TRE Environmental Strategies, LLC

100 Racquette Drive, Unit A, Fort Collins, Colorado, 80524 T 970.416.0916 F 970.490.2963



April 24, 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 Analytical Data for Experiment #10

Mr. Bittner/ Dr. Belovsky:

Below is a summary of the analytical data for the short-term chronic brine shrimp experiment initiated on March 25, 2020. Total arsenic samples were collected in new solutions at test initiation and on day 6. Total arsenic samples were also collected in old solutions at test termination or when there was complete mortality in a treatment.

Characterization of Recon Water

Sample No.	рН	Hard. (mg/L) ^a	Alk. (mg/L) ^a	Spec. Cond. (μS/cm)	TRC (mg/L) ^b	NH ₃ -N (mg/L)	Salinity (ppt)
RW#13876	7.9	NM	NM	141,000	NM	NM	120

^aAs CaCO3

Results of Arsenic Analysis

	T	otal Arsenic (mg	/L)		
Nominal Value (mg/L)	Day 0 New Solution	Day 6 New Solution	Old Solution (Day Measured)	Mean Value	Percent of Nominal
0	0.11 U	0.11 U	0.11 U (7)	0.11 U	
5	4.15	4.22	4.29 (7)	4.22	84%
20	17.6	15.1	15.3 (7)	16.0	80%
50	42.2	41.1	41.6 (7)	41.6	83%
100	83.1		79.4 (3)	81.2	81%
200	164		165 (1)	164	82%

U= below method detection limit (0.11 mg/L)

^bTotal residual chlorine

Mr. Bittner / Dr. Belovsky April 24, 2020 Page 2

Average measured arsenic concentrations ere then used to recalculate test endpoints on a measured basis.

Test Endpoints

Basis	Survival NOEC	Survival IC20	Growth NOEC	Growth IC20
Nominal	20	31.0 (29.6-38.7)	20	24.0 (2.48-30.1)
Measured	16.0	25.4 (23.0-29.2)	16.0	19.4 (6.17-24.7)

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

Rami B. Naddy, Ph.D.

naddyrb.tre@gmail.com

Manager / Environmental Toxicologist

Sincerely,

Amanda Bidlack
Project Specialist / QA Officer
bidlackac.tre@gmail.com

14001-474-058

Attachment

cc: David Pillard, TRE

Report Date: **Test Code:**

24 Apr-20 16:01 (p 1 of 2) 474-exp10 | 09-3915-2779

Maria Laboratoria					·	474-exp 10 09-3915-2779
mysidopsis 9	6-h Acute Survival 1	Test				TRE Environmental Strategies
Analysis ID: Analyzed:	19-8914-7364 24 Apr-20 16:01		4d Survival Rate Untrimmed Spearman-Kärber	CETIS Ver Official Re	sion:	CETISv1.8.7
Batch ID:	13-5729-9412		Growth-Survival (7d)	Analyst:	Lab	
Start Date:	25 Mar-20 15:00		EPA/821/R-02-013 (2002)	Diluent:	rGSL	
Ending Date:	01 Apr-20 15:25	Species:	Artemia franciscana	Brine:		al Sea

Duration: 7d 0h Source: In-House Culture Age: 48h Sample ID: 04-7522-1036 Code: 1C534C2C Client: Notre Dame Sample Date: 25 Mar-20 15:00 Material: Arsenic Project: Special Studies

Mu

Receive Date: 25 Mar-20 15:00 Source: Discharge Monitoring Report

Trim

Sample Age: NA Station: Effluent

Threshold

Spearman-Kärber Estimates

Threshold Option

Threshold	Option	Threshold	Trim	Mu	Sigma		LC50	95% LCL	95% UCL		
Control Th	reshold	0	0.00%	1.601	0.02626		39.95	35.4	45.08	<u> </u>	
d Surviv	al Rate Summary	1			Cal	culated Varia	ite(A/B)				
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	Α	В
)	Dilution Water	4	1	1	1	0	0	0.0%	0.0%		
.15		4	1	1	1	0	0			40	40
7.6		4	1	4		-	•	0.0%	0.0%	40	40
2.2		7		1	7	0	0	0.0%	0.0%	40	40
_		4	0.5	0.3	0.7	0.09129	0.1826	36.5%	50.0%	20	40
31.25		4	0	0	0	0	0				
64.5		4	0	-	-	_	-		100.0%	0	40
			<u> </u>	0	0	0	0		100.0%	0	40

4d Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
4.15		1	1	1	1
17.6		1	1	1	1
42.2		0.3	0.6	0.7	0.4
81.25		0	0	0	0
164.5		0	0	0	0

4d Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	10/10
4.15		10/10	10/10	10/10	10/10
17.6		10/10	10/10	10/10	10/10
42.2		3/10	6/10	7/10	4/10
81.25		0/10	0/10	0/10	0/10
164.5		0/10	0/10	0/10	0/10

Report Date: Test Code:

24 Apr-20 16:01 (p 2 of 2) 474-exp10 | 09-3915-2779

Mysidopsis 96-h Acute Survival Test

TRE Environmental Strategies

Analysis ID: Analyzed:

19-8914-7364 24 Apr-20 16:01

Endpoint: 4d Survival Rate Analysis:

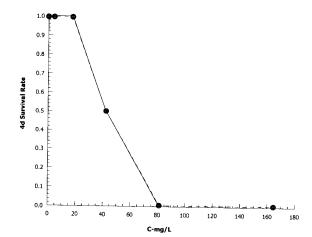
Untrimmed Spearman-Kärber

CETIS Version:

CETISv1.8.7

Official Results: Yes

Graphics



Report Date: Test Code:

21 Apr-20 10:16 (p 1 of 2) 474-exp10 | 09-3915-2779

Fathead-Minnow 7-d Larval Survival and Growth Test	

TRE Environmental Strategies

					The Environmental Strategies
Analysis ID: Analyzed:	19-0805-9569 21 Apr-20 10:16	Endpoint: Analysis:	7d Survival Rate Parametric-Control vs Treatments	CETIS Version: Official Results	
Batch ID: Start Date: Ending Date: Duration:	13-5729-9412 25 Mar-20 15:00 01 Apr-20 15:25 7d 0h	Test Type: Protocol: Species: Source:	Growth-Survival (7d) EPA/821/R-02-013 (2002) Artemia franciscana In-House Culture	Diluent: rGS	stal Sea
	04-7522-1036 25 Mar-20 15:00 25 Mar-20 15:00	Code: Material: Source:	1C534C2C Arsenic Discharge Monitoring Report	_	re Dame cial Studies

Sample Age: NA Station: Effluent

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Angular (Corrected)	NA	C > T	NA	NA	7.88%	16	41.63	25.81	

Dunnett Multiple Comparison Test

Control	vs	C-mg/L	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(a:5%)
Dilution Water		4.22	-0.7441	2.29	0.125	6	0.9321	CDF	Non-Significant Effect
		16	-0.7441	2.29	0.125	6	0.9321	CDF	Non-Significant Effect
		41.63*	11.64	2.29	0.125	6	<0.0001	CDF	Significant Effect

ANOVA Table

Between 1.329014 0.4430048 3 73.89 <0.0001 Significant Effect	Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(σ:5%)
Error 0.0719444 0.005995367 12	Between	1.329014	0.4430048	3	73.89		
		0.0719444	0.005995367	12	70.00	40.0001	Significant Effect
Total 1.400959 15		1.400959		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(a:1%)
Variances	Mod Levene Equality of Variance	3.64	5.95	0.0448	Equal Variances
Variances	Levene Equality of Variance	7.667	5.95	0.0040	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8588	0.841	0.0184	Normal Distribution

