

July 31, 2020

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**Subject: Results of Analytical Data for Experiment #17**

Mr. Bittner/ Dr. Belovsky:

Below is a summary of the analytical data for the acute brine shrimp experiment with copper initiated on May 28, 2020. Total copper samples were collected in old test solutions.

**Characterization of Recon Water**

Sample No.	pH	Hard. (mg/L) <sup>a</sup>	Alk. (mg/L) <sup>a</sup>	Spec. Cond. (µS/cm)	TRC (mg/L) <sup>b</sup>	NH <sub>3</sub> -N (mg/L)	Salinity (ppt)
RW#13937	8.0	NM	NM	134,600	NM	NM	120

<sup>a</sup>As CaCO<sub>3</sub>

<sup>b</sup>Total residual chlorine

**Results of Copper Analysis**

Nominal Value	Total Copper (µg/L)		Percent of Nominal
	Nominal Value	Measured Value	
0		U <100	---
94		144	153
188		180	96
375		336	90
750		774	103
1,500		1,440	96

U= below method detection limit (100 µg/L)

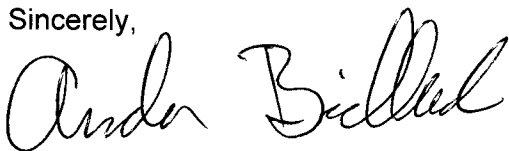
Measured copper values in the four highest treatments were similar to nominal values. The measured value in the lowest treatment was about 50% above nominal, but still provided for a clean monotonically increasing scale. Average measured copper concentrations were then used to recalculate the test endpoint on a measured basis. Both nominal and measured median lethal concentrations are presented in the following table for comparison.

### Test Endpoints

Survival 96-hour LC <sub>50</sub>	Value (µg/L Copper)
Nominal	1,336 (C.L. 1,082 – 1,650)
Measured	1,298 (C.L. 1,075 – 1,568)

We greatly appreciate the opportunity to complete this study for you. Please do not hesitate to call if you have any questions or concerns.

Sincerely,



Amanda Bidlack  
Project Specialist / QA Officer  
[bidlackac.tre@gmail.com](mailto:bidlackac.tre@gmail.com)



Rami B. Naddy, Ph.D.  
Manager / Environmental Toxicologist  
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17001-474-072

Attachment

cc: David Pillard, TRE

**CETIS Analytical Report**

Report Date: 29 Jul-20 16:39 (p 1 of 2)

Test Code: 474-072 | 05-2923-3275

① Brine shrimp

**Fathead Minnow-96-h Acute Survival Test**

TRE Environmental Strategies

<b>Analysis ID:</b> 09-8235-2129	<b>Endpoint:</b> 96h Survival Rate	<b>CETIS Version:</b> CETISv1.8.7
<b>Analyzed:</b> 29 Jul-20 16:39	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Official Results:</b> Yes
<b>Batch ID:</b> 09-2953-2358	<b>Test Type:</b> Survival (96h)	<b>Analyst:</b> Lab Tech
<b>Start Date:</b> 21 May-20 14:40	<b>Protocol:</b> EPA/821/R-02-012 (2002)	<b>Diluent:</b> rGSL
<b>Ending Date:</b> 25 May-20 14:15	<b>Species:</b> Artemia franciscana	<b>Brine:</b> Crystal Sea
<b>Duration:</b> 96h	<b>Source:</b> In-House Culture	<b>Age:</b> 48h
<b>Sample ID:</b> 20-5963-3281	<b>Code:</b> 7AC38281	<b>Client:</b> Notre Dame
<b>Sample Date:</b> 14 May-20 11:00	<b>Material:</b> Copper sulfate	<b>Project:</b> Special Studies
<b>Receive Date:</b> 21 May-20 11:00	<b>Source:</b> research	
<b>Sample Age:</b> 7d 4h	<b>Station:</b>	

**Trimmed Spearman-Kärber Estimates**

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	40.00%	3.113	0.04102	1298	1075	1568

**96h Survival Rate Summary**

**Calculated Variate(A/B)**

C-µg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
100	Dilution Water	2	1	1	1	0	0	0.0%	0.0%	20	20
144		2	1	1	1	0	0	0.0%	0.0%	20	20
180		2	1	1	1	0	0	0.0%	0.0%	20	20
336		2	1	1	1	0	0	0.0%	0.0%	20	20
774		2	1	1	1	0	0	0.0%	0.0%	20	20
1440		2	0.4	0.3	0.5	0.1	0.1414	35.4%	60.0%	8	20

