro Bay Public Works/WWTP

John Gunderlock

955 Shasta Ave.

Morro Bay, CA 93442

Sample Condition Upon Receipt

Order ID: 200722_08

Is there evidence of chilling?

Yes, received via FedEx.

*NOTE: Systems are encouraged but not required to hold samples
<10°C (Microbiology) or <6°C (Chemistry) during transit.

Did bottle arrive intact?

Yes

Did bottle labels agree with COC?

Yes

Adequate sample volume?

Yes

mg/L : Milligrams 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

MBAS Order ID: 200722_08



Chain of Custody / Analysis Request

4 Justin Court, Suite D, Monterey, CA 93940
 (831) 375-MBAS (6227) * Fax: (831) 641-0734
info@mbasinc.com www.MBASinc.com

Client / Company Name: City of Morro Bay	Attention: John Gunderlock	Email Address(es) to Send Report/Invoice: jgunderlock@morrobayca.gov	Phone Number: 805.772.6272
Project/System Info: Morro Bay WWTP Annual Effluent	State System ID:	Billing Address: 955 Shasta Avenue Morro Bay, CA 93442	Contract/ P.O. #:
For Regulatory Reporting? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (Please select one)			

Requested Analysis				*LAB USE ONLY*				
Nitrate (as NO3) [EPA 300.0]	O-Phosphate-P [EPA 300.0]	Dissolved Silica (as SiO2) [EPA 4500-Si-E]	Urea-N [Mulvenna & Savid]	1. <input type="checkbox"/> DW <input type="checkbox"/> WW <input type="checkbox"/> Soil <input type="checkbox"/> Other _____				
				2. Is there evidence of chilling? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N N/A < 2hrs				
				3. Adequate sample volume? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N				
				4. Was the sample filtered? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N				
				5. Did bottles agree with the COC? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N IR Used: <u>IR01</u>				
				Preservative (include pH) Initials: <u>DM</u>				
				HNO3	H2SO4	NaOH	HCl	Na2S2O3

MBAS Lab #	Source Code or Client Sample ID	Sample Description	Sample Collection		Receiving Temp (°C)	Coliform Analysis					Container		
			Date	Time		CL2 Residual (mg/L)	Routine	Other	Repeat	Special	# Cont.	Type*	Size
01		ARS Effluent Grab	7/21/20	0808	1.8						1	P	
		ARS Effluent Grab	7/21/20	0808	1.8						1	P	
		ARS Effluent Grab *	7/21/20	0808	1.8						1	P	
		ARS Effluent Grab **	7/21/20	0808	1.8						1	P	

Printed Name	Signature	Date	Time	Comments
John Gunderlock	<i>John Gunderlock</i>	7/21/20	1300	* Pour off 50 ml freeze to old for Urea test.
Isabelle Gunderlock	<i>Isabelle Gunderlock</i>	7/21/20	1150	** Sampler pre-filtered (0.45 micron)

Payment Received Check #: _____ Amount: _____ Date: _____

LABORATORY REPORT



**Aquatic
Testing
Laboratories**

"dedicated to providing quality aquatic toxicity testing"

Date: July 30, 2020
Client: City of Morro Bay Public Works
Wastewater Treatment Plant
160 Atascadero Road
Morro Bay, CA 93442
Attn: John Gunderlock

4350 Transport Street, Unit 107
Ventura, CA 93003
(805) 650-0546 FAX (805) 650-0756
CA ELAP Cert. No.: 1775

Laboratory No.: A-20072106-001/003
Sample I.D.: Comp ARS

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 used for dilution/control.

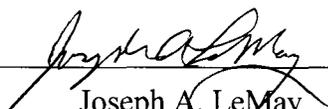
Date Sampled:	07/20/20	07/21/20	07/23/20
Date Received:	07/21/20	07/21/20	07/23/20
Temp. Received:	0.7°C	0.7°C	0.9°C
Chlorine (TRC):	0.0 mg/l	0.0 mg/l	0.0 mg/l
Date Tested:	07/21/20 to 07/28/20		

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:

<u>Test</u>	<u>NOEC</u>	<u>TUc</u>
Abalone Development:	5.6%	17.9
Kelp Spore Germination:	32%	3.12
Kelp Germ Tube Growth:	18%	5.56
Topsmelt Larval Survival:	32%	3.12
Topsmelt Larval Growth:	32%	3.12

Quality Control: Reviewed and approved by:



Joseph A. LeMay
Laboratory Director



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-20072106-002
Client/ID: Morro Bay WWTP

Date tested: 07/22/20 - 07/24/20

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-200722 (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)	93.7%	
Control-Dilution (Receiving Water)	94.7%	
Control-Culture (Lab Seawater)	92.8%	
1.8%	94.0%	
3.2%	94.0%	
5.6%	94.6%	
10.0%	28.0%	*
18.0%	0%	*
32.0%	0%	*
<p>* Statistically significantly less than control at P = 0.05 level Dilution and brine control not statistically significantly less than culture water control at P = 0.05 level Dilution water is client supplied receiving water Culture water control obtained from The Cultured Abalone Farm.</p>		

CHRONIC TOXICITY

NOEC	5.6%
TUc	17.9

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control normality ≥ 80%	PASS (94.7%)
Concentration response relationship acceptable	PASS (Response curve normal)
Please see RT-200722 report for additional test acceptability criteria.	

Abalone Larval Development Test-Proportion Normal

Start Date: 7/22/2020 15:00 Test ID: 20072106ab Sample ID: Morro Bay
 End Date: 7/24/2020 15:30 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/21/2020 08:08 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: HR-Haliotis rufescens
 Comments:

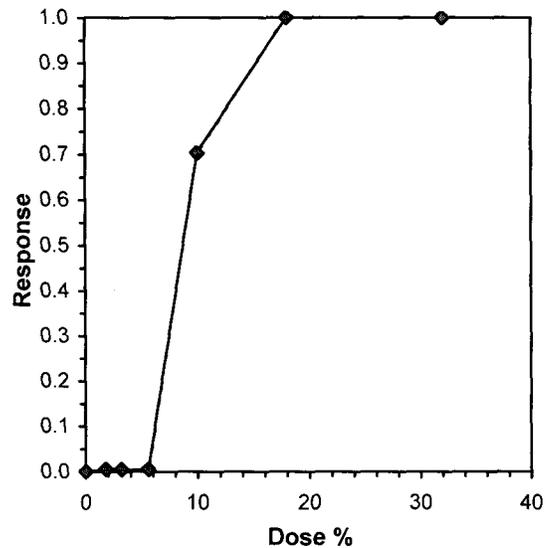
Conc-%	1	2	3	4	5
B-Control	0.9626	0.9314	0.9307	0.9709	0.8911
D-Control	0.9417	0.9706	0.9417	0.9804	0.9000
1.8	0.9519	0.9358	0.9406	0.9109	0.9623
3.2	0.9439	0.9612	0.9423	0.8922	0.9604
5.6	0.9808	0.9720	0.9200	0.9626	0.8922
10	0.2330	0.2477	0.2233	0.5905	0.1068
18	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				Rank Sum	1-Tailed Critical	Isotonic	
			Mean	Min	Max	CV%			Mean	N-Mean
B-Control	0.9373	0.9899	1.3240	1.2345	1.3993	4.942	5			
D-Control	0.9469	1.0000	1.3464	1.2490	1.4303	5.249	5	*		0.9471 1.0000
1.8	0.9403	0.9930	1.3264	1.2677	1.3753	3.046	5	24.00	17.00	0.9422 0.9949
3.2	0.9400	0.9927	1.3278	1.2362	1.3724	4.162	5	27.00	17.00	0.9422 0.9949
5.6	0.9455	0.9985	1.3461	1.2362	1.4317	6.143	5	28.00	17.00	0.9422 0.9949
*10	0.2803	0.2960	0.5452	0.3329	0.8764	36.666	5	15.00	17.00	0.2811 0.2968
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 non-normal distribution (p <= 0.05)	0.88313	0.918	1.23412	5.36417
Bartlett's Test indicates equal variances (p = 0.02)	11.9904	13.2767		
The control means are not significantly different (p = 0.62)	0.51886	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test Treatments vs D-Control	5.6	10	7.48331	17.8571

Linear Interpolation (200 Resamples)				
Point	%	SD	95% CL(Exp)	Skew
IC05	5.8830	0.0893	5.5754 5.9899	-1.3130
IC10	6.1981	0.0984	5.8936 6.3811	-0.1660
IC15	6.5133	0.1232	6.1835 6.7796	0.2822
IC20	6.8284	0.1534	6.4936 7.2495	0.5435
IC25	7.1435	0.1864	6.7368 7.6755	0.6915
IC40	8.0889	0.2927	7.5412 9.0688	0.8745
IC50	8.7192	0.3683	8.0523 10.0228	0.9734



Abalone Larval Development Test-Proportion Normal

Start Date: 7/22/2020 15:00 Test ID: 20072106ab Sample ID: Morro Bay
 End Date: 7/24/2020 15:30 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/21/2020 08:08 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: HR-Haliotis rufescens
 Comments:

Conc-%	1	2	3	4	5
B-Control	0.9626	0.9314	0.9307	0.9709	0.8911
D-Control	0.9417	0.9706	0.9417	0.9804	0.9000
1.8	0.9519	0.9358	0.9406	0.9109	0.9623
3.2	0.9439	0.9612	0.9423	0.8922	0.9604
5.6	0.9808	0.9720	0.9200	0.9626	0.8922
10	0.2330	0.2477	0.2233	0.5905	0.1068
18	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					N	t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%					
B-Control	0.9373	0.9899	1.3240	1.2345	1.3993	4.942	5				
D-Control	0.9469	1.0000	1.3464	1.2490	1.4303	5.249	5	*			
1.8	0.9403	0.9930	1.3264	1.2677	1.3753	3.046	5	0.298	2.300	0.1546	
3.2	0.9400	0.9927	1.3278	1.2362	1.3724	4.162	5	0.276	2.300	0.1546	
5.6	0.9455	0.9985	1.3461	1.2362	1.4317	6.143	5	0.004	2.300	0.1546	
*10	0.2803	0.2960	0.5452	0.3329	0.8764	36.666	5	11.918	2.300	0.1546	
18	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				
32	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.88313	0.918	1.23412	5.36417
Bartlett's Test indicates equal variances (p = 0.02)	11.9904	13.2767		
The control means are not significantly different (p = 0.62)	0.51886	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	5.6	10	7.48331	17.8571	0.08739	0.09194	0.62684	0.0113	1.5E-10	4, 20

Abalone Larval Development Test-Proportion Normal

Start Date: 7/22/2020 15:00 Test ID: 20072106ab Sample ID: Morro Bay
 End Date: 7/24/2020 15:30 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/21/2020 08:08 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: HR-Haliotis rufescens
 Comments:

Conc-%	1	2	3	4	5
C-Control	0.9010	0.9009	0.9619	0.9406	0.9333
D-Control	0.9417	0.9706	0.9417	0.9804	0.9000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				CV%	N	t-Stat	1-Tailed	
			Mean	Min	Max	MSD				Critical	MSD
C-Control	0.9275	1.0000	1.3020	1.2506	1.3744	4.043	5				
D-Control	0.9469	1.0209	1.3464	1.2490	1.4303	5.249	5	-1.127	1.860	0.0733	

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96481	0.842	-0.057	-0.8828		
F-Test indicates equal variances (p = 0.58)	1.80258	23.1545				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs C-Control	0.042	0.04519	0.00493	0.00388	0.29246	1, 8

ABALONE CHRONIC BIOASSAY



Lab No.: A-20072106-002
Client ID: Morro Bay Effluent

Start Date: 07/22/2020

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)	15.2	7.8	8.2	34	15.0	8.2	15.2	8.2	8.2	34
Control (dilution)	15.1	8.0	8.1	34	15.0	8.2	15.2	8.1	8.1	34
1.8%	15.1	8.1	8.1	34	15.1	8.1	15.2	8.0	8.1	34
3.2%	15.1	8.1	8.1	34	15.1	8.1	15.3	8.0	8.1	34
5.6%	15.2	8.2	8.1	34	15.1	8.1	15.2	8.0	8.1	34
10%	15.2	8.2	8.1	34	15.0	8.1	15.1	8.0	8.1	34
18%	15.1	8.2	8.1	34	15.0	8.2	15.0	7.9	8.1	34
32%	15.1	8.2	8.2	34	15.0	8.2	15.1	7.8	8.2	34

Sample as received: Chlorine: 0 mg/l; pH: 7.6; Salinity: 0 ppt; Temp: 0.7 °C; DO: 2.1 mg/l; NH₃-N: 45 mg/l

Dilution water is client supplied receiving water.