7d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	0.975	0.8954	1	1	0.9				
4.22		4	4	4		'	0.9	ı	0.025	5.13%	0.0%
_		4	1	1	1	1	1	1	0	0.0%	-2.56%
16		4	1	1	1	1	1	4	•		
41.63		1	0.45	0.0440			•	'	U	0.0%	-2.56%
		7	0.45	0.2446	0.6554	0.45	0.3	0.6	0.06455	28.7%	53.8%
81.25		4	0	0	0	0	0	0	0		
164.5		4	0	0	^	•	-	U	U		100.0%
				U	U	0	0	0	0		100.0%

Angular (Corrected) Transformed Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	1.371	1.242	1.501	1.412					
4.22						1.412	1.249	1.412	0.04074	5.94%	0.0%
		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	-2.97%
16		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	-2.97%
41.63		4	0.734	0.5244	0.9435	0.7254		·-	-		-2.97%
81.25						0.7351	0.5796	0.8861	0.06584	17.9%	46.5%
		4	0.1588	0.1588	0.1588	0.1588	0.1588	0.1588	0	0.0%	88.4%
164.5		4	0.1588	0.1588	0.1588	0.4500	0.4500		-		
		•	0.1000	0.1300	0.1008	0.1588	0.1588	0.1588	0	0.0%	88.4%

ON4 4/22/20 Cf

Analyst: QA: V. 3

CETIS™ v1.8.7.16

Report Date: **Test Code:**

21 Apr-20 10:16 (p 2 of 2) 474-exp10 | 09-3915-2779

Fathead Minner 7-d Larval Survival and Growth Test

TRE Environmental Strategies

Analysis ID:	19-0805-9569	Endpoint:	7d Survival Rate	CETIS Version:	CETISy1 8.7
Analyzed:	21 Apr-20 10:16	Analysis:	Parametric-Control vs Treatments	Official Results:	

7d Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	0.9
4.22		1	1	1	1
16		1	1	1	1
41.63		0.3	0.5	0.6	0.4
81.25		0	0	0	0
164.5		0	0	0	0

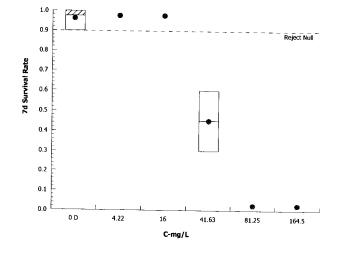
Angular (Corrected) Transformed Detail

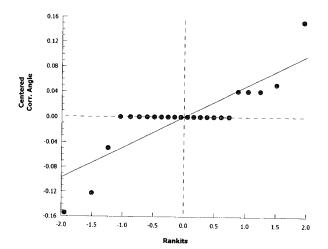
C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.412	1.412	1.412	1.249
4.22		1.412	1.412	1.412	1.412
16		1.412	1.412	1.412	1.412
41.63		0.5796	0.7854	0.8861	0.6847
81.25		0.1588	0.1588	0.1588	0.1588
164.5		0.1588	0.1588	0.1588	0.1588

7d Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	9/10
4.22		10/10	10/10	10/10	10/10
16		10/10	10/10	10/10	10/10
41.63		3/10	5/10	6/10	4/10
81.25		0/10	0/10	0/10	0/10
164.5		0/10	0/10	0/10	0/10

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CETIS Analytical Report O Bran shring

Report Date: **Test Code:**

21 Apr-20 09:31 (p 1 of 2) 474-exp10 | 09-3915-2779

Fathead Minhow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

04-9609-3362 Analysis ID: **Endpoint:** 7d Survival Rate **CETIS Version: CETISv1.8.7**

Analyzed: 21 Apr-20 9:31 Linear Interpolation (ICPIN) Analysis: Official Results: Yes

Batch ID: 13-5729-9412 Test Type: Growth-Survival (7d) Analyst: Lab Tech Start Date: 25 Mar-20 15:00 Protocol: EPA/821/R-02-013 (2002) Diluent: rGSL Ending Date: 01 Apr-20 15:25 Species: Artemia franciscana Brine: Crystal Sea 7d 0h **Duration:** Source: In-House Culture Age: 48h

Sample ID: 04-7522-1036 Code: 1C534C2C Client: Notre Dame Sample Date: 25 Mar-20 15:00 Material: Arsenic Project: Special Studies

Receive Date: 25 Mar-20 15:00 Source: Discharge Monitoring Report

Sample Age: NA Station: Effluent

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1152224	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC5	18.35	17.76	19.3
LC10	20.69	19.52	22.59
LC15	23.04	21.28	25.89
LC20	25.38	23.04	29.18
LC25	27.73	24.81	32.48
LC40	34.77	30.09	42.37
LC50	39.46	33.61	50.13

7d Surviv	al Rate Summary				Cal	culated Varia	ite(A/B)				
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	Α	В
	Dilution Water	4	0.975	0.9	1	0.025	0.05	5.13%	0.0%	39	40
22		4	1	1	1	0	0	0.0%	-2.56%	40	40
3		4	1	1	1	0	0	0.0%	-2.56%	40	40
1.63		4	0.45	0.3	0.6	0.06455	0.1291	28.7%	53.8%	18	40
1.25		4	0	0	0	0	0		100.0%	0	40
64.5		4	0	0	0	0	0		100.0%	0	40

7d Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	0.9
4.22		1	1	1	1
16		1	1	1	1
41.63		0.3	0.5	0.6	0.4
81.25		0	0	0	0
164.5		0	0	0	0

7d Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	9/10
4.22		10/10	10/10	10/10	10/10
16		10/10	10/10	10/10	10/10
41.63		3/10	5/10	6/10	4/10
81.25		0/10	0/10	0/10	0/10
164.5		0/10	0/10	0/10	0/10

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100.0%

0

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Report Date:

21 Apr-20 09:31 (p 2 of 2) 474-exp10 | 09-3915-2779

Test Code:

TRE Environmental Strategies

Fathead Minnow 7-d Larval Survival and Growth Test

Analysis ID: Analyzed:

04-9609-3362 21 Apr-20 9:31 Endpoint: 7d Survival Rate Analysis:

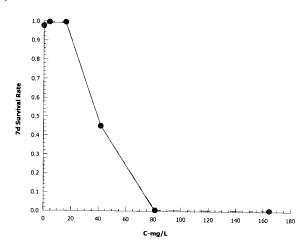
Linear Interpolation (ICPIN)

CETIS Version:

CETISv1.8.7

Official Results: Yes

Graphics



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CETIS™ v1.8.7.16

Report Date: Test Code:

21 Apr-20 10:16 (p 1 of 2) 474-exp10 | 09-3915-2779

Tathead Minnow 7	-d Larval	Survival	and	Growth	Test

TRE Env	ironmental	Strategies
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			IRE Environmental Strategies			
Analysis ID: Analyzed:	00-4233-6562 21 Apr-20 10:15	Endpoint: Analysis:	Mean Dry Biomass-mg Nonparametric-Control vs Treatments	CETIS Ver		CETISv1.8.7 Yes
Batch ID: Start Date: Ending Date: Duration:	13-5729-9412 25 Mar-20 15:00 01 Apr-20 15:25 7d 0h	Test Type: Protocol: Species: Source:	Growth-Survival (7d) EPA/821/R-02-013 (2002) Artemia franciscana In-House Culture	Analyst: Diluent: Brine: Age:	Lab T rGSL Crysta 48h	ech al Sea
	04-7522-1036 25 Mar-20 15:00 25 Mar-20 15:00 NA	Code: Material: Source: Station:	1C534C2C Arsenic Discharge Monitoring Report Effluent	Client: Project:		Dame al Studies