**96h Survival Rate Detail**

C-µg/L	Control Type	Rep 1	Rep 2
100	Dilution Water	1	1
144		1	1
180		1	1
336		1	1
774		1	1
1440		0.5	0.3

**96h Survival Rate Binomials**

C-µg/L	Control Type	Rep 1	Rep 2
100	Dilution Water	10/10	10/10
144		10/10	10/10
180		10/10	10/10
336		10/10	10/10
774		10/10	10/10
1440		5/10	3/10

① PAP 7/30/20 E

**CETIS Analytical Report**

*Brine shrimp*

Report Date: 29 Jul-20 16:39 (p 2 of 2)

Test Code: 474-072 | 05-2923-3275

**Fathead Minnow-96-h Acute Survival Test**

TRE Environmental Strategies

Analysis ID: 09-8235-2129

Endpoint: 96h Survival Rate

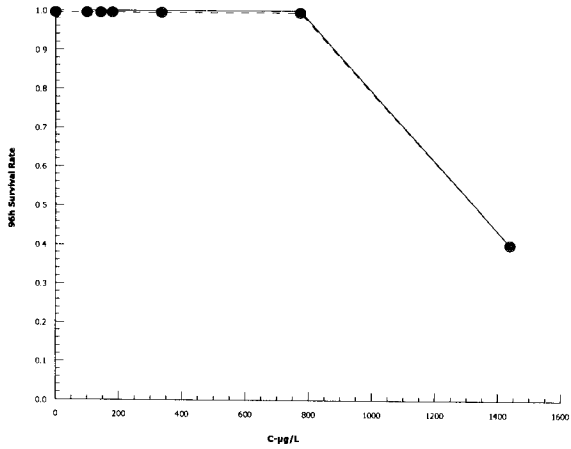
CETIS Version: CETISv1.8.7

Analyzed: 29 Jul-20 16:39

Analysis: Trimmed Spearman-Kärber

Official Results: Yes

**Graphics**



① *Done 7/30/2020*

June 11, 2020

Mr. Christopher Bittner  
Standards Coordinator  
Utah Dept. of Environmental Quality  
195 N 1950 W  
Salt Lake City, UT 84116

Dr. Gary Belovsky  
Environ. Res. Center & Dept. Biol Sci.  
University of Notre Dame  
Notre Dame, IN 46556

**Subject: Results of Acute Brine Shrimp Experiment #17**

Mr. Bittner/ Dr. Belovsky:

Below is a summary of the acute brine shrimp experiment initiated on May 21, 2020. The purpose of this experiment was to investigate an appropriate range for a short term chronic *Artemia franciscana* test with copper as the toxicant.

Along with a control, five different nominal copper concentrations (prepared with  $\text{CuCl}_2$ ) were tested:

- 94, 188, 375, 750, and 1,500  $\mu\text{g/L}$

The results of these studies will help determine the experimental design of the definitive short-term chronic toxicity tests. The test volume was consistent at 50 ml.

**Species:** *Artemia franciscana*

**Test type:**

- Test duration: 4 days
- Test type: static-renewal (solutions and food renewed daily)
- Algae: *Dunaliella viridis*
- Food concentration: 72.5  $\mu\text{g/L}$  Ch1a and 0.3 ml YTC<sup>1</sup>
- Temperature: 20°C
- Test volume(s): 50 ml
- Replicates: 2
- Organisms/Rep: 10
- Test media: 120 ppt rGSL media (per Notre Dame recipe)

**Pretest conditions:** <24-h old *A. franciscana* were hatched out in ~29 ppt artificial seawater (Crystal Sea Marine Mix) and ~200 organisms were placed in 120 ppt rGSL water and fed *Dunaliella viridis* at a density of 72.5  $\mu\text{g/L}$  Ch1a and 0.3 ml YTC. Solutions were gently aerated.