Initial readings: Date/Time: 7-27-20 1500 Final readings: Date/Time: 1500

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	74	79	15	C	99	3	29	18	0	100
2	C	97	6	16	10	27	82	30	1.8	92	9
3	1.8	0	100	17	C	97	6	31	1.8	0	100
4	1.8	99	5	18	1.8	0	100	32	3.2	91	11
5	5.6	102	2	19	3.2	98	6	33	C	90	10
6	BC	103	4	20	10	23	80	34	10	11	92
7	3.2	0	100	21	BC	94	7	35	1.8	102	4
8	3.2	101	6	22	3.2	0	100	36	3.2	0	100
9	BC	95	7	23	1.8	95	6	37	BC	90	11
10	1.8	102	7	24	5.6	42	8	38	3.2	0	100
11	5.6	104	3	25	C	100	2	39	5.6	91	11
12	1.8	0	100	26	5.6	103	4	40	3.2	97	4
13	3.2	99	4	27	10	62	43				
14	3.2	0	100	28	BC	100	3				

Microscopic examination: Analyst: Date: 7-27-20 Time: 0700



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



Lab No.: A-20072106-002
Client/ID: Morro Bay WWTP

Date Tested: 07/22/20 - 07/24/20

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-200722 (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)	84.0%	16.15
Control-Dilution (Receiving Water)	82.6%	16.15
Control-Culture (Lab Water)	86.1%	15.90
3.2%	82.9%	16.15
5.6%	84.6%	15.90
10%	84.8%	15.75
18%	79.9%	14.90
32%	83.6%	13.95

* 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	32%	18%
TUc (100/NOEC)	3.12	5.56

QA/QC TEST ACCEPTABILITY

Parameter	Result
Mean control germination $\geq 70\%$	PASS (82.6%)
Mean control germination tube length $> 10 \mu\text{m}$	PASS (16.15 μm)
Concentration response relationship acceptable	PASS (Response curve normal)

Please see RT-200722 report for additional test acceptability criteria.

Macrocystis Germination and Growth Test-Proportion Germinated

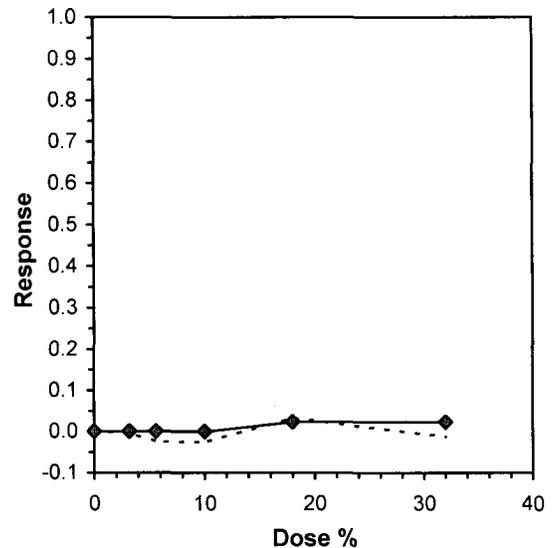
Start Date: 7/22/2020 16:00 Test ID: 20072106k Sample ID: MORRO BAY
 End Date: 7/24/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/21/2020 08:08 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: MP-Macrocystis pyrifera
 Comments:

Conc-%	1	2	3	4	5
B-Control	0.8932	0.7921	0.8627	0.8491	0.8039
D-Control	0.8020	0.8545	0.8056	0.8738	0.7963
3.2	0.8559	0.8679	0.7736	0.8378	0.8113
5.6	0.8224	0.9020	0.8545	0.7981	0.8532
10	0.8407	0.9109	0.8020	0.8393	0.8476
18	0.8667	0.8131	0.8037	0.7248	0.7870
32	0.8824	0.8962	0.8058	0.8039	0.7921

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	Mean					N-Mean	
B-Control	0.8402	1.0167	1.1621	1.0973	1.2379	4.978	5						
D-Control	0.8264	1.0000	1.1427	1.1025	1.2076	4.172	5	*				0.8374	1.0000
3.2	0.8293	1.0035	1.1466	1.0749	1.1989	4.319	5	-0.107	2.360	0.0861		0.8374	1.0000
5.6	0.8460	1.0237	1.1700	1.1047	1.2523	4.750	5	-0.749	2.360	0.0861		0.8374	1.0000
10	0.8481	1.0262	1.1731	1.1096	1.2677	4.928	5	-0.834	2.360	0.0861		0.8374	1.0000
18	0.7991	0.9669	1.1084	1.0185	1.1970	5.789	5	0.938	2.360	0.0861		0.8175	0.9763
32	0.8361	1.0117	1.1575	1.0973	1.2428	5.924	5	-0.405	2.360	0.0861		0.8175	0.9763

Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.95104	0.927	0.32584	-0.888						
Bartlett's Test indicates equal variances (p = 0.98)	0.73255	15.0863								
The control means are not significantly different (p = 0.58)	0.57826	2.306								
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	32	>32		3.125	0.06958	0.08407	0.00278	0.00333	0.5373	5, 24
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			



Macrocystis Germination and Growth Test-Growth-Length

Start Date: 7/22/2020 16:00 Test ID: 20072106k Sample ID: MORRO BAY
 End Date: 7/24/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/21/2020 08:08 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: MP-Macrocystis pyrifera
 Comments:

Conc-%	1	2	3	4	5
B-Control	16.500	15.500	15.750	16.000	17.000
D-Control	15.500	15.750	17.000	17.000	15.500
3.2	16.250	17.000	15.000	16.000	16.500
5.6	15.250	16.250	16.000	16.250	15.750
10	16.500	16.000	14.750	15.500	16.000
18	16.000	15.750	16.000	13.500	13.250
32	14.250	14.000	14.750	14.000	12.750

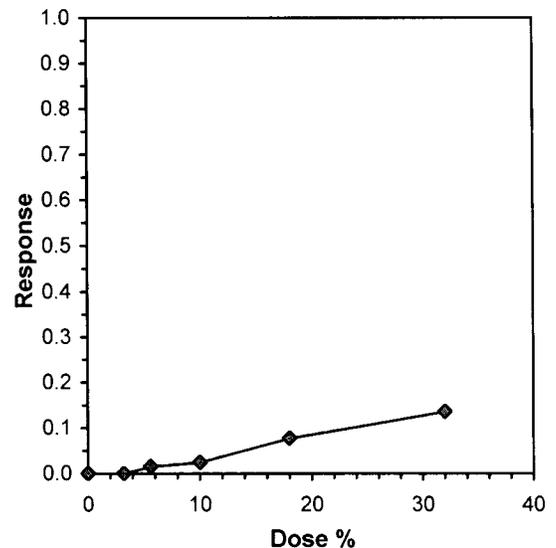
Conc-%	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	Mean					N-Mean	
B-Control	16.150	1.0000	16.150	15.500	17.000	3.728	5						
D-Control	16.150	1.0000	16.150	15.500	17.000	4.846	5	*				16.150	1.0000
3.2	16.150	1.0000	16.150	15.000	17.000	4.592	5	0.000	2.360	1.260	1.260	16.150	1.0000
5.6	15.900	0.9845	15.900	15.250	16.250	2.631	5	0.468	2.360	1.260	1.260	15.900	0.9845
10	15.750	0.9752	15.750	14.750	16.500	4.200	5	0.749	2.360	1.260	1.260	15.750	0.9752
18	14.900	0.9226	14.900	13.250	16.000	9.387	5	2.341	2.360	1.260	1.260	14.900	0.9226
*32	13.950	0.8638	13.950	12.750	14.750	5.286	5	4.121	2.360	1.260	1.260	13.950	0.8638

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94137	0.927	-0.5021	-0.5989
Bartlett's Test indicates equal variances (p = 0.34)	5.69465	15.0863		
The control means are not significantly different (p = 1.00)	0	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	18	32	24	5.5556	1.2599	0.07801	3.82333	0.7125	0.00189	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	13.835	3.910	4.191	23.692	0.4164
IC10	23.379				
IC15	>32				
IC20	>32				
IC25	>32				
IC40	>32				
IC50	>32				



Macrocystis Germination and Growth Test-Proportion Germinated

Start Date: 7/22/2020 16:00 Test ID: Kelp Contr Sample ID: REF-Ref Toxicant
 End Date: 7/24/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/22/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: MP-Macrocystis pyrifera
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	0.8431	0.9029	0.7981	0.8679	0.8932
RW - Control	0.8020	0.8545	0.8056	0.8738	0.7963

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
D-Control	0.8611	1.0000	1.1918	1.1047	1.2539	5.036	5	1.433	1.860	0.0637
RW - Control	0.8264	0.9598	1.1427	1.1025	1.2076	4.172	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.92246	0.842	-0.1505	-1.0885		
F-Test indicates equal variances (p = 0.67)	1.58519	23.1545				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs D-Control	0.04665	0.05404	0.00603	0.00294	0.18974	1, 8

Macrocystis Germination and Growth Test-Growth-Length

Start Date: 7/22/2020 16:00 Test ID: Kelp Contr Sample ID: REF-Ref Toxicant
 End Date: 7/24/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/22/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: MP-Macrocystis pyrifera
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	15.250	16.250	16.500	16.250	15.250
RW - Control	15.500	15.750	17.000	17.000	15.500

Conc-ug/L	Mean	N-Mean	Transform: Untransformed				N	Rank Sum	1-Tailed Critical
			Mean	Min	Max	CV%			
D-Control	15.900	1.0000	15.900	15.250	16.500	3.787	5		
RW - Control	16.150	1.0157	16.150	15.500	17.000	4.846	5	31.00	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution ($p \leq 0.05$)	0.80735	0.842	0.17893	-2.0806
F-Test indicates equal variances ($p = 0.62$)	1.68966	23.1545		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences
 Treatments vs D-Control

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST



Lab No.: A-20072106-002

Client ID: Morro Bay

Start Date: 07/22/2020

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	111	95	16	7	6	7	6	5	8	7	7	6	6
2	18	105	91	14	8	8	7	5	6	5	6	7	6	6
3	BC	103	92	11	8	6	7	7	5	7	6	7	7	6
4	10	113	95	18	6	7	7	6	8	5	7	7	6	7
5	C	101	81	20	5	7	6	7	6	5	7	6	7	6
6	5.6	107	88	19	6	5	7	6	6	7	5	6	6	7
7	32	102	90	12	6	5	5	7	6	5	7	5	5	6
8	C	110	94	16	7	6	5	7	7	7	6	5	7	5
9	5.6	102	92	10	7	5	5	7	8	7	7	6	7	6
10	18	107	87	20	5	7	7	7	6	5	7	6	6	7
11	BC	101	80	21	5	7	5	7	7	6	5	7	6	7
12	10	101	92	19	5	7	6	7	8	7	7	6	5	6
13	3.2	106	92	16	5	7	8	7	6	9	6	7	7	6
14	32	106	95	11	6	7	7	5	7	4	3	7	6	4
15	BC	102	88	14	7	7	6	5	6	7	7	7	5	6
16	5.6	110	94	16	7	6	7	5	7	7	6	7	5	7
17	10	101	81	20	5	7	6	7	5	4	7	5	7	6
18	18	107	86	21	7	8	6	7	7	5	5	7	6	6
19	32	103	83	20	8	7	6	7	6	5	4	4	5	7
20	C	108	87	21	7	5	7	8	8	7	6	7	6	7

Comments:

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

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST



Lab No.: A-20072106-002

Client ID: Morro Bay

Start Date: 07/22/2020

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	3.2	106	82	24	5	7	6	5	4	6	7	7	7	6
22	5.6	104	83	21	7	6	5	8	7	7	5	6	7	7
23	32	102	82	20	6	5	5	7	6	6	5	4	6	6
24	15	109	79	30	6	5	7	4	5	4	6	5	5	7
25	10	112	94	18	7	6	5	7	6	7	5	7	6	6
26	BC	106	90	16	5	7	8	7	7	6	5	7	6	6
27	3.2	111	93	18	8	5	7	6	6	7	7	7	6	5
28	10	105	89	16	7	6	7	5	7	7	5	6	7	7
29	3.2	106	86	20	6	5	7	7	8	7	6	5	7	8
30	C	103	90	13	5	7	7	8	6	7	8	6	7	7
31	BC	102	82	20	7	6	8	5	7	7	8	6	7	7
32	5.4	109	93	16	7	6	5	7	7	6	5	7	7	6
33	32	101	80	21	4	4	4	5	5	6	7	7	4	5
34	18	108	85	23	5	7	6	5	4	4	5	7	6	4
35	C	108	86	22	7	6	7	5	4	7	7	6	7	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



Lab No.: A-20072106-002
Client ID: Morro Bay

Start Date: 07/22/2020

WATER QUALITY READINGS

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

Sample as received: Chlorine: 0 mg/l; pH: 7.6; Salinity: 0 ppt; Temp: 0.7 °C;
DO: 2.1 mg/l; NH₃-N: 45 mg/l

Control/dilution water is client supplied receiving water.