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD /	NOE	LOEL	TOEL	TU	
Untransformed	NA	C > T	NA	NA	19.8%	16	41.63	25.81		
Steel Many One Benk 6	Same Tares									

Steel Many-One Rank Sum Test

Control	vs	C-mg/L	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(a:5%)
Dilution Water		4.22	14	10	n	6	0.2626	Asymp	
		40			U	U	0.2020	Asymp	Non-Significant Effect
		16	14	10	0	6	0.2626	Asymp	Non-Significant Effect
		41.63*	10	10	0	6	0.0276	Asymp	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(a:5%)
Between	0.09445569	0.03148523	3	38.44	<0.0001	Significant Effect
Error	0.009828749	0.0008190624	12		0.000.	Organicant Encor
Total	0.1042844		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(a:1%)
Variances	Bartlett Equality of Variance	9.149	11.3	0.0274	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.834	0.841	0.0080	Non-normal Distribution

Mean Dry Biomass-mg Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	0.234	0.1506	0.3174	0.25	0.158	0.278			
4.22		4	0.0007						0.02619	22.4%	0.0%
		4	0.2237	0.1993	0.2482	0.2275	0.202	0.238	0.007685	6.87%	4.38%
16		4	0.209	0.191	0.227	0.211	0.194	0.22	0.005672	5.43%	10.7%
41.63		4	0.046	0.02542	0.06658	0.0505	0.027	0.056			
81.25		4	0	0.02012	0.00000	0.0000		0.056	0.006468	28.1%	80.3%
		4	0	U	0	0	0	0	0		100.0%
164.5		4	0	0	0	0	0	0	0		100.0%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.252	0.248	0.278	0.158
4.22		0.238	0.202	0.226	0.229
16		0.22	0.194	0.215	0.207
41.63		0.027	0.056	0.05	0.051
81.25		0	0	0	0
164.5		0	0	0	0

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Report Date: **Test Code:**

21 Apr-20 10:16 (p 2 of 2) 474-exp10 | 09-3915-2779

Eathead Minnow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

Analysis ID: Analyzed:

00-4233-6562 21 Apr-20 10:15 **Endpoint:**

Mean Dry Biomass-mg

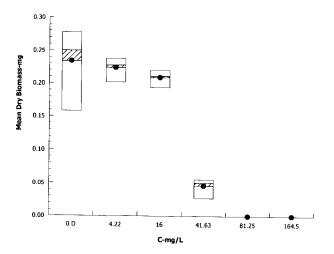
Nonparametric-Control vs Treatments Analysis:

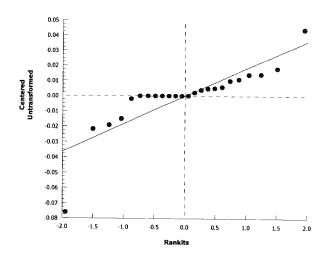
CETIS Version:

CETISv1.8.7

Official Results: Yes

Graphics





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Analyst: 18-

Report Date: **Test Code:**

21 Apr-20 09:31 (p 1 of 2) 474-exp10 | 09-3915-2779

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TRE Environmental Strategies

Analysis ID:	19-2902-2621	Endpoint:	Mean Dry Biomass-mg	CETIS Version:	CETISv1.8.7
Analyzed:	21 Apr-20 9:31	Analysis:	Linear Internolation (ICPINI)	Official Descrite	

Official Results: Yes

Batch ID: 13-5729-9412 Test Type: Growth-Survival (7d) Analyst: Lab Tech Start Date: 25 Mar-20 15:00 Protocol: EPA/821/R-02-013 (2002) Diluent: rGSL Ending Date: 01 Apr-20 15:25 Species: Artemia franciscana Brine: Crystal Sea **Duration:** 7d 0h Source: In-House Culture Age: 48h

Sample ID: 04-7522-1036 Code: 1C534C2C Client: Notre Dame Sample Date: 25 Mar-20 15:00 Material: Arsenic Project: Special Studies

Receive Date: 25 Mar-20 15:00 Source: Discharge Monitoring Report Sample Age: NA Station: Effluent

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
(Linear)	Linear	87420	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	5.378	N/A	25.06
IC10	14.72	N/A	22.14
IC15	17.59	N/A	23.11
IC20	19.43	6.172	24.72
IC25	21.27	13.73	26.31
IC40	26.79	21.01	31.15
IC50	30.47	25.83	34.59

Mean Dry	Biomass-mg Sum	mary							
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
)	Dilution Water	4	0.234	0.158	0.278	0.02619	0.05238	22.4%	0.0%
.22		4	0.2237	0.202	0.238	0.007685	0.01537	6.87%	4.38%
6		4	0.209	0.194	0.22	0.005672	0.01134	5.43%	10.7%
1.63		4	0.046	0.027	0.056	0.006468	0.01294	28.1%	80.3%
1.25		4	0	0	0	0	0	, , ,	100.0%
64.5		4	0	0	0	0	0		100.0%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.252	0.248	0.278	0.158
4.22		0.238	0.202	0.226	0.229
16		0.22	0.194	0.215	0.207
41.63		0.027	0.056	0.05	0.051
81.25		0	0	0	0
164.5		0	0	0	0

Draw y/w/w CP

Analyst:_

CETIS™ v1.8.7.16

000-470-187-3

Report Date: Test Code:

21 Apr-20 09:31 (p 2 of 2) 474-exp10 | 09-3915-2779

Fathead Minnow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

Analysis ID: Analyzed:

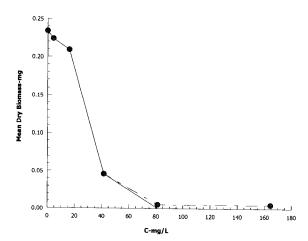
19-2902-2621 21 Apr-20 9:31 Endpoint: Mean Dry Biomass-mg

Analysis: Linear Interpolation (ICPIN) **CETIS Version:**

CETISv1.8.7

Official Results: Yes

Graphics



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Analyst: As QA: VW



April 13, 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 Short-term Chronic Brine Shrimp Experiment #10

Mr. Bittner/ Dr. Belovsky:

Below is a summary of the short-term chronic brine shrimp experiment initiated on March 25, 2020. The purpose of this experiment was to investigate whether feeding an algae/YTC mix would affect the response of *Artemia franciscana* to arsenic in the short-term chronic test. Data from this 7-day study were compared to data from earlier 7-day and 10-day tests where brine shrimp were fed algae only.

Along with a control, an algae-only concurrent control and five different arsenic concentrations were tested:

• 5, 20, 50, 100, and 200 mg/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: 7 days

• Test type: static-renewal (solutions and food renewed daily)

• Algae: Dunaliella viridis

Algae concentration: 145 μg/L Chla, or 72.5 μg/L Chla and 0.33ml YTC¹

Temperature: 20°CTest volume(s): 50 ml

Replicates: 4

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

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

(Crystal Sea Marine Mix) and ~200 organisms were placed in 120 ppt rGSL water and fed *Dunaliella viridis* at a density of 100 µg/L Chla. Solutions were gently aerated.