<sup>1</sup> yeast-trout chow-cerophyl mixture used as a typical food for water fleas in whole effluent toxicity testing (USEPA 2002)

### Characterization of Recon Water

Sample No.	pH	Hard. (mg/L) <sup>a</sup>	Alk. (mg/L) <sup>a</sup>	Spec. Cond. ( $\mu$ S/cm)	TRC (mg/L) <sup>b</sup>	NH <sub>3</sub> -N (mg/L)	Salinity (ppt)
RW#13937	8.0	NM	NM	134,600	NM	NM	120

<sup>a</sup>As CaCO<sub>3</sub>

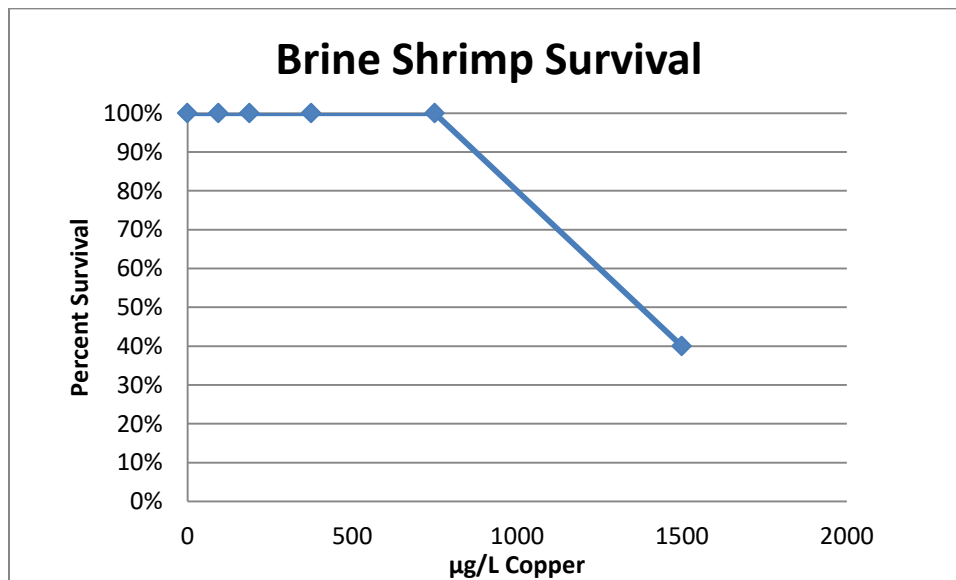
<sup>b</sup>Total residual chlorine

#### Test activities:

- Biological observations (primarily survival) taken daily.
- Chemistries taken daily (i.e., pH, dissolved oxygen, and temperature).
- Conductivity was measured at test termination or when there was 0% survival in that treatment.
- Copper was added to 120 rGSL media containing food and allowed to equilibrate for 3 hours prior to use in the toxicity tests.

#### Results:

The survival of the brine shrimp in the copper treatments is illustrated in the following figure:



### Test Endpoints

Test Concentration ( $\mu\text{g/L}$ Copper) (nominal)	Percent Survival of <i>Artemia franciscana</i>			
	24 hours	48 hours	72 hours	96 hours
0 (rGSL)	100	100	100	100
94	100	100	100	100
188	100	100	100	100
375	100	100	100	100
750	100	100	100	100
1,500	95	50	45	40
Control Performance	Acceptable			

### Data Analysis and Test Endpoints

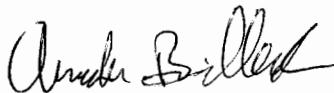
Biological Endpoint	Statistical Endpoint	Value ( $\mu\text{g/L}$ Copper) (nominal)
Survival	96-hour $\text{LC}_{50}$	1,336 (C.L. 1,082 -1,650)

### Summary and findings:

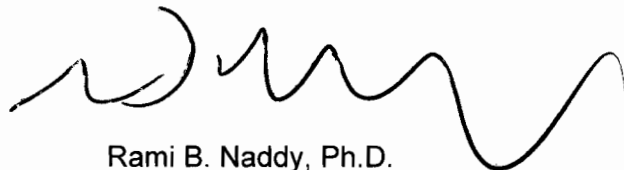
- Organism survival was  $\geq 90\%$  for the controls.
- Acute copper toxicity was clearly demonstrated at the highest test concentration.
  - Test concentrations were selected based on the round 1 acute toxicity tests with copper.
- Samples were collected for copper analysis.
- Copper concentrations for a short term chronic test will be similar to those used here.

We greatly appreciate the opportunity to complete this study for you. Please do not hesitate to call if you have any questions or concerns.