Illumination (16 hr light / 8 hr dark at 50 ± 10 uE/m²/s) at 5 locations in incubator:
(four corners and center): 423, 413, 401, 402, 406 uE/m²/s.

Initial readings: Analyst: [Signature] Date: 7-22-20 Time: 1600

Final readings: Analyst: [Signature] Date: 7-24-20 Time: 1600

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST



Lab No.: A-20072106-002
Client ID: Morro Bay

Start Date: 07/22/2020

RANDOMIZATION WORKSHEET

Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Beaker No.	Sample Conc.	Notes
1	3.2	13	3.2	25	10	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	14	32	26	10	
3	BL	15	BL	27	3.2	
4	10	16	5.6	28	10	
5	C	17	10	29	3.2	
6	5.6	18	18	30	C	
7	32	19	32	31	BL	
8	C	20	C	32	5.6	
9	5.6	21	3.2	33	32	
10	18	22	5.6	34	18	
11	BL	23	32	35	C	
12	10	24	18			

Analyst: Date: 7-22-20 Time: 1300



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**



Lab No.: A20072106-001/003
Client/ID: Morro Bay WWTP

Date Tested: 07/21/20 - 07/28/20

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: 10 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-200721

RESULTS SUMMARY

Sample Concentration	Percent Survival	Mean Weight of Larvae (Biomass)
Control-Brine (Receiving Water)	96%	1.965 mg
Control-Dilution (Receiving Water)	100%	2.004 mg
Control-Culture (Aquatic BioSystems)	100%	2.063 mg
Control-Lab (Cultured Abalone Farm)	96%	1.763 mg
3.2%	92%	1.734 mg
5.6%	100%	1.830 mg
10.0%	100%	2.090 mg
18.0%	100%	1.898 mg
32.0%	96%	2.174 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 = 2.004 mg (10 day old))
Concentration response relationship acceptable	PASS (Response curve normal)

Please see RT-200721 report for additional QA Information

Larval Fish Growth and Survival Test-7 Day Survival

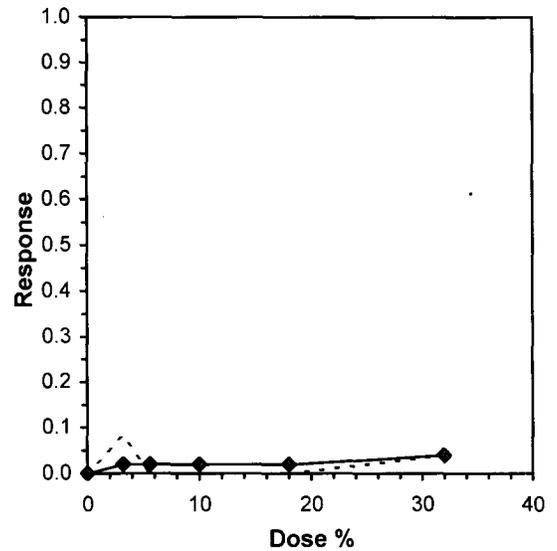
Start Date: 7/21/2020 16:00 Test ID: 20072106t Sample ID: Morro Bay
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/20/2020 08:00 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

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

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					Rank Sum	1-Tailed Critical	Isotonic	
			Mean	Min	Max	CV%	N			Mean	N-Mean
B-Control	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5				
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	*		1.0000	1.0000
3.2	0.9200	0.9200	1.2500	1.1071	1.3453	10.434	5	22.50	16.00	0.9800	0.9800
5.6	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00	0.9800	0.9800
10	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00	0.9800	0.9800
18	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00	0.9800	0.9800
32	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5	25.00	16.00	0.9600	0.9600

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.71382	0.927	-1.4688	3.36952
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: 7/21/2020 16:00 Test ID: 20072106t Sample ID: Morro Bay
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/20/2020 08:00 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

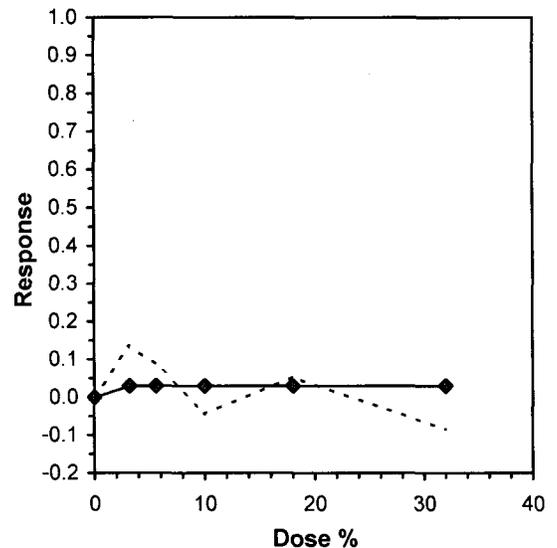
Conc-%	1	2	3	4	5
B-Control	1.6860	1.5820	1.9840	2.2340	2.3400
D-Control	2.1980	1.9960	1.7240	1.9620	2.1420
3.2	1.9320	1.5680	1.8880	1.6920	1.5880
5.6	2.0060	1.6900	1.6780	2.0200	1.7580
10	2.4420	1.9040	1.9620	1.7100	2.4340
18	2.1320	1.8840	1.7220	1.7620	1.9880
32	1.6980	1.9560	1.9240	2.3100	2.9840

Conc-%	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	Mean					N-Mean	
B-Control	1.9652	0.9804	1.9652	1.5820	2.3400	16.836	5				2.0044	1.0000	
D-Control	2.0044	1.0000	2.0044	1.7240	2.1980	9.230	5	*					
3.2	1.7336	0.8649	1.7336	1.5680	1.9320	9.719	5	1.511	2.360	0.4229	1.9453	0.9705	
5.6	1.8304	0.9132	1.8304	1.6780	2.0200	9.262	5	0.971	2.360	0.4229	1.9453	0.9705	
10	2.0904	1.0429	2.0904	1.7100	2.4420	15.823	5	-0.480	2.360	0.4229	1.9453	0.9705	
18	1.8976	0.9467	1.8976	1.7220	2.1320	8.839	5	0.596	2.360	0.4229	1.9453	0.9705	
32	2.1744	1.0848	2.1744	1.6980	2.9840	23.123	5	-0.949	2.360	0.4229	1.9453	0.9705	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.94382	0.927	0.91057	2.0263
Bartlett's Test indicates equal variances (p = 0.10)	9.15557	15.0863		
The control means are not significantly different (p = 0.82)	0.23123	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	0.42291	0.21099	0.13675	0.08028	0.17221	5, 24

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 Growth

Start Date: 7/21/2020 16:00 Test ID: 20072106t Sample ID: Morro Bay
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/20/2020 08:00 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

Conc-%	1	2	3	4	5
B-Control	1.6860	1.9775	1.9840	2.2340	2.3400
D-Control	2.1980	1.9960	1.7240	1.9620	2.1420
3.2	1.9320	1.9600	1.8880	1.6920	1.9850
5.6	2.0060	1.6900	1.6780	2.0200	1.7580
10	2.4420	1.9040	1.9620	1.7100	2.4340
18	2.1320	1.8840	1.7220	1.7620	1.9880
32	2.1225	1.9560	1.9240	2.3100	2.9840

Conc-%	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%	Critical			MSD	
B-Control	2.0443	1.0199	2.0443	1.6860	2.3400	12.469	5				
D-Control	2.0044	1.0000	2.0044	1.7240	2.1980	9.230	5	*			
3.2	1.8914	0.9436	1.8914	1.6920	1.9850	6.193	5	0.690	2.360	0.3863	
5.6	1.8304	0.9132	1.8304	1.6780	2.0200	9.262	5	1.063	2.360	0.3863	
10	2.0904	1.0429	2.0904	1.7100	2.4420	15.823	5	-0.525	2.360	0.3863	
18	1.8976	0.9467	1.8976	1.7220	2.1320	8.839	5	0.652	2.360	0.3863	
32	2.2593	1.1272	2.2593	1.9240	2.9840	19.177	5	-1.557	2.360	0.3863	

Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.951	0.927	0.9205	1.71548						
Bartlett's Test indicates equal variances (p = 0.11)	8.9323	15.0863								
The control means are not significantly different (p = 0.78)	0.28327	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	0.38632	0.19274	0.12635	0.06699	0.13426	5, 24

TOPSMELT CHRONIC BIOASSAY

Survival and Growth Raw Data Sheet



Lab No.: A-20072106-001/003

Start Date: 07/21/2020

Client ID: Morro Bay

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	327.42	316.43
	B	5	5	5	5	5	5	5	5	0	326.27	316.29
	C	5	5	5	5	5	5	5	5	0	324.86	316.24
	D	5	5	5	5	5	5	5	5	0	332.42	322.61
	E	5	5	5	5	5	5	5	5	0	331.93	321.22
3.2%	A	5	5	5	5	5	5	5	5	0	331.80	322.14
	B	5	5	5	5	5	4	4	5	1	326.01	312.17
	C	5	5	5	5	5	5	5	5	0	307.17	297.73
	D	5	5	5	5	5	5	5	5	0	331.87	323.41
	E	5	5	5	5	4	4	4	5	1	318.87	310.93
5.6%	A	5	5	5	5	5	5	5	5	0	336.12	326.09
	B	5	5	5	5	5	5	5	5	0	323.48	315.03
	C	5	5	5	5	5	5	5	5	0	347.36	338.97
	D	5	5	5	5	5	5	5	5	0	328.19	318.09
	E	5	5	5	5	5	5	5	5	0	343.27	334.48
10%	A	5	5	5	5	5	5	5	5	0	322.06	309.85
	B	5	5	5	5	5	5	5	5	0	345.93	336.41
	C	5	5	5	5	5	5	5	5	0	341.21	331.40
	D	5	5	5	5	5	5	5	5	0	339.04	330.49
	E	5	5	5	5	5	5	5	5	0	324.60	312.43
18%	A	5	5	5	5	5	5	5	5	0	333.50	322.84
	B	5	5	5	5	5	5	5	5	0	348.47	339.05
	C	5	5	5	5	5	5	5	5	0	340.12	331.51
	D	5	5	5	5	5	5	5	5	0	339.02	330.21
	E	5	5	5	5	5	5	5	5	0	351.78	341.84
32%	A	5	5	5	5	5	4	4	5	1	341.22	332.73
	B	5	5	5	5	5	5	5	5	0	334.63	324.85
	C	5	5	5	5	5	5	5	5	0	351.14	341.52
	D	5	5	5	5	5	5	5	5	0	343.40	331.85
	E	5	5	5	5	5	5	5	5	0	340.51	325.59

32

40

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TOPSMELT CHRONIC BIOASSAY

Water Chemistries Raw Data Sheet



Lab No.: A-20072106-001/003
 Client ID: Morro Bay

Start Date: 07/21/2020

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		Initial	Final												
Analyst Initials:		2	1	2	2	2	2	2	2	2	1	2	2	2	2
Time of Readings:		1600	1530	1530	1530	1530	1530	1530	1530	1520	1545	1545	1500	1500	1600
Control	DO	7.8	6.7	7.7	6.5	7.0	6.7	6.7	6.2	7.1	6.1	6.3	5.9	2.1	5.9
	pH	7.9	7.9	7.9	7.9	8.0	7.7	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.8
	°C	20.2	20.3	20.4	20.1	20.0	20.1	20.2	20.2	20.2	20.2	20.4	20.6	20.7	20.4
	Sal.	32	32	33	33	33	33	33	33	33	33	33	33	33	33
3.2%	DO	8.1	6.8	7.2	6.5	7.1	6.3	6.8	6.2	7.0	6.2	6.8	5.9	2.2	5.8
	pH	8.0	8.0	8.0	7.9	8.0	7.8	7.9	7.8	7.9	7.9	8.0	7.9	8.0	7.9
	°C	20.2	20.2	20.3	20.1	20.0	20.1	20.2	20.2	20.4	20.4	20.3	20.7	20.5	20.5
	Sal.	32	32	33	33	33	33	33	33	33	33	33	33	33	33
5.6%	DO	8.0	6.7	7.2	6.5	7.0	6.1	6.8	6.3	6.9	6.2	6.6	5.8	6.8	5.7
	pH	8.1	8.0	8.0	7.4	8.0	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0	7.9
	°C	20.2	20.2	20.7	20.1	20.0	20.1	20.4	20.4	20.2	20.4	20.5	20.6	20.5	20.5
	Sal.	32	32	33	33	33	33	33	33	33	33	33	33	33	33
10%	DO	7.9	6.7	7.1	6.5	6.8	6.0	6.9	6.1	6.8	6.7	6.7	5.7	6.8	5.8
	pH	8.1	8.0	8.1	7.9	8.0	7.9	8.0	7.9	7.9	7.9	8.0	7.9	8.0	7.9
	°C	20.3	20.1	20.3	20.1	20.0	20.1	20.1	20.2	20.3	20.4	20.5	20.7	20.5	20.5
	Sal.	32	32	33	33	33	33	33	33	33	33	33	33	33	33
18%	DO	7.9	6.7	7.2	6.5	6.8	6.0	6.7	6.4	6.8	6.0	6.5	5.3	6.3	5.6
	pH	8.2	8.1	8.2	8.0	8.1	7.9	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9
	°C	20.3	20.1	20.2	20.1	20.1	20.0	20.1	20.3	20.2	20.2	20.4	20.6	20.5	20.4
	Sal.	32	32	33	33	33	33	33	33	33	33	33	33	33	33
32%	DO	7.7	6.6	7.1	6.3	6.9	6.0	6.8	6.1	6.7	5.9	6.3	5.2	6.5	5.9
	pH	8.2	8.1	8.2	8.0	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.2	8.0
	°C	20.5	20.0	20.1	20.1	20.1	20.0	20.1	20.2	20.3	20.3	20.4	20.6	20.5	20.4
	Sal.	32	32	33	33	33	33	33	33	33	33	33	33	33	33

Comments:

Dissolved Oxygen (DO) readings in mg/l O₂; 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.