Characterization of Recon Water

Sample No.	рН	Hard. (mg/L) ^a	Alk. (mg/L) ^a	Spec. Cond. (μS/cm)	TRC (mg/L) ^b	NH ₃ -N (mg/L)	Salinity (ppt)
RW#13876	7.9	NM	NM	141,000	NM	NM	120

^aAs CaCO3

Test activities:

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

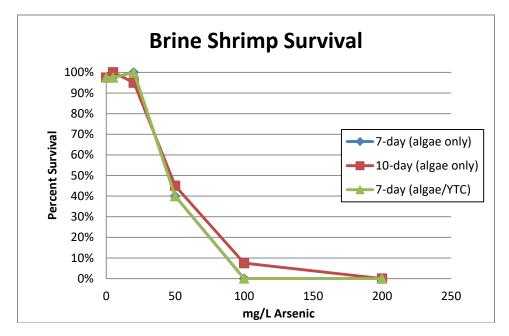
Results:

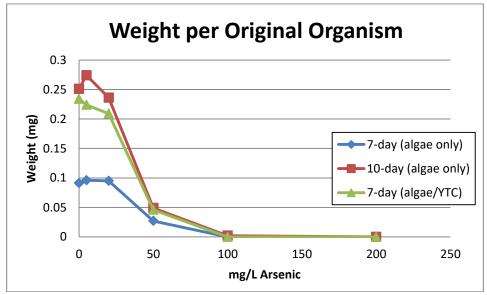
The results of the two control treatments (fed only *D. viridis* and fed a mixture of *D. viridis*/YTC) are below. Survival and growth (dry wt) were nearly identical between the two treatments.

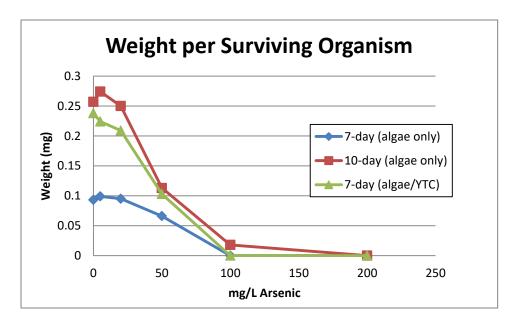
Treatment	Survival	Weight Per Original Org	Weight Per Surviving Org
D. viridis only	97.5%	0.235 mg	0.241 mg
D. viridis/ YTC	97.5%	0.234 mg	0.238 mg

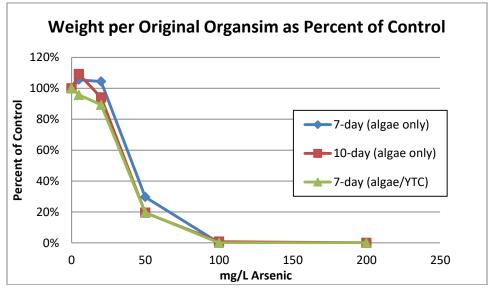
The survival and average dry weights for the brine shrimp in the arsenic treatments are illustrated in the following figures and are compared to two previous arsenic studies.

^bTotal residual chlorine









Test Endpoints

	Test Endpoints (mg As/L, nominal)								
Study	Survival NOEC	Survival LOEC	Growth NOEC	Growth LOEC	Growth IC25				
7-Day (Algae only, Exp 5)	20	50	20	50	30.43 (25.72-32.91)				
10-Day (Algae only, Exp 5)	20	50	20	50	26.26 (19.22-31.09)				
7-Day (YTC/Algae)	20	50	20	50	26.17 (18.02-31.89)				

Summary and findings:

- Organism survival was ≥ 90% for all controls.
- Growth was very similar between the algae-only treatment and the algae + YTC treatment.
- The effect of arsenic on brine shrimp survival was similar for both feeding regimes.
- The growth IC₂₅ values for each test were similar and fell within the confidence limits of the previous tests (nominal basis).

Based on these results, feeding an algae/YTC mixture does not appear to affect arsenic toxicity when compared to feeding with just algae. Based on nominal arsenic concentrations, statistical endpoints were nearly identical in all tests.

Analytical samples from each treatment have been collected and sent in for arsenic measurement. We will provide a summary of those results separately.

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

14001-474-058

Attachment

cc: David Pillard, TRE

Rami B. Naddy, Ph.D.

Manager / Environmental Toxicologist

naddyrb.tre@gmail.com

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TOXICITY DATA PACKAGE COVER SHEET

w		18	120
05	V	•	

Test Type:	Chronic		_ F	Project Number:		17001-474-	<u>Exp</u>
Test Substance:	Arsenic (Na	2HAsO4)	-	Species:	Artemia franci	scana	
Dilution Water:	rGSL		-	Organism Lot of	or Batch Number	er:	032320
Concurrent Control Water:	NA		_	Age: 48HR ((48 hr)	Supplier:	TRE
Date and Time Test Began:	3/25/20	@ 1200	_	Date and Time	Test Ended:	4/1/20	_@ 1625
Protocol Number:			-	Investigator(s):	HR/ce/A	5 PRIE	J
Background Information					,		
Towns of Town	.			pH control?:	Yes	No	
Type of Test:	Static-Rene	wal (Daily)	•	If yes, give % (CO ₂ :	NA	
Test Temperature:	20 ± 1 °C	-	Env. Chr	nbr /Bath #: <u>25</u>	_	Test	Chmbrs: 147-ml cups
Photoperiod:	16 h light : 8	3 h dark		Light intensity:		50-100 ft-c	<u>.</u>
Test Solution Vol.:		50 ml		Replicates per	Treatment:	4	
Length of Test:	7 days	_		Organisms per	Replicate:	10	
Type of Food and Quantity per	Chamber:	72.5 ug/L Chla/	0.33 ml Y	Feeding Freque	ency:	Initiation ar	nd Renwals
Test Substance Characteriza	tion Param	eters and Frequ	iency:				
Hardness: <u>Test Initiation</u>	Alkalinity:	Test Initiation	•	t Initiation	TRC: Test Init	iation	
pH: <u>Daily</u>	Conductivity	/: <u>Daily</u>					
Test Concentrations (Volume:	√olume):	D. viridis, rGSL	, 5, 20, 50,	100, and 200 m	ng/L as As		
Agency Summary Sheet(s)?:		None					
Reference Toxicant Data:	Test Dates:	No	to_D	<u>A</u>		IC ₂₅ :	
Hist. 95% Control Limits:		to	Method fo	or Determining R	Ref. Tox. Value:	Linear Inte	rpolation_
Chaolal Brassdamas and O							
Special Procedures and Con			N				
Organisms hatched 2 days prion Treatment one- Fed D. viridis			SL WITH TOO	ug/L Chia			
The state of the s	1 10 ag/2 0/1	<u> </u>	**		, <u>.</u>		
						· // -	
Appropriate correction factors I	nave been a	pplied to all temp	eratur e s r	ecorded in this o	data package	·	
Study Director Initials:	w	Date: 3	25/20	2			