Sincerely,



Amanda Bidlack  
Project Specialist / QA Officer  
[bidlackac.tre@gmail.com](mailto:bidlackac.tre@gmail.com)



Rami B. Naddy, Ph.D.  
Manager / Environmental Toxicologist  
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17001-474-072

Attachment

cc: David Pillard, TRE

TRE

QA: ~~WSP~~ 6/8/20

TOXICITY DATA PACKAGE COVER SHEET

Test Type: Chronic Project Number: 17001-474-072  
Test Substance: Copper (CuCl<sub>2</sub>) Species: Artemia franciscana  
Dilution Water: rGSL Organism Lot or Batch Number: 051920  
Concurrent Control Water: NA Age: 48hr (48 hr) Supplier: TRE  
Date and Time Test Began: 5/21/20 @ 1440 Date and Time Test Ended: 5/25/20 @ 1415  
Protocol Number: \_\_\_\_\_ Investigator(s): CP/AB/BS/AF/ES

Background Information

Type of Test: Static-Renewal (48 h) pH control?: Yes No  
If yes, give % CO<sub>2</sub>: NA  
Test Temperature: 20 ± 1 °C Env. Chmbr/Bath #: 25 Test Chmbrs: 147-ml cups  
Photoperiod: 16 h light : 8 h dark Light intensity: 50-100 ft-c.  
Test Solution Vol.: 50 ml Replicates per Treatment: 2  
Length of Test: 96 hr Organisms per Replicate: 10  
Type of Food and Quantity per Chamber: 72.5 ug/L Chla/ 0.3 ml YTC Feeding Frequency: Initiation and Renewals

Test Substance Characterization Parameters and Frequency:

Hardness: Test Initiation Alkalinity: Test Initiation NH<sub>3</sub>: Test Initiation TRC: Test Initiation  
pH: Daily Conductivity: Daily  
Test Concentrations (Volume:Volume): rGSL, 94, 188, 375, 750, and 1,500 µg/L as Cu  
Agency Summary Sheet(s)?: None

Reference Toxicant Data: Test Dates: \_\_\_\_\_ to \_\_\_\_\_ IC<sub>25</sub>: \_\_\_\_\_  
Hist. 95% Control Limits: \_\_\_\_\_ to \_\_\_\_\_ Method for Determining Ref. Tox. Value: Linear Interpolation

Special Procedures and Considerations:  
Organisms hatched 2 days prior to initiation and held in rGSL with 72.5 ug/L Chla/ 0.3 ml YTC  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Appropriate correction factors have been applied to all temperatures recorded in this data package  
Study Director Initials: BS Date: 5/20/20



**TEST SUBSTANCE USAGE LOG**

Project Number: 17001-474-072

QA: DAF 6/8/20

	Sample 1	Sample 2	Sample 3	Sample 4
Test Substance Number	ENSR # 19122			
Test Substance Collection Date and Time	From:	From:	From:	From:
	@	@	@	@
	To:	To:	To:	To:
	@	@	@	@
Sample Type (Grab or Comp)				
Date Test Substance Received				
Dilution Water Number RW# or TRE#, circle one	13937			
Concurrent Control Water RW#				
Date(s) Used	5/21/20			
	5/23/20			
	05/23/20			

**Preparation of Test Solutions**

Test Substance Conc. (µg/L)	Test Substance Volume (ml)	Dilution Water Volume (ml)	Total Volume (ml)	Test Substance Volume (ml)	Dilution Water Volume (ml)	Total Volume (ml)	Test Substance Volume (ml)	Dilution Water Volume (ml)	Total Volume (ml)
0	0	125	125						
94	8	117	125						
188	16	109	125						
375	31	94	125						
750	63	63	125						
1500	125	0	125						
	242	508	750						
Initials / Date	AS 5/21/20 Michael BS								
Initials / Date	R 5/23/20 I.								
Initials / Date	AD								
Initials / Date									
Initials / Date									
Initials / Date									
Initials / Date									
Initials / Date									