Larval Fish Growth and Survival Test-7 Day Survival

Start Date: 7/21/2020 16:00 Test ID: 20072106c Sample ID: Morro Bay
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/20/2020 08:00 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

Conc-%	1	2	3	4	5
Lab-Control	1.0000	1.0000	1.0000	1.0000	0.8000
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
Culture Control	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	Rank Sum	1-Tailed Critical
			Mean	Min	Max	CV%			
Lab-Control	0.9600	0.9600	1.2977	1.1071	1.3453	8.207	5	*	
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	5		
Culture Control	1.0000	1.0000	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) Equality of variance cannot be confirmed	0.62485	0.842	-2.5156	7.15179
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 Lab-Control				

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date: 7/21/2020 16:00 Test ID: 20072106c Sample ID: Morro Bay
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: EFF1-POTW
 Sample Date: 7/20/2020 08:00 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

Conc-%	1	2	3	4	5
Lab-Control	1.9040	1.8340	1.8480	1.7280	1.5000
D-Control	2.1980	1.9960	1.7240	1.9620	2.1420
Culture Control	2.4360	1.9100	2.0600	1.9620	1.9480

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
Lab-Control	1.7628	0.8795	1.7628	1.5000	1.9040	9.083	5	*		
D-Control	2.0044	1.0000	2.0044	1.7240	2.1980	9.230	5			
Culture Control	2.0632	1.0293	2.0632	1.9100	2.4360	10.451	5	-2.501	1.860	0.2233

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96235	0.842	0.75627	1.054		
F-Test indicates equal variances (p = 0.58)	1.81365	23.1545				
The control means are not significantly different (p = 0.06)	2.20804	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	0.22334	0.1267	0.2256	0.03606	0.03688	1, 8

TOPSMELT CHRONIC BIOASSAY



Lab No.: A-20072106-additional controls

Client ID: Morro Bay

Start Date: 07/21/2020

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		0 hr	24hr												
Analyst Initials:		7	7	7	7	8	7	7	7	7	7	7	7	7	7
Time of Readings:		1600	1530	1530	1530	1530	1530	1530	1530	1530	1545	1545	1500	1600	1600
Brine Control	DO	7.2	6.8	7.2	6.6	7.0	6.3	7.0	6.5	7.0	5.8	6.7	6.3	7.1	6.0
	pH	8.4	8.4	8.4	8.3	8.2	8.1	8.1	8.1	8.1	8.1	8.0	8.1	8.1	7.9
	°C	20.1	20.2	20.3	20.1	20.0	20.2	20.3	20.4	20.2	20.6	20.4	20.0	20.5	20.4
	Sal.	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Culture Water Control	DO	7.1	6.8	7.1	6.6	7.0	6.1	6.6	6.0	6.8	5.9	6.7	6.1	7.0	6.0
	pH	8.0	8.0	8.0	7.9	7.9	7.8	7.9	7.8	8.0	7.8	7.9	8.0	8.0	8.0
	°C	20.1	20.2	20.3	20.2	20.1	20.3	20.3	20.3	20.2	20.5	20.6	20.7	20.5	20.4
	Sal.	32	32	32	32	32	32	32	32	32	32	32	32	32	32

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 O₂. Salinity (Sal.) in ppt.

Original sample used for all renewals. No ammonia (< 0.1 mg/L NH₃-N) detected in either sample.

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	A	5	5	5	5	5	5	5	5	0	347.25	338.82
	B	5	5	5	5	5	5	4	5	1	315.90	207.99
	C	5	5	5	5	5	5	5	5	0	324.91	314.99
	D	5	5	5	5	5	5	5	5	0	317.01	305.84
	E	5	5	5	5	5	5	5	5	0	335.10	323.46
Culture Water Control	A	5	5	5	5	5	5	5	5	0	325.77	313.59
	B	5	5	5	5	5	5	5	5	0	324.47	314.92
	C	5	5	5	5	5	5	5	5	0	331.05	320.75
	D	5	5	5	5	5	5	5	5	0	327.20	317.39
	E	5	5	5	5	5	5	5	5	0	316.41	306.67

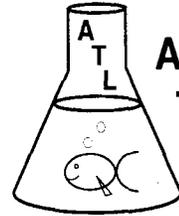
Additional Water Quality Parameters for 100% Effluent Samples as Received	Sample 001	Sample 002	Sample 003
DO (mg/L O ₂)	4.6	2.1	5.7
pH	7.7	7.6	7.7
Salinity (ppt) - sample adjusted with sea salts	0	0	0
Ammonia (mg/l NH ₃ -N)	45	45	43.5



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
 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	7/20/2020	0800	E	<0.05	1 (2.5 gallon)	3 Species Marine 0.7°C Chronic
Comp ARS	7/21/2020	0808	E	<0.05	2.5 gal.	0.7°C
Seawater	7/21/2020	0720	RW	—	5 gal.	4.6°C

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)
<i>[Signature]</i>	<i>[Signature]</i>	7/21/20	1025	—	—
<i>[Signature]</i>	<i>[Signature]</i>	7.21/20	10:05 3:00 PM	Yes	0.7°

CHAIN OF CUSTODY

Client: City of Morro Bay Public Works
 Wastewater Treatment Plant
 Address: 160 Atascadero Road
 Morro Bay, CA 93442
 Project Manager: John Gunderlock
 Phone: (805) 772-6272
 Email: jgunderlock@morrobayca.gov
 Purchase Order No:



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	7/23/20	0810	E	< 0.05	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)
<i>[Signature]</i>	<i>[Signature]</i>	7/23/20	1230	Yes	0.4



***REFERENCE
TOXICANT
DATA***



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 ***



QA/QC Batch No.: RT-200722

Date tested: 07/22/20 – 07/24/20

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: ZnSO₄(7H₂O).

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	92.8%
10 µg/l	92.3%
18 µg/l	92.4%
32 µg/l	23.3% *
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	22.7 µg/l

QA/QC TEST ACCEPTABILITY

Parameter	Result
Average control normality ≥80%	Yes (92.8%)
56 µg/l treatment response significantly less than control response	Yes (NOEC = 18 µg/l)
%MSD <20% relative to control	Yes (%MSD = 8.8%)

Abalone Larval Development Test-Proportion Normal

Start Date: 7/22/2020 15:00 Test ID: RT200722ab Sample ID: REF-Ref Toxicant
 End Date: 7/24/2020 15:30 Lab ID: CAATL-Aquatic Testing Labs Sample Type: ZNSO-Zinc sulfate
 Sample Date: 7/22/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: HR-Haliotis rufescens
 Comments:

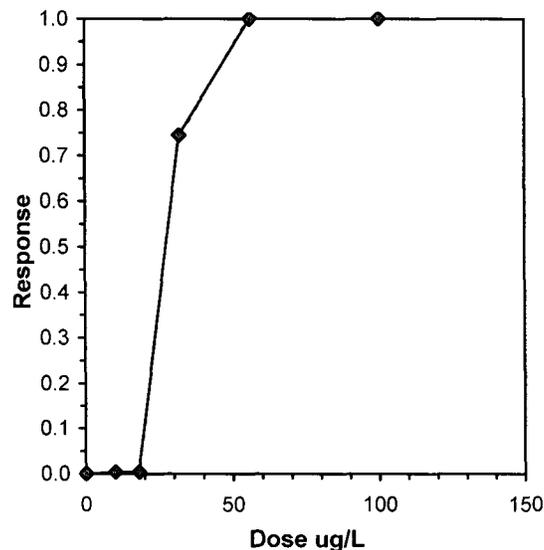
Conc-ug/L	1	2	3	4	5
D-Control	0.9010	0.9009	0.9619	0.9406	0.9333
10	0.9020	0.9706	0.9412	0.8911	0.9109
18	0.8900	0.9510	0.9417	0.9314	0.9057
32	0.4828	0.1321	0.1509	0.1863	0.2110
56	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					Rank Sum	1-Tailed Critical	Isotonic	
			Mean	Min	Max	CV%	N			Mean	N-Mean
D-Control	0.9275	1.0000	1.3020	1.2506	1.3744	4.043	5			0.9273	1.0000
10	0.9231	0.9953	1.2957	1.2345	1.3984	5.160	5	28.00	17.00	0.9236	0.9960
18	0.9240	0.9961	1.2943	1.2327	1.3475	3.686	5	27.00	17.00	0.9236	0.9960
*32	0.2326	0.2508	0.4925	0.3719	0.7682	32.363	5	15.00	17.00	0.2375	0.2561
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 non-normal distribution (p <= 0.05)	0.86061	0.905	1.76899	4.82798
Bartlett's Test indicates equal variances (p = 0.06)	7.58493	11.3449		

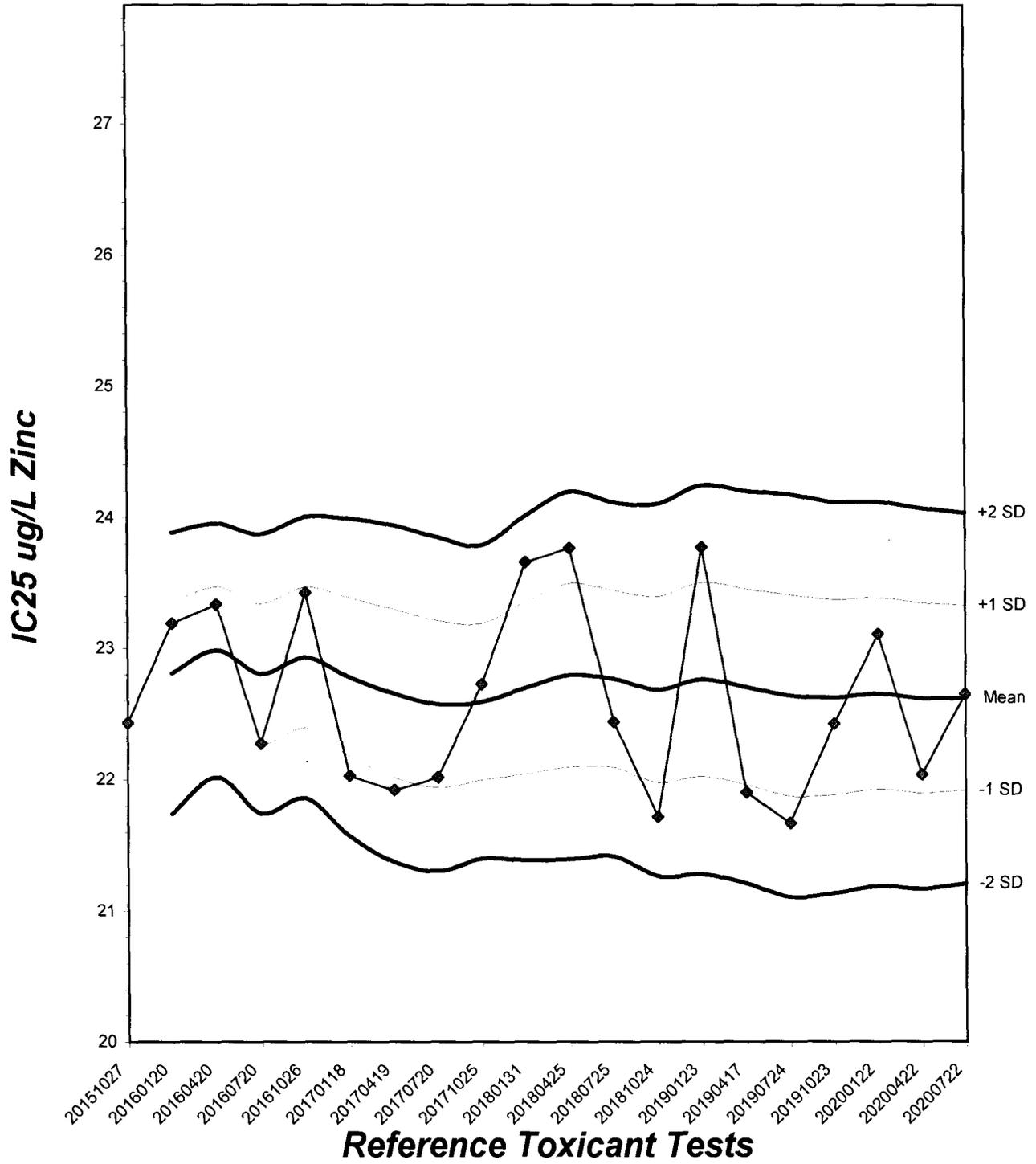
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	18	32	24	
Treatments vs D-Control				