Artemia franciscana CHRONIC BIOLOGICAL DATA

es ner 4/8/20

Project Number: ____ 17001-474-Exp

						Numbe	r of Survi	iving Orga	nieme	10 C. P. () A
	Test	Day	Day	Day	Day	Day	Day	Day	Day	le surving!
_mg/L	Replicate		1 1	2	3	4	5	6	7	Remarks
D. viridis	Α	10	10	10	10	10	10	10	9	97.5
<u> </u>	В	10	10	10	10	10	10	10	و١	
	СС	10	10	10	10	10	10	10	lΟ	
	D	10	10	10	(0)	10	10	10	10	
0	A	10	10	10	10	lo	10	10	Οj	97.5
	В	10	10	10	10	6)	10	10	įO	
	С	10	(0	10	10	lio	10	10	10	
	D	(0	10	10	(D	b	(0	9	9	
5	Α_	10	(0	10	10	10	10	10	lΟ	ର
	В	10	10	10	(D	io	10	10	10	
	С	10	10	10	10	(o	10	10	10	
	D	10	ΙO	10	10	10	10	10	ÌØ	
20	Α	10	10	10	10	10	סו	10	10	100
	В	10	10	10	10	10	ιÔ	10	10	100
	С	10	(0	10	10	10	10	10	[0	
	D	10	10	10	(D)	10	10	10	10	
50	Α	10	9	3	3	3	3	3	3	45
	В	10	9	7	6	le	6	6	5	-,,3
	С	10	9*	7	7	7	7	7	6	* I weak org
	D	(0	8	4	4	4	4	4	4	
100	Α	10	0							
	В	10	3	1	0					0
	С	10	0							
	D	ΙD	1	0						
200	Α	(0)	0		<u> </u>			 		<u></u>
	В	10	1	D						0
	С	10	D					1_		
	D	(0)	0							
		3/25/20	3/26/20	3/27/20	3/28/20	3/29/28	3/30/10	3/31/20	4/1/20	
	Time:	1500	1335	1340	1446	1355	1445	1515	1525	
		CP/M	СР	ce	CP	133 138	EN	CP	C	
		- '		<u> </u>		<u>'0</u>	1 610	1 2	UI .	

CHRONIC CHEMICAL DATA (INITIAL)

Dr w 4/8/20

Project Number: 17001-474-Exp

Test Species: Artemia franciscana

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Meter #	Remarks
Conc.: D. viridis									All Conc.	
pH	8.0	8.0	8.0	8.0	7.9	7.8	8.0		FM27	
D.O. (mg/L)	5.1	5,1	5.1	5.2	53	5.1	5.1		ίζ	
Temp. (°C)	20	20	20	20	30	20	20		IRI	
Cond. (µS/cm)	141000	141000	13900	139000	139500	203800	137600		15	,
Hard. (mg/L)										
Alk. (mg/L)										
TRC (mg/L)										
NH ₃ (mg/L)										
Conc.: 0										
рН	7.9	8.0	8.0	7.9	7.9	7.8	8.0		3	
D.O. (mg/L)	51	5.2	5.2	5.2	5.3	5.1	5.2			
Temp. (°C)	20	20	20	w	96	20	20			
Cond. (µS/cm)	14100	14/000	140000	136000	139,200	186200	137300			Salinty = 120
Hard. (mg/L)										7
Alk. (mg/L)										
TRC (mg/L)										
NH ₃ (mg/L)										
Conc.: 5										
рН	7.9	8.0	8.0	7.9	7.9	7.8	8.0			
D.O. (mg/L)	5.1	5,1	5.1	5.2	51	51	5.3			
Temp. (°C)	20	20	20	20	90	20	20			
Cond. (µS/cm)	141000	141000	140000	134000	138900	223400	137000			
Conc.: 20										
рН	7.9	8.0	8.0	7.9	79	7.8	7.9			
D.O. (mg/L)	5.2	5.2	5.3	5,1	5.1	5.1	5.3			
Temp. (°C)	w	ro	го	w	96	20	20			
Cond. (µS/cm)	141000	141000	14000	135000	138,60		137300			
Date:	3/25/20	3/26/20	3/27/20	3/28/20	3/29/26	3/30/20	3/31/20			
Time:	1445	1320	1325	1435		1430	1500	**		
Initials:	CP	ce	CP	CP	13/	EN	ce			

Note: Hardness, alkalinity, TRC, and NH3 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 25°C prior to making the dilution series. The temperature of resulting effluent dilution is assumed to also be 25°C.

CHRONIC CHEMICAL DATA (INITIAL)

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Project Number: 17001-474-Exp

Test Species: Artemia franciscana

Conc.: 50	%		Day	Day	Day	Day	Day	Day	I Day	Day	Meter#	Remarks
Su					2	3 3		5 Day	Day 6	Day 7	Weter #	Remarks
Description	Conc.:	50										
D.O. (mg/L) Temp. (°C) Too 20 20 20 20 20 20 20 20 20 20 20 20 20	<u> </u>		1	0 -		- 0		~ ()			Conc.	
Temp. (°C)			 						 			
Cond. (µS/cm)			 									
Conc. 100												
Description			141000	141000	14000	13600	138,100	222200	136800			
D.O. (mg/L)	Conc.:	100										
Temp. (°C)	рН		7.9	7.9	8.0		1					
Cond. (µS/cm) 14 1000 1000	D.O. (mg/L)		5.1		5.2							
Conc.:	Temp. (°C)				20							
DH DO.O. (mg/L) Temp. (°C) Cond. (μS/cm) DO.O. (mg/L) Temp. (°C) Cond. (μS/cm) T. 9	Cond. (µS/cm)		14 1000	14000	141000							
D.O. (mg/L)	Conc.:								-			
D.O. (mg/L)	pH											
Temp. (°C) Cond. (μS/cm) Conc.: DH D.O. (mg/L) Temp. (°C) Cond. (μS/cm) Conc.: DOH DOH DOH DOH DOH DOH DOH DO												
Cond. (µS/cm) Conc:												
Conc.:												
D.O. (mg/L) Temp. (°C) Cond. (μS/cm) Conc.: 200 DH 7.9 7.9 7.9 7.9 7.0 Temp. (°C) Cond. (μS/cm) Temp. (°C) Cond. (μS/cm) Hard. (mg/L) Alk. (mg/L) TRC (mg/L) Date: 3/25/20 3/24/20 3/27/20 3/28/20 3/31/20								1				
D.O. (mg/L) Temp. (°C) Cond. (μS/cm) Conc.: 200 DH 7.9 7.9 7.9 7.9 7.0 Temp. (°C) Cond. (μS/cm) Temp. (°C) Cond. (μS/cm) Hard. (mg/L) Alk. (mg/L) TRC (mg/L) Date: 3/25/20 3/24/20 3/27/20 3/28/20 3/31/20	pН									•••		
Temp. (°C) Cond. (μS/cm)	· · · · · · · · · · · · · · · · · · ·											
Cond. (µS/cm) Conc.: 200												
Conc.: 200 7.9			i									
D.O. (mg/L) Femp. (°C) Cond. (μS/cm) H41000 H41000 H21000 Hard. (mg/L) RC (mg/L) FRC (mg/L) NH ₃ (mg/L) Date: 3/25/20 3/21/20 3/21/20 3/21/20 3/21/20 3/21/20		200										
D.O. (mg/L) Femp. (°C) Cond. (μS/cm) H41000 141000 Hard. (mg/L) Alk. (mg/L) FRC (mg/L) NH ₃ (mg/L) Date: 3/25/20 3/21/20 3/21/20 3/21/20 3/31/20	pН		7.9	7.9			\			· · · · · · · · · · · · · · · · · · ·		
Temp. (°C) το το το Cond. (μS/cm) H41000 141000 Hard. (mg/L) Alk. (mg/L) TRC (mg/L) NH ₃ (mg/L) Date: 3/25/2ο 3/21/20 3/21/20 3/31/20			5.2									
Cond. (μS/cm)												
Hard. (mg/L) Alk. (mg/L) FRC (mg/L) NH ₃ (mg/L) Date: 3/25/20 3/20/20 3/27/20 3/28/20 3/31/20					\		\vdash	\				
Alk. (mg/L) FRC (mg/L) NH ₃ (mg/L) Date: 3/25/20 3/27/20 3/28/20 3/31/20 3/25/20 3/25/20 3/25/20 3/31/20							` `					
TRC (mg/L)		-										······································
NH ₃ (mg/L) Date: 3/25/20 3/27/20 3/28/20 3/31/20 3/31/20		···										
	NH ₃ (mg/L)											
		Date:	3/25/20	3/26/20	3/27/20	3/28/20	3/25/2	2/21/10	3/31/20		<u> </u>	
				1320								
Initials: CP CP CP CP FY EN CP												