DAF 5/23/20E

**Artemia franciscana**  
**CHRONIC BIOLOGICAL DATA**

QA: DDP 6/18/20

Project Number: 17001-474-072

2 SUMM

µg/L	Test Replicate	Number of Surviving Organisms								Remarks
		Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
0	A	10	10	10	10	10	/	/	/	100
	B	10	10	10	10	10	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
94	A	10	10	10	10	10	/	/	/	100
	B	10	10	10	10	10	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
188	A	10	10	10	10	10	/	/	/	100
	B	10	10	10	10	10	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
375	A	10	10	10	10	10	/	/	/	100
	B	10	10	10	10	10	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
750	A	10	10	10	10	10	/	/	/	100
	B	10	10	10	10	10	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
1500	A	10	10	6	6	5	/	/	/	40
	B	10	9	4	3	3	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
	A	/	/	/	/	/	/	/	/	
	B	/	/	/	/	/	/	/	/	
	C	/	/	/	/	/	/	/	/	
	D	/	/	/	/	/	/	/	/	
Date:		5/21/20	5/22/20	5/23/20	5/24/20	5/25/20				
Time:		1440	1615	1140	1115	1415				
Initials:		CP/AM	CP	AF/	ES/	AF				

CHRONIC CHEMICAL DATA (INITIAL)

QA: NAP 6/8/20

Project Number:	17001-474-072
Test Species: <i>Artemia franciscana</i>	

µg/L	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Meter #	Remarks
Conc.: 0									All Conc.	
pH	8.0	/	7.8	/	/	/	/	/	FM27	
D.O. (mg/L)	5.4	/	6.3	/	/	/	/	/	17	
Temp. (°C)	20	/	20	/	/	/	/	/	IR1	
Cond. (µS/cm)	134,600	/	133,200	/	/	/	/	/	15	
Hard. (mg/L)		/		/	/	/	/	/		
Alk. (mg/L)		/		/	/	/	/	/		
TRC (mg/L)		/		/	/	/	/	/		
NH <sub>3</sub> (mg/L)		/		/	/	/	/	/		
Conc.: 94										
pH	8.0	/	7.8	/	/	/	/	/		
D.O. (mg/L)	5.7	/	6.4	/	/	/	/	/		
Temp. (°C)	20	/	20	/	/	/	/	/		
Cond. (µS/cm)	134,400	/	133,500	/	/	/	/	/		
Hard. (mg/L)		/		/	/	/	/	/		
Alk. (mg/L)		/		/	/	/	/	/		
TRC (mg/L)		/		/	/	/	/	/		
NH <sub>3</sub> (mg/L)		/		/	/	/	/	/		
Conc.: 188										
pH	7.9	/	7.8	/	/	/	/	/		
D.O. (mg/L)	5.5	/	6.4	/	/	/	/	/		
Temp. (°C)	20	/	20	/	/	/	/	/		
Cond. (µS/cm)	134,600	/	133,900	/	/	/	/	/		
Hard. (mg/L)		/		/	/	/	/	/		
Alk. (mg/L)		/		/	/	/	/	/		
TRC (mg/L)		/		/	/	/	/	/		
NH <sub>3</sub> (mg/L)		/		/	/	/	/	/		
Conc.: 375										
pH	7.9	/	7.8	/	/	/	/	/		
D.O. (mg/L)	5.6	/	6.1	/	/	/	/	/		
Temp. (°C)	20	/	20	/	/	/	/	/		
Cond. (µS/cm)	134,400	/	134,400	/	/	/	/	/		
Date:	5/21/20		5/23/20							
Time:	1430		1125							
Initials:	CP		AF							

Note: Hardness, alkalinity, TRC, and NH<sub>3</sub> data appearing on this page have been transcribed from the wet chemistry log QA Form No. 084.

\*Dilution/control water and effluent were brought to 25C prior to making the dilution series. The temperature of resulting effluent dilution is assumed to also be 25C.

CHRONIC CHEMICAL DATA (INITIAL)

QA: JWP 6/8/20

Project Number:	17001-474-072
Test Species:	<i>Artemia franciscana</i>

µg/L	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Meter #	Remarks
Conc.: 750									All Conc.	
pH	7.9	/	7.8	/	/	/	/	/		
D.O. (mg/L)	5.2	/	6.0	/	/	/	/	/		
Temp. (°C)	20	/	20	/	/	/	/	/		
Cond. (µS/cm)	134,500	/	134,000	/	/	/	/	/		
Conc.:		/		/	/	/	/	/		
pH	/	/	/	/	/	/	/	/		
D.O. (mg/L)	/	/	/	/	/	/	/	/		
Temp. (°C)	/	/	/	/	/	/	/	/		
Cond. (µS/cm)	/	/	/	/	/	/	/	/		
Conc.:		/		/	/	/	/	/		
pH	/	/	/	/	/	/	/	/		
D.O. (mg/L)	/	/	/	/	/	/	/	/		
Temp. (°C)	/	/	/	/	/	/	/	/		
Cond. (µS/cm)	/	/	/	/	/	/	/	/		
Conc.: 1500										
pH	7.9	/	7.8	/	/	/	/	/		
D.O. (mg/L)	5.1	/	6.0	/	/	/	/	/		
Temp. (°C)	20	/	20	/	/	/	/	/		
Cond. (µS/cm)	134,700	/	134,000	/	/	/	/	/		
Hard. (mg/L)	/	/	/	/	/	/	/	/		
Alk. (mg/L)	/	/	/	/	/	/	/	/		
TRC (mg/L)	/	/	/	/	/	/	/	/		
NH <sub>3</sub> (mg/L)	/	/	/	/	/	/	/	/		
Date:	5/21/20		5/23/20							
Time:	1430		1125							
Initials:	CP		AF							