Point	ug/L	SD	Linear Interpolation (200 Resamples)		
			95% CL(Exp)	Skew	
IC05	18.870	0.230	17.853	19.154	-0.6233
IC10	19.816	0.249	18.862	20.293	-0.1303
IC15	20.762	0.292	19.765	21.433	0.2689
IC20	21.708	0.349	20.628	22.626	0.4909
IC25	22.654	0.416	21.463	23.853	0.6011
IC40	25.492	0.641	23.992	27.645	0.7000
IC50	27.385	0.800	25.663	30.144	0.7138



Abalone Larval Development Laboratory Control Chart

CV% = 3.12



Abalone Larval Development Test-Proportion Normal

Start Date: 7/22/2020 15:00 Test ID: RT200722ab Sample ID: REF-Ref Toxicant
 End Date: 7/24/2020 15:30 Lab ID: CAATL-Aquatic Testing Labs Sample Type: ZNSO-Zinc sulfate
 Sample Date: 7/22/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: HR-Haliotis rufescens
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	0.9010	0.9009	0.9619	0.9406	0.9333
10	0.9020	0.9706	0.9412	0.8911	0.9109
18	0.8900	0.9510	0.9417	0.9314	0.9057
32	0.4828	0.1321	0.1509	0.1863	0.2110
56	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%	Critical			MSD	
D-Control	0.9275	1.0000	1.3020	1.2506	1.3744	4.043	5				
10	0.9231	0.9953	1.2957	1.2345	1.3984	5.160	5	0.105	2.230	0.1318	
18	0.9240	0.9961	1.2943	1.2327	1.3475	3.686	5	0.129	2.230	0.1318	
*32	0.2326	0.2508	0.4925	0.3719	0.7682	32.363	5	13.697	2.230	0.1318	
56	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	5				

Auxiliary Tests					Statistic	Critical	Skew	Kurt				
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)					0.86061	0.905	1.76899	4.82798				
Bartlett's Test indicates equal variances (p = 0.06)					7.58493	11.3449						
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test			18	32	24		0.08154	0.08773	0.80972	0.00873	2.5E-10	3, 16
Treatments vs D-Control												

ABALONE CHRONIC BIOASSAY
Reference Toxicant - Zinc Sulfate



QA/QC No.: RT-200722

Start Date: 07/22/2020

WATER QUALITY READINGS

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

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

Initial readings: gm Date/Time: 7-22-20 1500 Final readings: gm Date/Time: 7-24-20 1500

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	18	89	11	11	32	14	92	21	C	95	6
2	56	0	100	12	100	0	100	22	100	0	100
3	10	92	10	13	56	0	100	23	18	95	7
4	100	0	100	14	10	96	6	24	56	0	100
5	C	91	10	15	32	16	90	25	10	92	9
6	32	56	60	16	C	100	4	26	56	0	100
7	10	99	3	17	18	97	6	27	C	98	7
8	56	0	100	18	100	0	100	28	100	0	100
9	18	97	5	19	10	90	11	29	18	96	10
10	C	100	11	20	32	19	83	30	32	23	86

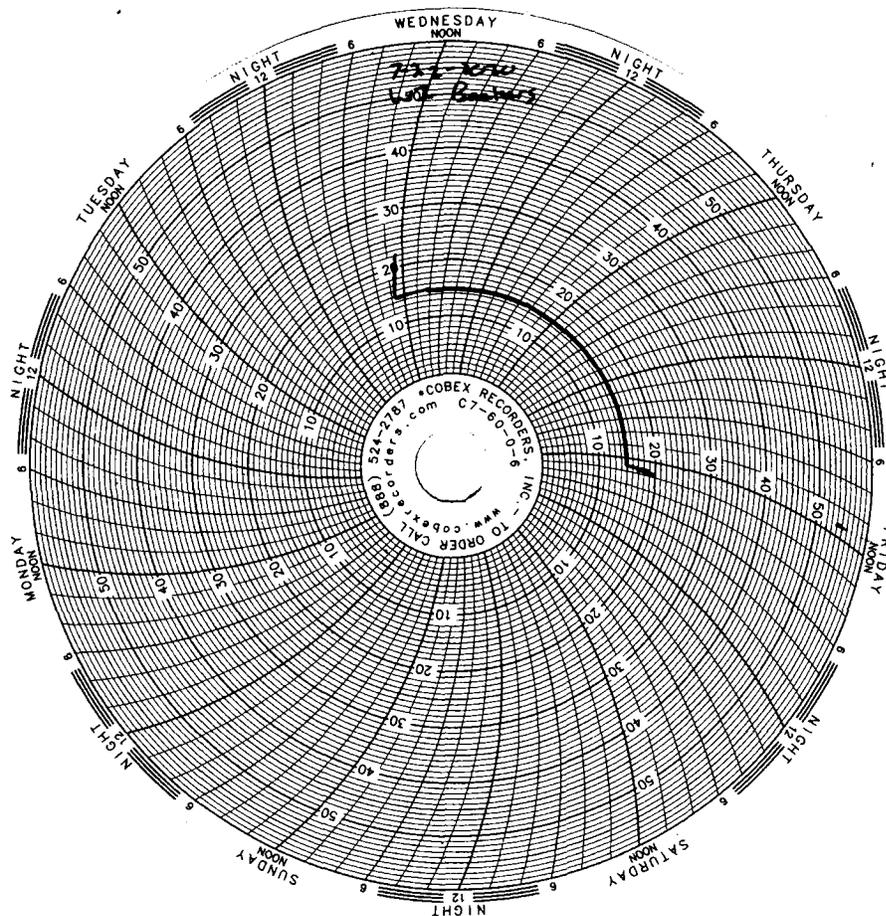
Microscopic examination: Analyst: gm Date: 7-27-20 Time: 0600

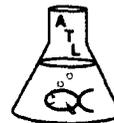
Test Temperature Chart

Test No: RT-200722

Date Tested: 07/22/20 to 07/24/20

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



QA/QC Batch No.: RT-200722

Date Tested: 07/22/20 - 07/24/20

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	86.1%		15.90	
10 $\mu\text{g/l}$	86.0%		15.85	
18 $\mu\text{g/l}$	85.6%		15.95	
32 $\mu\text{g/l}$	70.9%	*	14.80	
56 $\mu\text{g/l}$	52.9%	*	11.10	*
100 $\mu\text{g/l}$	15.4%	*	7.15	*
180 $\mu\text{g/l}$	4.7%	*	5.55	*

* Statistically significantly less than control at P = 0.05 level

CHRONIC TOXICITY

Germination NOEC	18 $\mu\text{g/l}$
Germination IC25	40.3 $\mu\text{g/l}$
Germ Tube Growth NOEC	32 $\mu\text{g/l}$
Germ Tube Growth IC25	50.6 $\mu\text{g/l}$

QA/QC TEST ACCEPTABILITY

Parameter	Result
Mean control germination $\geq 70\%$	Yes (86.1%)
Mean control germination tube length $> 10 \mu\text{m}$	Yes (15.90 μm)
Germination tube growth NOEC $< 35 \mu\text{g/l}$ Copper	Yes (32 $\mu\text{g/l}$)
%MSD $< 20\%$ relative to control (germination & growth)	Yes (germ = 10.2%, growth = 6.9%)

Macrocyctis Germination and Growth Test-Proportion Germinated

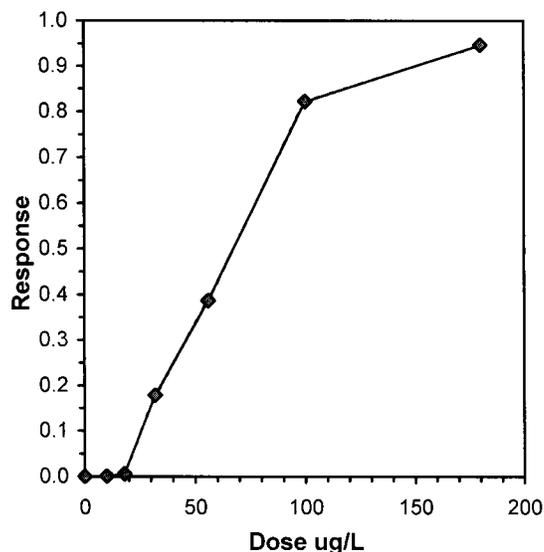
Start Date: 7/22/2020 16:00 Test ID: RT200722k Sample ID: REF-Ref Toxicant
 End Date: 7/24/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/22/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: MP-Macrocyctis pyrifera
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	0.8431	0.9029	0.7981	0.8679	0.8932
10	0.9048	0.7961	0.8911	0.9118	0.7981
18	0.8317	0.8812	0.9048	0.8515	0.8113
32	0.7170	0.7692	0.7451	0.6460	0.6667
56	0.6796	0.3889	0.4727	0.5763	0.5283
100	0.1560	0.2308	0.0980	0.1600	0.1262
180	0.0388	0.0194	0.0196	0.1089	0.0481

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					N	1-Tailed			Isotonic	
			Mean	Min	Max	CV%	t-Stat		Critical	MSD	Mean	N-Mean	
D-Control	0.8611	1.0000	1.1918	1.1047	1.2539	5.036	5				0.8610	1.0000	
10	0.8604	0.9992	1.1936	1.1023	1.2692	6.965	5	-0.037	2.409	0.1153	0.8602	0.9991	
18	0.8561	0.9942	1.1841	1.1215	1.2571	4.594	5	0.160	2.409	0.1153	0.8560	0.9942	
*32	0.7088	0.8232	1.0020	0.9336	1.0697	5.705	5	3.963	2.409	0.1153	0.7073	0.8215	
*56	0.5292	0.6146	0.8153	0.6734	0.9691	13.612	5	7.863	2.409	0.1153	0.5284	0.6137	
*100	0.1542	0.1791	0.4001	0.3185	0.5011	16.949	5	16.532	2.409	0.1153	0.1544	0.1794	
*180	0.0470	0.0545	0.2072	0.1398	0.3363	38.861	5	20.559	2.409	0.1153	0.0468	0.0543	