Note: Hardness, alkalinity, TRC, and NH3 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 25°C prior to making the dilution series. The temperature of resulting effluent dilution is assumed to also be 25°C.

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からる CHRONIC CHEMICAL DATA (FINAL)

Od van aktro

Project Number:	17001-474-Exp	
Test Species:	Artemia franciscana	

%		Day	Day	Meter #	Remarks						
		1	2	3	4	5	6	7	8		
Conc.:	D. viridis			*				130700		All Conc.	* conductivity
pH		8.0	S. 1	8.0	7.9	7.9	7.8	7.9		FM27	
D.O. (mg/L)		5.9	5.1	5.2	5.2	5.4	4.9	4.8		17	
Temp (°C)		20	10	10	19	20	20	21		1-6	
Conc.:	0							129200			* conductivity
рН		7.9	8.1	7.9	7.9	7.9	7.8	7.8			
D.O. (mg/L)		5.6	4.9	5.0	4.8	5.2	4.6	4.6			
Temp (°C)		20	21	w	19	20	w	21			
Conc.:	5							128600			* conductivity
рН		7.9	8.0	7.9	7.9	7.8	7.8	1.8			
D.O. (mg/L)		5,5	5.0	5.0	4.8	49	4.7	4.5			
Temp (°C)		20	21	10	19	20	20	21			
Conc.:	20							128300			* conductivity
рН		8.0	8.0	8.0	7.9	7.8	7.8	7.8			
D.O. (mg/L)		5.4	5.1	5.0	4.8	4.01	4.7	4.5			
Temp (°C)		20	21	w	19	20	w	21			
Conc.:	50							127600			* conductivity
рН		8.0	8.0	7.9	7.9	78	7.8	7.9			
D.O. (mg/L)		5.7	5.1	5.0	4.9	51	5.1	4.6			
Temp (°C)		20	21	20	19	20	20	21			
Conc.:	100			13300			\	\	\		* conductivity
рН		8.0	8.0	8.0							
D.O. (mg/L)		5.6	5.2	5.4							
Temp (°C)		20	21	и	\		7				
Conc.:	200		138000				\	\	\		* conductivity
рН		8,0	8.0								
D.O. (mg/L)		5,4	5.3								,
Temp (°C)		20	21	7					\		
	Date:	3/26/20	3/27/20	3/28/20	2/2/100	3/34/20	3/31/20	\$4/1/20			
	Time:	1355	1400	1500	1355	1440	1540	1545			
	Initials:	CP	d	ce	PO	EN	CP	CP			

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Show uplo

THE DAILY TOXICITY TEST LOG

Project Number:

Test Species:

17001-474-Exp Artemia franciscana

General				•		Feeding	Initials/Date
Comments						72.5 ug/l Chla	
	Random Ch	art: '' ¹	マ <u>"</u>	Min/Max Thermometer #	M-15	0.33ml YTC	
Test Day 0	Test Solution			55		Fed @ 1130 g	40
	Test Organi	sms Ad	ded at:	1500		1	4
							op 3/25/20
Test Day 1	Real Time:	18	°C	Min-Max Range: 18 - 20	°C	Fed @ 1035	cl
		=-					3/26/20
Test Day 2	Real Time:	19	°C	Min-Max Range: 18-21	°C	Fed @ 1055	or
							3/27/20
							3/21/40
Test Day 3	Real Time:	19	°C	Min-Max Range: 19 - 19	°C	Fed @1135 cp	СР
							3/28/20
							3/28/20
Test Day 4	Real Time:	20	°C	Min-Max Range:)ァ- _る 。	°C	Fed @ 1030 D	325
							3.0°100
							B
Test Day 5	Real Time:	19	°C	Min-Max Range: 1821	°C	Fed @ (1 3) R	- ,
							EN
							3/30/20
Test Day 6	Real Time:	19	°C	Min-Max Range: 18-21	°C	Fed @ (150	
							op 3/31/20
							3/31/20
Test Day 7	Real Time:	19	°C	Min-Max Range: パーン(°C	Fed @	
						NONE	Cf 4/1/20
						12012	4/1/20

Page of QA Form No.010
Revision 7
Effective 01/20

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

17	3								ĺ			
t Number: '	3	Project Number: 17001 - 474 -058	258	Test Substance:		Arsenic (Na 24As Ou	As 04)		Comments:			
Species: Artemia franciscana	r fr	maiscar	ğ	Analyst Tare: ${\cal O}$	re: ${\cal R}$	Analyst Gross: AF	ross: AF		Analytical Balance ID: Sart#1	nce ID: Sar	七#1 44:14:15 H	i i
ime of Tare Wt	t.: 4/	1/2000/	(500	Date/Time	of Gross Wt.:	413/20@ 16	305			2 G 2 G 2 G 2 G	ate: 44/20 T	me: <u>୧୯୬୦</u> ime: ୧୯୬୦
	Rep.			e (Circle):	Wet Blot D	1y (Dry (60-90	1°C) Dry (>1		(>200°C)	Lot or Batch	- 11	032320
		<u>.</u>		Gross Weight (g)		Adjusted Net Weight (g)	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism	Mean Wt. per Treatment (mg) (Surviving)
2	4		1.13798	ગાંભાય	0.00218					O.	(mg)	
	a		1.13780	1:13972	0.00192					2		
	3		1.11500	1-11713	0.00213					S		
	۵		1.13955	00141.1	0,00205) i		
	A		1.13976	1.14 00)	0.00058					2 "		
	2		1.11762		0.00054					J. C.		
	0		1.14765	ľ	0.00048					, 0		
	۵		1.13105		proou <i>, 0</i>					בוק		
											,	
ution Volume:						oading Rate:						
weight loss of b	olank t	oat, if app	ropriate.									
्र वर]० _न						- <u>-</u>						
	Boat Treatment No. Solution Volume: Add in weight loss of b	Treatment Rep. 70 A 70 A 70 A 70 A 70 A 70 A 71 A 72 A 73 A 74 A 75 A 76 A 77 A 78 A 79 A 70 A 71	ime of Tare Wt.: 4/1 /2₀ (②) Treatment Rep. Length 20 A 50 A 50 A C C C C C C C C C C C C C	N: 4/1 /2 @ II. Rep. Length D C D C D D D D D D D D D	Rep. Length Weight Type Units: Tare Weight (g) A 1.13780 C 1.11\$700 D 1.13450 C 1.14765 D 1.13105 D 1.13105 D 1.1305 D 1.13105 D 1.13105 D 1.13105 D 1.13105 D 1.14765 D 1.147	A Length Weight Type (Circle): Wet Weight (g) Weight	A Length Weight Type (Circle): Wet Weight (g) Weight	A Length Weight Type (Circle): Wet Weight (g) Weight	Rep. Length Weight Type (Circle): Wet Blot Dry (Dry (60-90°C) Dry (>100°C) Organisms Units: Tare Gross Net Weight Original Original	Rep Length Weight Type (Circle): Wet Blot Dry Cpy (60-30°C) Dry (>100°C) AFDW (Signal Units): Tare Gross Net Weight Adjusted No. of Original Organisms Organis	Rep. Length Weight Type (Circle): Wet Blot Dry GD-GD-GD-Dry (-100°C) Activated Activated	Rep. Length Weight Type (Circle) Wet Blot Dny (Circle) Circles Circles Weight Good Circles Circles Weight Good Circles Weight Good Circles Circles Circles Weight Good Circles Circles