Note: Hardness, alkalinity, TRC, and NH<sub>3</sub> data appearing on this page have been transcribed from the wet chemistry log QA Form No. 084.

\*Dilution/control water and effluent were brought to 25C prior to making the dilution series. The temperature of resulting effluent dilution is assumed to also be 25C.

QA: DSP 6/8/20

CHRONIC CHEMICAL DATA (FINAL)

Project Number:	17001-474-072
Test Species:	<i>Artemia franciscana</i>

µg/L	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Meter #	Remarks
Conc.: 0				159,100	/	/	/	/	All Conc.	* conductivity 15
pH	7.9	8.0	7.8	7.7	/	/	/	/	FM27	
D.O. (mg/L)	5.5	5.5	4.6	5.9	/	/	/	/	17	
Temp (°C)	21	22 <sup>A</sup>	20	20	/	/	/	/	L-13	
Conc.: 94				100,300	/	/	/	/		* conductivity
pH	7.9	7.9	7.9	7.7	/	/	/	/		
D.O. (mg/L)	5.4	5.8	4.3	6.0	/	/	/	/		
Temp (°C)	21	21	20	20	/	/	/	/		
Conc.: 188				159,500	/	/	/	/		* conductivity
pH	7.9	7.9	7.9	7.7	/	/	/	/		
D.O. (mg/L)	5.3	5.5	4.4	6.0	/	/	/	/		
Temp (°C)	21	22 <sup>A</sup>	20	20	/	/	/	/		
Conc.: 375				100,100	/	/	/	/		* conductivity
pH	7.9	7.9	7.9	7.7	/	/	/	/		
D.O. (mg/L)	5.2	5.6	4.5	6.2	/	/	/	/		
Temp (°C)	21	21	20	20	/	/	/	/		
Conc.: 750				100,400	/	/	/	/		* conductivity
pH	7.9	7.9	7.9	7.7	/	/	/	/		
D.O. (mg/L)	5.2	4.9	4.3	6.2	/	/	/	/		
Temp (°C)	22 <sup>A</sup>	22 <sup>A</sup>	20	20	/	/	/	/		
Conc.: 1500				100,200	/	/	/	/		* conductivity
pH	7.8	7.8	7.9	7.7	/	/	/	/		
D.O. (mg/L)	5.1	4.9	4.3	6.1	/	/	/	/		
Temp (°C)	22 <sup>A</sup>	22 <sup>A</sup>	20	20	/	/	/	/		
Conc.:					/	/	/	/		
pH					/	/	/	/		
D.O. (mg/L)					/	/	/	/		
Temp (°C)					/	/	/	/		
Date:	5/22/20	5/23/20	5/24/20	5/25/20						
Time:	1620	1145	1130	1425						
Initials:	CP	AF	ES	AF						

<sup>A</sup> checked both reps

CAF

QA: WAP 6/3/20

DAILY TOXICITY TEST LOG

Project Number:	17001-474-072
Test Species:	<i>Artemia franciscana</i>

General Comments	Feeding	Initials/Date
Random Chart: _____ Min/Max Thermometer # M-15	72.5 ug/l Chla 0.3 ml YTC	
Test Day 0 Test Solution Mixed at: 1100 Test Organisms Added at: 1440	Fed @ 1100	CP 5/21/20
Test Day 1 Real Time: 20 °C      Min-Max Range: 20-22 °C	NONE	CP 5/22/20
Test Day 2 Real Time: 22 °C      Min-Max Range: 21-22 °C	Fed @ 0840	AF/ 5/23/20
Test Day 3 Real Time: 21 °C      Min-Max Range: 21-22 °C	NONE	5/24/20
Test Day 4 Real Time: 20 °C      Min-Max Range: 20-22 °C	NONE	AF 5/25/20