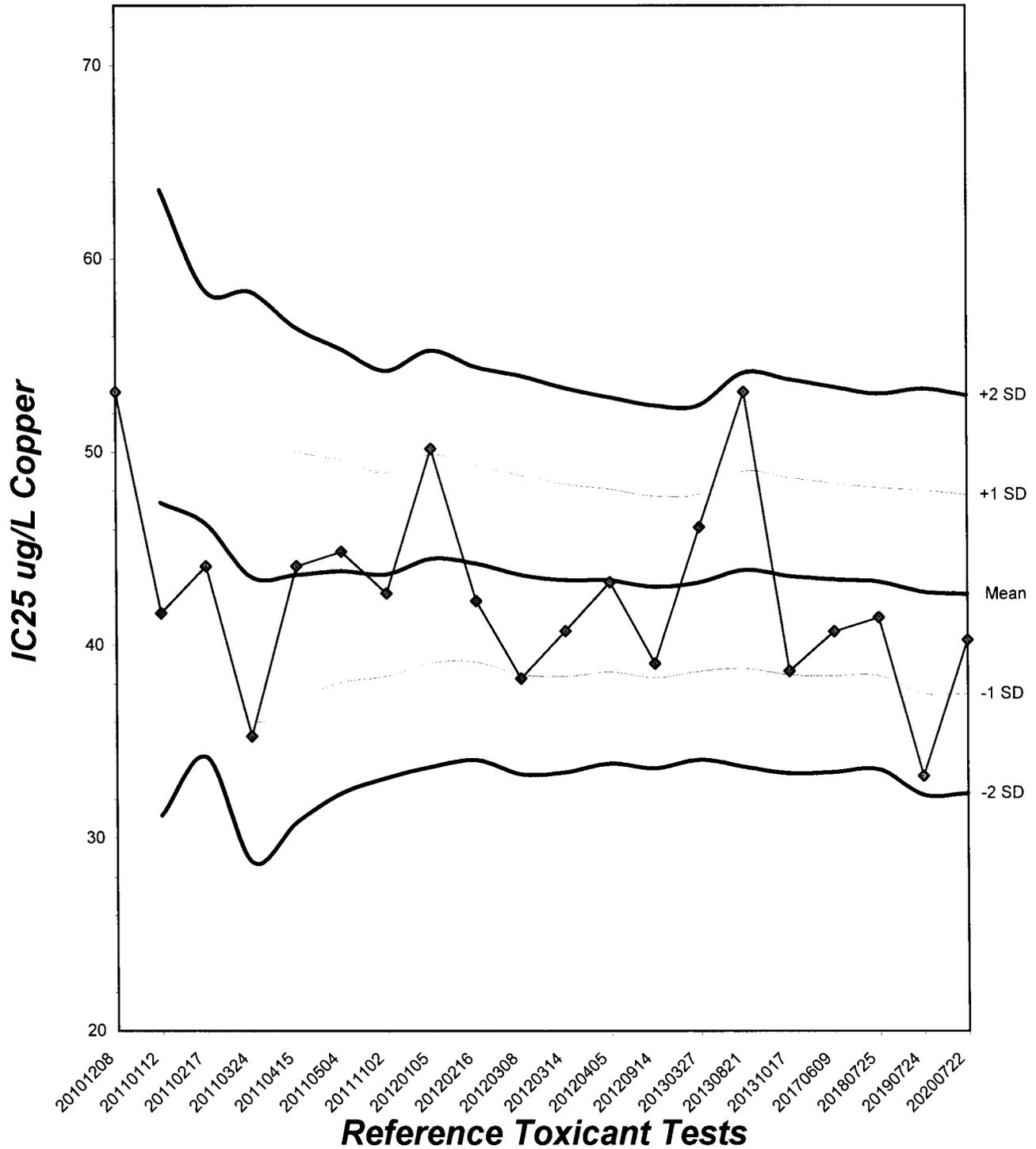
Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.97983	0.934	0.1665	-0.4384						
Bartlett's Test indicates equal variances (p = 0.80)	3.05047	16.8119								
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	18	32	24		0.08822	0.10221	0.82181	0.00573	1.1E-19	6, 28

Linear Interpolation (200 Resamples)					
Point	ug/L	SD	95% CL(Exp)		Skew
IC05	21.585	2.498	9.704	24.600	-2.9163
IC10	25.637	1.857	19.975	31.140	0.4525
IC15	29.690	2.299	24.663	38.388	0.7937
IC20	34.484	2.979	27.008	44.426	0.6379
IC25	40.260	3.544	30.968	52.642	0.5495
IC40	57.393	4.205	44.977	68.947	-0.0141
IC50	67.522	3.779	53.449	76.612	-0.6034



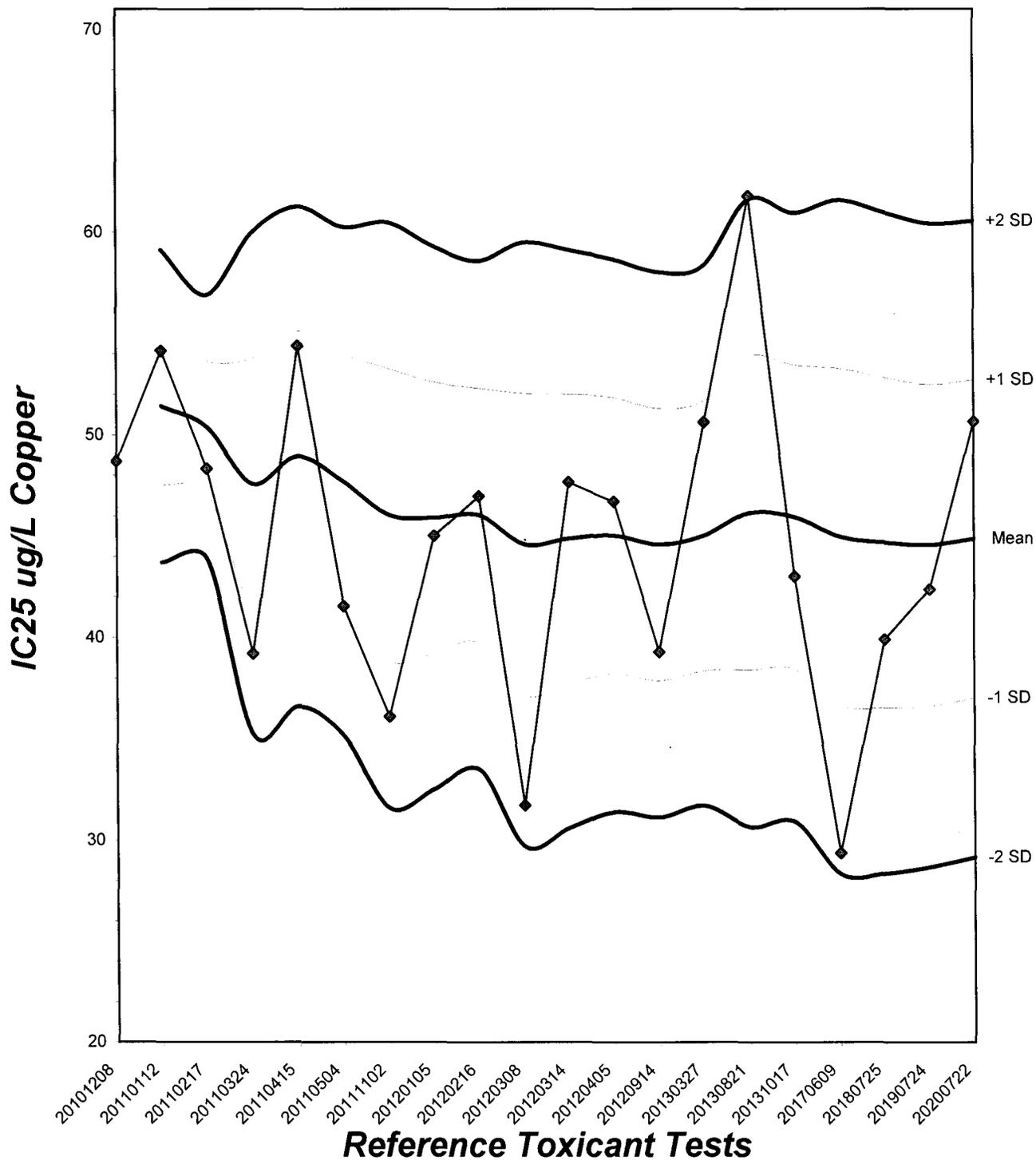
Macrocystis Germination Laboratory Control Chart

CV% = 12.1



Macrocystis Germ Tube Growth Laboratory Control Chart

CV% = 17.5



Macrocystis Germination and Growth Test-Growth-Length

Start Date: 7/22/2020 16:00 Test ID: RT200722k Sample ID: REF-Ref Toxicant
 End Date: 7/24/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/22/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: MP-Macrocystis pyrifera
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	15.250	16.250	16.500	16.250	15.250
10	15.750	15.750	15.750	15.750	16.250
18	15.750	15.500	16.500	16.000	16.000
32	13.250	15.250	15.000	14.750	15.750
56	10.500	9.000	11.750	12.750	11.500
100	7.000	7.500	6.750	7.250	7.250
180	5.750	5.750	5.500	5.500	5.250

Conc-ug/L	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%	Critical			MSD	
D-Control	15.900	1.0000	15.900	15.250	16.500	3.787	5				
10	15.850	0.9969	15.850	15.750	16.250	1.411	5	0.111	2.409	1.090	
18	15.950	1.0031	15.950	15.500	16.500	2.325	5	-0.111	2.409	1.090	
*32	14.800	0.9308	14.800	13.250	15.750	6.365	5	2.432	2.409	1.090	
*56	11.100	0.6981	11.100	9.000	12.750	12.800	5	10.611	2.409	1.090	
*100	7.150	0.4497	7.150	6.750	7.500	3.987	5	19.342	2.409	1.090	
*180	5.550	0.3491	5.550	5.250	5.750	3.769	5	22.879	2.409	1.090	

Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.91634	0.934	-0.8632	3.54674						
Bartlett's Test indicates unequal variances (p = 7.24E-04)	23.2262	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		1.08958	0.06853	98.8786	0.51161	1.9E-21	6, 28

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST



QA/QC No.: RT-200722

Start Date: 07/22/2020

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	56	103	70	33	5	4	3	3	4	5	6	5	3	4
2	10	105	95	10	7	6	5	2	7	6	5	7	7	6
3	32	106	76	30	5	7	5	4	5	6	6	5	6	4
4	180	103	4	99	2	0 ₂	0 ₂	3	2	3	2	2	2	3
5	100	109	17	92	3	2	2	3	4	3	3	3	2	3
6	28	101	84	17	6	7	5	7	7	6	5	7	7	6
7	C	102	86	16	7	6	5	5	7	6	7	5	6	7
8	22	104	80	24	5	7	7	6	2	5	5	7	6	6
9	10	103	82	21	6	7	7	5	7	6	7	5	7	6
10	56	108	42	66	3	5	3	4	4	3	4	3	3	4
11	18	101	89	12	6	7	6	7	5	7	6	6	7	5
12	180	103	2	101	2	2	2	3	2	2	2	3	3	2
13	C	103	93	10	7	6	7	5	4	8	8	7	7	6
14	100	104	74	80	2	3	4	7	3	2	2	4	4	3
15	32	102	76	26	5	7	6	6	5	7	6	6	7	5
16	10	101	90	11	6	5	7	7	4	3	8	6	6	7
17	180	102	2	100	2	2	3	2	2	3	2	2	2	2
18	C	104	83	21	6	5	7	7	8	7	6	6	7	7
19	18	105	95	10	6	7	6	6	2	8	7	6	7	6
20	56	110	52	58	7	5	6	4	4	5	6	4	5	5

Comments:

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

GIANT KELP GERMINATION AND GROWTH SHORT-TERM TOXICITY TEST



QA/QC No.: RT-200722

Start Date: 07/22/2020

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	100	102	10	92	7	2	2	3	4	2	3	3	3	2
22	10	101	86	15	6	7	5	7	8	2	6	6	7	5
23	56	118	68	50	7	6	5	4	3	4	7	6	5	4
24	10	102	93	19	7	6	5	7	7	7	6	5	2	6
25	2	106	92	14	6	7	5	7	7	6	5	7	8	7
26	100	100	16	84	3	2	4	3	2	3	4	3	3	2
27	180	101	11	90	2	2	2	3	2	3	2	2	2	2
28	32	113	73	40	7	5	5	6	4	5	6	7	7	7
29	32	108	72	36	6	7	5	7	6	7	7	6	5	7
30	180	104	5	99	2	3	2	2	2	2	2	2	2	2
31	10	106	86	20	7	6	7	6	7	5	7	6	7	6
32	100	103	13	90	2	3	3	4	3	2	2	3	3	4
33	10	104	83	21	7	7	7	8	7	4	5	7	7	6
34	56	106	56	50	5	4	6	4	5	4	4	3	5	6
35	2	103	92	11	7	5	7	6	6	7	5	4	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



QA/QC No.: RT-200722

Start Date: 07/22/2020

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	15.5	8.2	8.1	34	14.9	8.1	14.8	8.5	8.1	34
10 µg/l	15.5	8.2	8.1	34	14.8	8.1	15.0	8.2	8.1	34
18 µg/l	15.5	8.2	8.1	34	14.6	8.1	14.8	8.3	8.1	34
32 µg/l	15.5	8.3	8.1	34	14.7	8.1	14.8	8.2	8.1	34
56 µg/l	15.5	8.2	8.1	34	14.6	8.1	14.7	8.3	8.1	34
100 µg/l	15.5	8.2	8.1	34	14.6	8.1	14.7	8.2	8.1	34
180 µg/l	15.5	8.2	8.1	34	14.6	8.1	14.8	8.2	8.1	34

Comments:

Reference toxicant: Copper chloride.

All dilutions made with reference lab seawater.

Illumination (16 hr light / 8 hr dark at $50 \pm 10 \text{ uE/m}^2/\text{s}$) at 5 locations in incubator:
(four corners and center): 42.3, 41.5, 40.1, 40.2, 40.6 $\text{uE/m}^2/\text{s}$.

Initial readings: Analyst: [Signature] Date: 7-22-20 Time: 1600

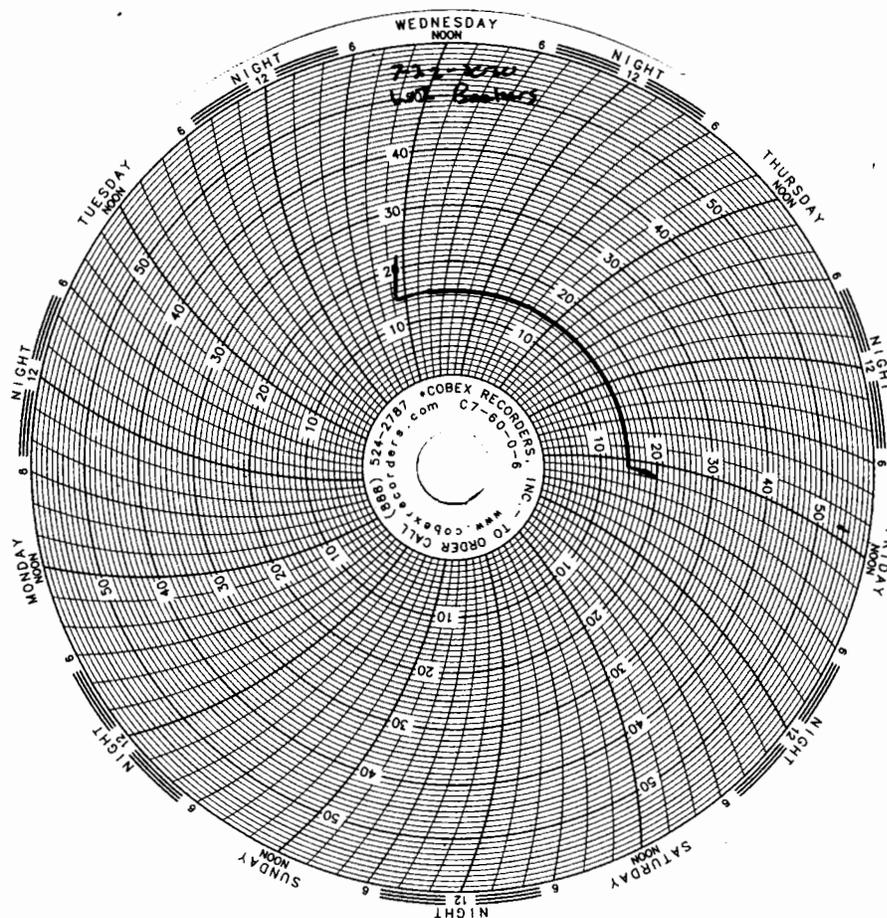
Final readings: Analyst: [Signature] Date: 7-24-20 Time: 1600

Test Temperature Chart

Test No: RT-200722

Date Tested: 07/22/20 to 07/24/20

Acceptable Range: 15 +/- 1°C



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**



QA/QC Batch No.: RT-200721

Date Tested: 07/21/20 - 07/28/20

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: 10 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%		1.763 mg	
56 µg/l	100%		1.878 mg	
100 µg/l	96%		1.880 mg	
180 µg/l	44%	*	0.600 mg	**
320 µg/l	4%	*	0.036 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	176.7 µg/l
Biomass IC25	129.7 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 = 1.838 mg (10 day old))
Survival LC50 ≤2 SD of control chart mean	PASS (see chart)
Survival LC50 <205 µg/l Copper	PASS (LC50 = 176.7 µg/l Copper)
%MSD of <25% relative to control survival	PASS (%MSD = 11.6%)
%MSD of <50% relative to control growth	PASS (%MSD = 16.5%)
Concentration response relationship acceptable	PASS (Response curve normal)

Larval Fish Growth and Survival Test-7 Day Survival

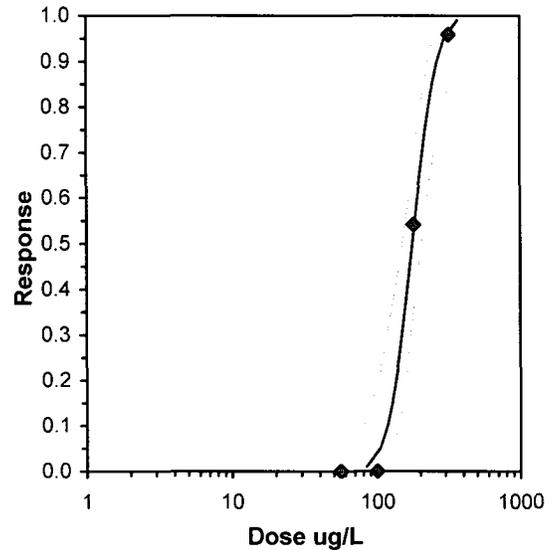
Start Date: 7/21/2020 16:00 Test ID: RT200721t Sample ID: REF-Ref Toxicant
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/21/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

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

Conc-ug/L	Transform: Arcsin Square Root							Rank Sum	1-Tailed Critical	Number Resp	Total Number
	Mean	N-Mean	Mean	Min	Max	CV%	N				
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	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	27.50	17.00	1	25
*180	0.4400	0.4583	0.7210	0.4636	0.8861	24.356	5	15.00	17.00	14	25
*320	0.0400	0.0417	0.2731	0.2255	0.4636	38.990	5	15.00	17.00	24	25

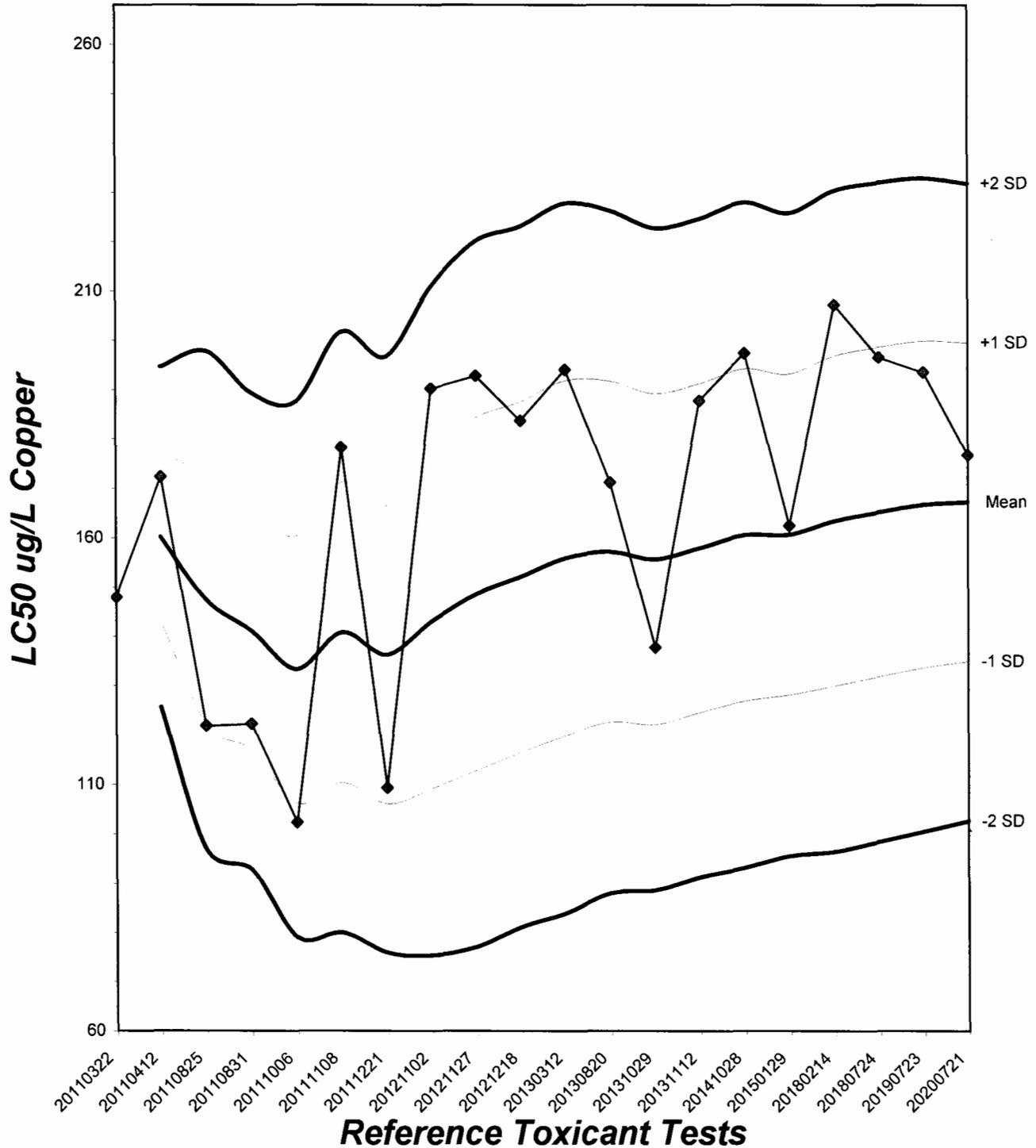
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.90307	0.918	-0.59	1.11415
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	
Treatments vs D-Control				

Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit						
			Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter		
Slope	7.25349	1.56158	4.1928	10.3142	0.04	0.72069	5.99146	0.7	2.24734	0.13786	5
Intercept	-11.301	3.544	-18.247	-4.3548							
TSCR	0.01807	0.01855	-0.0183	0.05443							
Point	Probits	ug/L	95% Fiducial Limits								
EC01	2.674	84.4542	45.9203	109.881							
EC05	3.355	104.852	66.1791	129.069							
EC10	3.718	117.669	80.1945	141.016							
EC15	3.964	127.191	91.1205	149.977							
EC20	4.158	135.305	100.695	157.756							
EC25	4.326	142.677	109.535	165.007							
EC40	4.747	163.085	134.078	186.627							
EC50	5.000	176.743	149.862	203.063							
EC60	5.253	191.545	165.737	223.3							
EC75	5.674	218.943	191.285	267.857							
EC80	5.842	230.872	201.13	289.849							
EC85	6.036	245.601	212.532	318.842							
EC90	6.282	265.474	226.953	360.821							
EC95	6.645	297.927	248.898	435.591							
EC99	7.326	369.882	293.399	625.54							



Topsmelt Chronic Survival Laboratory Control Chart

CV% = 19.3



Larval Fish Growth and Survival Test-7 Day Survival

Start Date: 7/21/2020 16:00 Test ID: RT200721t Sample ID: REF-Ref Toxicant
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/21/2020 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	1.0000	1.0000	1.0000	0.8000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	0.8000
180	0.6000	0.4000	0.2000	0.4000	0.6000
320	0.0000	0.0000	0.0000	0.0000	0.2000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%	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	-0.661	2.300	0.1657	
100	0.9600	1.0000	1.2977	1.1071	1.3453	8.207	5	0.000	2.300	0.1657	
*180	0.4400	0.4583	0.7210	0.4636	0.8861	24.356	5	8.004	2.300	0.1657	
*320	0.0400	0.0417	0.2731	0.2255	0.4636	38.990	5	14.222	2.300	0.1657	

Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05) Equality of variance cannot be confirmed	0.90307	0.918	-0.59	1.11415						
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	180	134.164		0.10775	0.11621	1.12713	0.01297	2.4E-12	4, 20

Larval Fish Growth and Survival Test-7 Day Biomass

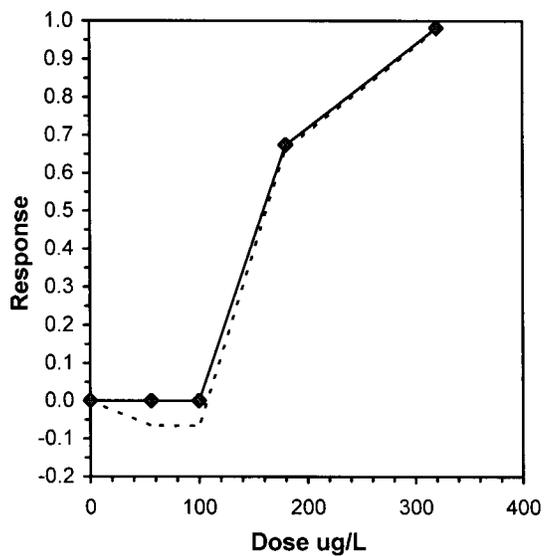
Start Date: 7/21/2020 16:00 Test ID: RT200721t Sample ID: REF-Ref Toxicant
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/21/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	1.9040	1.8340	1.8480	1.7280	1.5000
56	1.9660	1.8660	1.7760	2.1180	1.6640
100	1.8080	1.9440	1.7140	2.3480	1.5840
180	1.0380	0.6080	0.1360	0.4760	0.7400
320	0.0000	0.0000	0.0000	0.0000	0.1780

Conc-ug/L	Mean	N-Mean	Transform: Untransformed					N	1-Tailed			Isotonic	
			Mean	Min	Max	CV%	t-Stat		Critical	MSD	Mean	N-Mean	
D-Control	1.7628	1.0000	1.7628	1.5000	1.9040	9.083	5				1.8401	1.0000	
56	1.8780	1.0654	1.8780	1.6640	2.1180	9.287	5	-0.837	2.110	0.2903	1.8401	1.0000	
100	1.8796	1.0663	1.8796	1.5840	2.3480	15.590	5	-0.849	2.110	0.2903	1.8401	1.0000	
180	0.5996	0.3401	0.5996	0.1360	1.0380	55.451	5				0.5996	0.3258	
320	0.0356	0.0202	0.0356	0.0000	0.1780	223.607	5				0.0356	0.0193	