**GETIS Analytical Report**

*1 Brineshrimp*

Report Date: 26 May-20 14:02 (p 1 of 2)

Test Code: 474-072 | 05-2923-3275

**Fathead Minnow 96-h Acute Survival Test**

**TRE Environmental Strategies**

<b>Analysis ID:</b> 10-2289-6469	<b>Endpoint:</b> 96h Survival Rate	<b>CETIS Version:</b> CETISv1.8.7
<b>Analyzed:</b> 26 May-20 14:02	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Official Results:</b> Yes
<b>Batch ID:</b> 09-2953-2358	<b>Test Type:</b> Survival (96h)	<b>Analyst:</b> Lab Tech
<b>Start Date:</b> 21 May-20 14:40	<b>Protocol:</b> EPA/821/R-02-012 (2002)	<b>Diluent:</b> rGSL
<b>Ending Date:</b> 25 May-20 14:15	<b>Species:</b> Artemia franciscana	<b>Brine:</b> Crystal Sea
<b>Duration:</b> 96h	<b>Source:</b> In-House Culture	<b>Age:</b> 48h
<b>Sample ID:</b> 20-5963-3281	<b>Code:</b> 7AC38281	<b>Client:</b> Notre Dame
<b>Sample Date:</b> 21 May-20 11:00	<b>Material:</b> Copper sulfate	<b>Project:</b> Special Studies
<b>Receive Date:</b> 21 May-20 11:00	<b>Source:</b> research	
<b>Sample Age:</b> 4h	<b>Station:</b>	

**Trimmed Spearman-Kärber Estimates**

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	40.00%	3.126	0.0458	1336	1082	1650

**96h Survival Rate Summary**

**Calculated Variate(A/B)**

C-µg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Dilution Water	2	1	1	1	0	0	0.0%	0.0%	20	20
94		2	1	1	1	0	0	0.0%	0.0%	20	20
188		2	1	1	1	0	0	0.0%	0.0%	20	20
375		2	1	1	1	0	0	0.0%	0.0%	20	20
750		2	1	1	1	0	0	0.0%	0.0%	20	20
1500		2	0.4	0.3	0.5	0.1	0.1414	35.4%	60.0%	8	20

**96h Survival Rate Detail**

C-µg/L	Control Type	Rep 1	Rep 2
0	Dilution Water	1	1
94		1	1
188		1	1
375		1	1
750		1	1
1500		0.5	0.3

**96h Survival Rate Binomials**

C-µg/L	Control Type	Rep 1	Rep 2
0	Dilution Water	10/10	10/10
94		10/10	10/10
188		10/10	10/10
375		10/10	10/10
750		10/10	10/10
1500		5/10	3/10

*1 DAP 6/8/20 E*

CETIS Analytical Report

~~Brine Shrimp~~

Report Date: 26 May-20 14:02 (p 2 of 2)

Test Code: 474-072 | 05-2923-3275

① Fathead Minnow 96-h Acute Survival Test

TRE Environmental Strategies

Analysis ID: 10-2289-6469

Endpoint: 96h Survival Rate

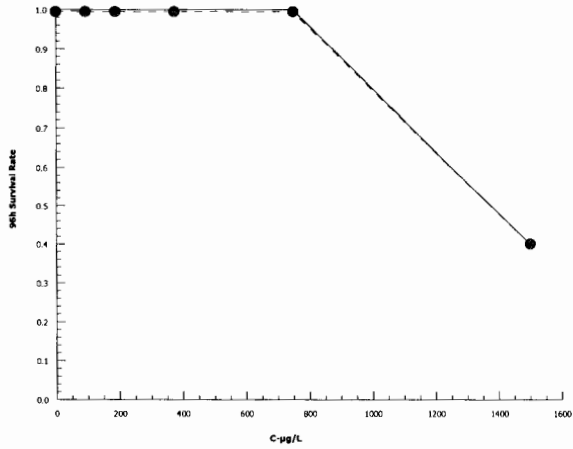
CETIS Version: CETISv1.8.7

Analyzed: 26 May-20 14:02

Analysis: Trimmed Spearman-Kärber

Official Results: Yes

Graphics



① DAP 6/8/20 E