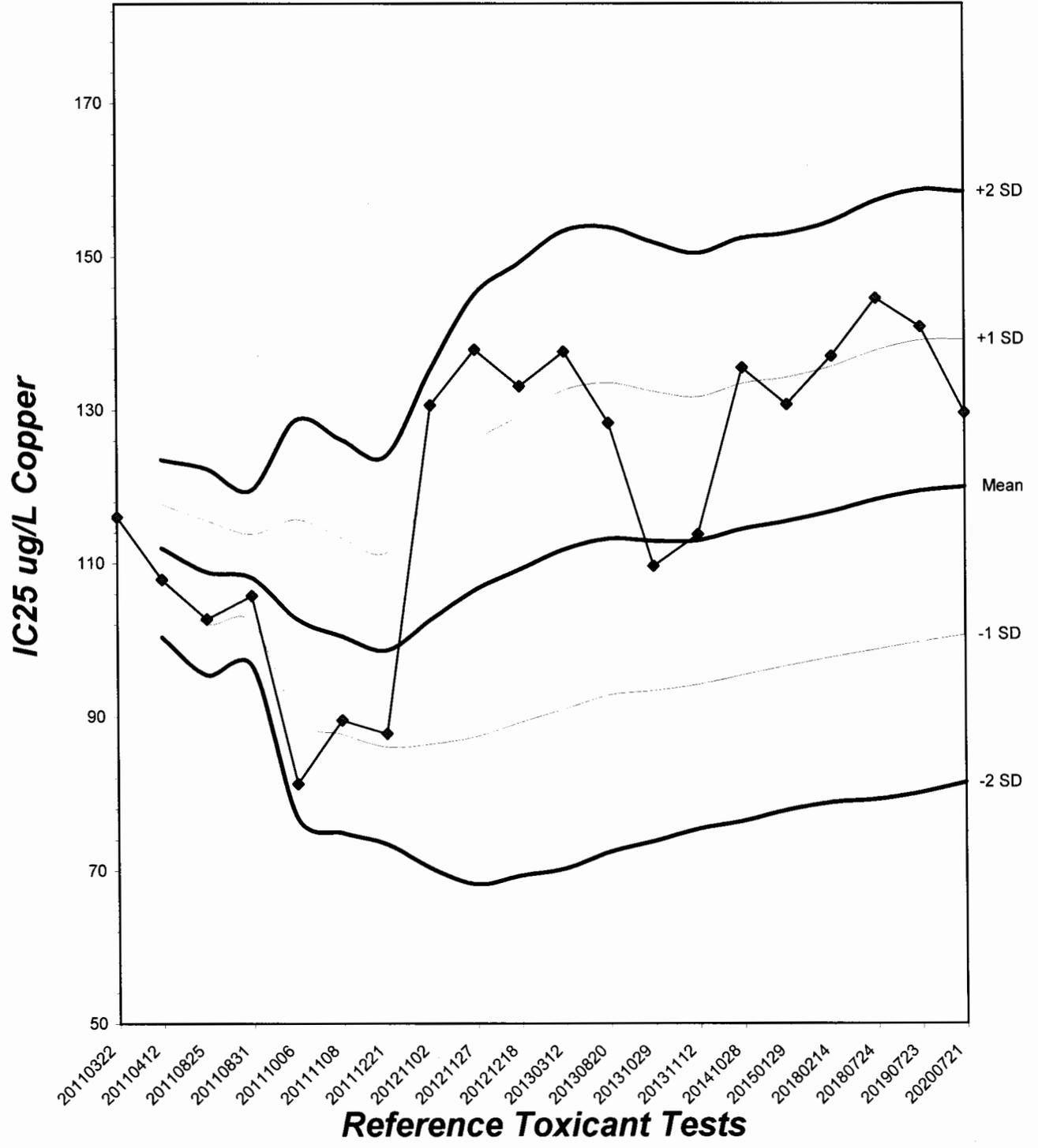
Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.9597	0.881	0.62114	0.73489						
Bartlett's Test indicates equal variances (p = 0.44)	1.64926	9.21034								
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	100	>100			0.29026	0.16466	0.02243	0.04731	0.63361	2, 12

Linear Interpolation (200 Resamples)					
Point	ug/L	SD	95% CL(Exp)		Skew
IC05	105.93	7.65	66.51	107.95	-3.9537
IC10	111.87	3.54	95.54	115.90	-2.8207
IC15	117.80	3.33	102.90	123.85	-1.3819
IC20	123.73	3.57	109.00	131.80	-0.7278
IC25	129.67	3.94	114.83	139.75	-0.2598
IC40	147.47	5.51	133.14	164.72	0.2700
IC50	159.33	6.76	142.00	180.90	0.3459



Topsmelt Chronic Growth Laboratory Control Chart

CV% = 16



Larval Fish Growth and Survival Test-7 Day Growth

Start Date: 7/21/2020 16:00 Test ID: RT200721t Sample ID: REF-Ref Toxicant
 End Date: 7/28/2020 16:00 Lab ID: CAATL-Aquatic Testing Labs Sample Type: CUCL-Copper chloride
 Sample Date: 7/21/2020 Protocol: EPAW 95-EPA/600/R-95/136 Test Species: AA-Atherinops affinis
 Comments:

Conc-ug/L	1	2	3	4	5
D-Control	1.9040	1.8340	1.8480	1.7280	1.8750
56	1.9660	1.8660	1.7760	2.1180	1.6640
100	1.8080	1.9440	1.7140	2.3480	1.9800
180	1.7300	1.5200	0.6800	1.1900	1.2333
320	0.8900				

Conc-ug/L	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%	Critical			MSD	
D-Control	1.8378	1.0000	1.8378	1.7280	1.9040	3.644	5				
56	1.8780	1.0219	1.8780	1.6640	2.1180	9.287	5	-0.360	2.110	0.2357	
100	1.9588	1.0658	1.9588	1.7140	2.3480	12.369	5	-1.083	2.110	0.2357	
180	1.2707	0.6914	1.2707	0.6800	1.7300	31.231	5				
320	0.8900	0.4843	0.8900	0.8900	0.8900	0.000	1				

Auxiliary Tests		Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)		0.93659	0.881	0.82007	1.27004						
Bartlett's Test indicates equal variances (p = 0.09)		4.79932	9.21034								
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test		100	>100			0.23573	0.12827	0.01899	0.0312	0.56012	2, 12
Treatments vs D-Control											

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



QA/QC No.: RT-200721

Start Date: 07/21/2020

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	332.84	323.32
	B	5	5	5	5	5	5	5	5	0	346.29	327.12
	C	5	5	5	5	5	5	5	5	0	339.00	329.76
	D	5	5	5	5	5	5	5	5	0	334.47	325.83
	E	5	5	5	5	5	5	4	5	1	328.26	320.76
56 µg/l	A	5	5	5	5	5	5	5	5	0	341.01	331.18
	B	5	5	5	5	5	5	5	5	0	331.82	322.49
	C	5	5	5	5	5	5	5	5	0	337.70	328.82
	D	5	5	5	5	5	5	5	5	0	341.03	330.44
	E	5	5	5	5	5	5	5	5	0	351.97	343.65
100 µg/l	A	5	5	5	5	5	5	5	5	0	326.94	317.90
	B	5	5	5	5	5	5	5	5	0	340.70 332.08	330.98
	C	5	5	5	5	5	5	5	5	0	330.59	322.02
	D	5	5	5	5	5	5	5	5	0	341.28	329.64
	E	5	5	5	5	4	4	4	5	1	345.28	337.36
180 µg/l	A	5	5	5	5	4	3	3	5	2	327.82	322.63
	B	5	5	4	3	2	2	2	5	3	328.72	325.68
	C	5	5	4	3	3	1	1	5	4	332.34	331.06
	D	5	5	4	3	3	2	2	5	3	321.94	329.56
	E	5	5	4	4	3	3	3	5	2	330.09	326.39
320 µg/l	A	4	2	1	0	0	0	0	5	5	—	—
	B	3	2	0	0	0	0	0	5	5	—	—
	C	3	1	0	0	0	0	0	5	5	—	—
	D	4	2	1	0	0	0	0	5	5	—	—
	E	3	2	2	1	1	1	1	5	4	322.22	321.24

Time placed in drying oven: 1600 Temperature of drying oven: 60°C (dry for 24 hr at 60°C)

Time placed in desiccator: 1600 Analyst: [Signature] Date/Time: 7-28-20 1600

Blank: 336.20 335.81

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



QA/QC No.: RT-200721

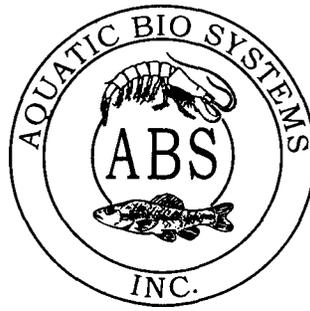
Start Date: 07/21/2020

		DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7	
		Initial	Final												
Analyst Initials:		Z	Z	P	Z	Z	Z	Z	Z	Z	Z	Z	K	L	J
Time of Readings:		1600	1530	1530	1530	1530	1530	1530	1530	1530	1545	1545	1600	1500	1600
Control	DO	7.2	6.8	7.2	6.6	7.1	6.4	6.6	6.3	7.1	6.0	6.4	6.6	7.0	6.1
	pH	8.1	7.9	8.0	7.9	7.9	7.7	7.8	7.8	7.9	7.8	7.9	7.9	8.2	8.2
	Temp	20.0	20.0	20.1	19.9	20.0	20.0	20.1	20.2	20.2	20.5	20.4	20.7	20.6	20.3
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
56 µg/l	DO	7.2	6.8	7.2	6.7	7.0	6.2	6.7	6.3	7.0	6.3	6.6	6.5	7.0	6.0
	pH	8.0	7.9	8.0	7.9	7.9	7.8	7.9	7.8	7.9	7.8	7.9	7.9	8.0	7.7
	Temp	20.0	20.0	20.2	19.9	20.0	20.0	20.1	20.2	20.3	20.4	20.3	20.5	20.4	20.2
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 µg/l	DO	7.2	6.7	7.2	6.7	7.0	6.4	6.8	6.3	7.1	6.3	6.6	6.4	7.0	5.9
	pH	8.0	7.9	8.0	7.9	7.9	7.8	7.9	7.8	8.0	7.8	7.9	7.9	7.9	7.7
	Temp	20.0	20.1	20.3	19.9	20.1	20.0	20.1	20.2	20.3	20.4	20.3	20.5	20.4	20.1
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
180 µg/l	DO	7.2	6.9	7.2	6.8	7.0	6.7	6.9	6.5	7.1	6.4	6.8	6.7	7.3	6.2
	pH	8.1	7.9	8.0	7.9	8.0	7.8	7.9	7.8	8.0	7.8	7.9	7.8	8.0	7.8
	Temp	20.1	20.1	20.2	20.1	20.1	20.0	20.2	20.3	20.3	20.3	20.4	20.4	20.4	20.2
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33
320 µg/l	DO	7.2	6.9	7.2	6.9	7.1	6.8	7.1	6.7	7.2	6.6	6.9	6.8	7.2	6.4
	pH	8.1	7.9	8.0	8.0	8.0	7.9	7.9	7.9	8.0	7.8	7.9	7.8	8.0	7.6
	Temp	20.1	20.1	20.3	20.1	20.0	20.1	20.2	20.3	20.2	20.3	20.4	20.4	20.5	20.3
	Sal.	33	33	33	33	33	33	33	33	33	33	33	33	33	33

Comments:

Dissolved Oxygen (DO) readings in mg/l O₂.
 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: 7/20/2020

SPECIES: Atherinops affinis

AGE: 9 day

LIFE STAGE: Larvae

HATCH DATE: 7/11/2020

BEGAN FEEDING: Immediately

FOOD: Artemia sp.

Water Chemistry Record:

	Current	Range
TEMPERATURE:	<u>21°C</u>	<u>20-25°C</u>
SALINITY/CONDUCTIVITY:	<u>30 ppt</u>	<u>30-34 ppt</u>
TOTAL HARDNESS (as CaCO ₃):	<u>--</u>	<u>--</u>
TOTAL ALKALINITY (as CaCO ₃):	<u>140 mg/l</u>	<u>140-170 mg/l</u>
pH:	<u>7.99</u>	<u>7.50-8.00</u>

Comments:



Facility Supervisor

Test Temperature Chart

Test No: RT-200721

Date Tested: 07/21/20 to 07/28/20

Acceptable Range: 20 +/- 1°C