Page__ of__ QA Form No. 010a Revision 1 Effective 02/14 **△6 4(4)**

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number._

14001-474 -058

Species:

Artemia franciscana

actiff and the

Γ			g)	5	<u> </u>	Т	Τ	Т	74	Γ	Γ	T		ı Ω	Τ	Γ	T	Τ	ĺ	1	Γ	T		Ŋ		_	T	Т	Т	T	Τ	Ţ	T
	Mean Wt.	Treatment (mg)	(Surviving)						0.2384					0.2238			l		0.2090					0.1032					#DIV/0i	1			
	Mean Wt./	Surviving Organism	(mg)	0.248	0.270	0.213	0.234		0.252	0.248	0.278	0.176		0.238	0.202	0.226	0.229		0.220	0.194	0.215	0.207		0.090	0.112	0.083	0.128		1	-	,	1	†
	-	Number of Surv.	Organisms	6	10	10	10		10	10	10	6		10	10	10	10		9	10	10	10		က	5	9	4		0	0	0	0	
	Mean Wt./	reatment (mg)	(Original)	0.2350					0.2340					0.2238					0.2090					0.0460					0.0000				
	Mean Wt./	Organism	(gm)	0.223	0.270	0.213	0.234		0.252	0.248	0.278	0.158		0.238	0.202	0.226	0.229		0.220	0.194	0.215	0.207	100	0.027	0.056	0.050	0.051		000.0	0.000	0.000	000.0	
		No of Orig.	Organisms	10	10	10	10		10	10	10	10		10	10	10	10		10	10	10	10		2	10	10	10		10	10	10	10	
	7000	ight	(g)	0.00223	0.00270	0.00213	0.00234		0.00252	0.00248	0.00278	0.00158		0.00238	0.00202	0.00226	0.00229		0.00220	0.00194	0.00215	0.00207	10000	0.00027	0.00056	0.00050	0.00051		0.0000.0	0.0000.0	0.0000	0.0000.0	
		Net Weight	(g)	0.00221	0.00268	0.00211	0.00232		0.00250	0.00246	0.00276	0.00156		0.00236	0.00200	0.00224	0.00227		0.00218	0.00192	0.00213	0.00205	20000	0.0000	0.00054	0.00048	0.00049		0.0000	0.00000	0.0000.0	0.0000.0	
		Gross	Weight (g)	1.12645	1.14581	1.13089	1.14363		1.13843	1.13392	1.12335	1.13868		1.13676	1.13315	1.13732	1.14169		1.14016	1.13972	1.11713	1.14160	1 4 4 0 0 0 1	1.14001	1.11816	1.14813	1.13154		0.0000	0.00000	0.0000.0	0.00000	
		Tare	Weight (g)	1.12424	1.14313	1.12878	1.14131	000	1.13593	1.13146	1.12059	1.13712		1.13440	1.13115	1.13508	1.13942		1.13798	1.13780	1.11500	1.13955	1 13076	1,13970	1.11/62	1.14/65	1.13105		0.00000	0.00000	0.00000	0.0000	_
			Units:																														_
			rı	∢	В	ပ		<	₹ (20	ر د		1	∢ (20	ا د	ᅴ	1	∢	ω (ပ		┪	10		ا د	ᅴ	1	∢ ′	m			_
ļ.		- - -	i reatment	i	rGSL	algae only				rGSL					5 mg/L)				20 mg/L	<u> </u>				50 mg/L					100 ma/L H			_

Page of ___ QA Form No. 010a Revision 1 Effective 02/14

#DIV/0i				
ı	1	'	-	
0	0	0	0	
0.000.0				
0.00	0.000	0.000	0.000	
10	10	10	10	
0.0000.0	0.0000.0	0.0000	0.0000	
0.00000	0.0000.0	0.0000.0	0.0000	-0.00002
0.0000	0.0000	0.0000.0	0.0000.0	1.13000
0.00000	0.00000	0.00000	0.0000	1.13002
∢	Ω	ပ	۵	
	200 mg/l	1/6111007		Blank

Artemia franciscana Species: Project Number:

04:000 4/11/20

) >	5.128%	0.000%	%000.0	28.689%	#DIV/0i	#DIV/0!		> 	22.386%	6.869%	5.427%	28.121%	#DIV/0i	#DIV/0!	
	S	0.0500	0.0000	0.000	0.1291	0.000	0.000		SD	0.0524	0.0154	0.0113	0.0129	0.000	0.0000	
	Mean	0.9750	1.0000	1.0000	0.4500	0.000	0.0000	original)	Mean	0.2340	0.2238	0.2090	0.0460	0.000	0.000.0	
_	Max	1.0	1.0	1.0	9.0	0.0	0.0	(dry wt per	Max	0.278	0.238	0.220	0.056	0.000	0.000	
ırvival Data	L	6.0	1.0	1.0	0.3	0.0	0.0	owth Data	Min	0.158	0.202	0.194	0.027	0.000	0.000	
stics for Su	ZI	4	4	4	4	4	4	stics for Gr	Z	4	4	4	4	4	4	
Summary Statistics for Survival Data	Treatment	rGSL	5 mg/L	20 mg/L	50 mg/L	100 mg/L	200 mg/L	Summary Statistics for Growth Data (dry wt per original)	Treatment	rGSL	5 mg/L	20 mg/L	50 mg/L	100 mg/L	200 mg/L	

) >	18.436%	6.869%	5.427%	19.674%	#DIV/0i	#DIV/0i
organism)	SD	0.0439	0.0154	0.0113	0.0203	#DIV/0i	
ırviving	Mean	0.2384	0.2238	0.2090	0.1032	IV/0i	#DIV/0i
a (dry wt pe	Max	0.278	0.238	0.220	0.128	000.0	0.000
Srowth Data	Min	0.176	0.202	0.194	0.083	0.000	0.000
atistics for (Z	4	4	4	4	0	0
Summary St	<u>Treatment</u> N Min	rGSL	5 mg/L	20 mg/L	50 mg/L	100 mg/L	200 mg/L

Report Date:

06 Apr-20 08:54 (p 1 of 2) 4558-8240

est Code:	474-exp 03-4

							Test	Code:		474-exp (03-4558-82
Fathead Minn	ow 7-d Larval S	Survival	and Growth	Test					TRE Env	ironmenta	I Strategie
Analysis ID:	12-6256-2136		Endpoint:	7d Survival Rat	te		CET	IS Version	: CETISv	1.8.7	
Analyzed:	06 Apr-20 8:53	3	Analysis:	Parametric-Cor	ntrol vs Trea	itments	Offic	cial Results			
Batch ID:	13-5729-9412		Test Type:	Growth-Surviva	ıl (7d)		Ana	lvst: Lat	Tech		
Start Date:	25 Mar-20 15:0			EPA/821/R-02-	, ,		Dilu	-			
Ending Date:	01 Apr-20 15:2			Artemia francis			Brin		stal Sea		
Duration:	7d 0h			In-House Cultu			Age	•			
Sample ID:	01-8576-9191		Code:	B129CE7			Clie	nt: Not	re Dame		
Sample Date:	25 Mar-20 15:0	00	Material:	Arsenic			Proj	ect: Spe	ecial Studies	;	
Receive Date:	: 25 Mar-20 15:0	00	Source:	Discharge Mon	itoring Repo	ort	•	<u> </u>			
Sample Age:	NA		Station:	Effluent							
Data Transfor	m	Zeta	Alt Hy	p Trials	Seed		PMSD /	NOEL	LOEL	TOEL	TU
Angular (Corre	ected)	NA	C > T	NA	NA		7.88%	20	50	31.62	
Dunnett Multi	ple Comparisor	n Test								****	
Control	vs C-mg/L		Test St	tat Critical	MSD DF	P-Value	P-Type	Decision	(a:5%)		
Dilution Water	5		-0.7441	1 2.29	0.125 6	0.9321	CDF		ificant Effec	<u> </u>	
	20		-0.7441	1 2.29	0.125 6	0.9321	CDF	•	ificant Effec		
	50*		11.64	2.29	0.125 6	<0.0001	CDF	Significar			
ANOVA Table											
Source	Sum Squ	ares	Mean S	Square	DF	F Stat	P-Value	Decision	(a:5%)		
Between	1.329014		0.4430	048	3	73.89	<0.0001	Significar	`		
Error	0.071944	4	0.00599	95367	12		0.000	Oigiioui	it Liloot		
Total	1.400959				15						
Distributional	Tests					-					
Attribute	Test			Test Stat	Critical	P-Value	Decision	(a:1%)			
Variances	Mod Leve	ene Equ	ality of Variar	nce 3.64	5.95	0.0448	Equal Var	iances			***
Variances	Levene E	equality of	of Variance	7.667	5.95	0.0040	Unequal \	/ariances			
Distribution	Shapiro-\	Wilk W N	Normality	0.8588	0.841	0.0184	Normal D	istribution			
7d Survival Ra	ate Summary										
	Control Type	Count		95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
	Dilution Water	4	0.975	0.8954	1	1	0.9	1	0.025	5.13%	0.0%
5		4	1	1	1	1	1	1	0	0.0%	-2.56%
20		4	1	1	1	1	1	1	0	0.0%	-2.56%
50		4	0.45	0.2446	0.6554	0.45	0.3	0.6	0.06455	28.7%	53.8%
		4	0	0	0	0	0	0	0		100.0%
100 200		4	0	0							

Analyst: **%** Page 15 of 22

000-470-187-3

C-mg/L

0

5

20

50

100

200

Control Type

Dilution Water

Count

4

4

4

4

4

Mean

1.371

1.412

1.412

0.734

0.1588

0.1588

95% LCL

1.242

1.412

1.412

0.5244

0.1588

0.1588

CETIS™ v1.8.7.16

95% UCL Median

1.412

1.412

1.412

0.7351

0.1588

0.1588

1.501

1.412

1.412

0.9435

0.1588

0.1588

Min

1.249

1.412

1.412

0.5796

0.1588

0.1588

Max

1.412

1.412

1.412

0.8861

0.1588

0.1588

Std Err

0.04074

0.06584

0

0

0

0

CV%

5.94%

0.0%

0.0%

0.0%

0.0%

17.9%

%Effect

0.0%

-2.97%

-2.97%

46.5%

88.4%

88.4%

Report Date:

06 Apr-20 08:54 (p 2 of 2)

toport bate.	00 Apr-20 00.34 (p 2 01 2
est Code:	474-exp 03-4558-8240

Fathead Mini	now 7-d Larval S	urviva	l and Growt	h Test			TRE Environmental Strategies
Analysis ID: Analyzed:	12-6256-2136 06 Apr-20 8:53	-	Endpoint: Analysis:	7d Survival Ra	ate ontrol vs Treatments	CETIS Version: Official Results:	CETISv1.8.7 Yes
7d Survival F	Rate Detail						
C-mg/L	Control Type	Rep 1	1 Rep 2	Rep 3	Rep 4		
0	Dilution Water	0.9	1	1	1		
5		1	1	1	1		
20		1	1	1	1		
50		0.3	0.5	0.6	0.4		
100		0	0	0	0		

Angular (Corrected) Transformed Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.249	1.412	1.412	1.412
5		1.412	1.412	1.412	1.412
20		1.412	1.412	1.412	1.412
50		0.5796	0.7854	0.8861	0.6847
100		0.1588	0.1588	0.1588	0.1588
200		0.1588	0.1588	0.1588	0.1588

0

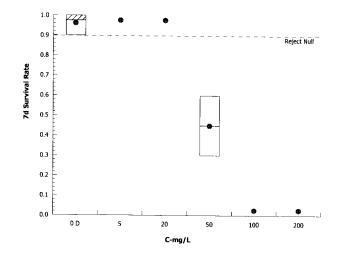
0

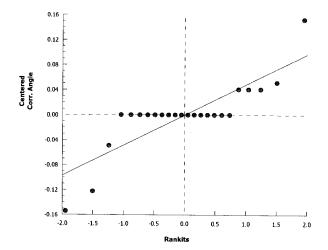
7d Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	
0	Dilution Water	9/10	10/10	10/10	10/10	
0	Lab Water	10/10	10/10	10/10	9/10	
5		10/10	10/10	10/10	10/10	
20		10/10	10/10	10/10	10/10	
50		3/10	5/10	6/10	4/10	
100		0/10	0/10	0/10	0/10	
200		0/10	0/10	0/10	0/10	

Graphics

200





Analyst: 15 Page 16 of 22

Report Date:

06 Apr-20 08:54 (p 1 of 2)

Test Code:

474-exp | 03-4558-8240

								Test	Code:		474-exp	03-4558-82
Fathea	d Minno	ow 7-d Larval S	Survival	and Grow	th Test			_		TRE Env	ironmen	ntal Strategi
Analys Analyz		13-7830-0865 06 Apr-20 8:54		Endpoint: Analysis:	7d Survival F Linear Interp		N)		IS Versio		1.8.7	
Batch I	ID:	13-5729-9412		Test Type:	Growth-Surv	ival (7d)		Ana	lvst:	ab Tech		
Start D	ate:	25 Mar-20 15:0		Protocol:	EPA/821/R-0	` '	2)	Dilu		GSL		
Ending	Date:	01 Apr-20 15:2	5	Species:	Artemia franc	ciscana	,	Brin		Crystal Sea		
Duratio	on:	7d 0h		Source:	In-House Cu	lture		Age		8h		
Sample	e ID:	01-8576-9191		Code:	B129CE7			Clie		lotre Dame		
Sample	e Date:	25 Mar-20 15:0		Material:	Arsenic			Proj		pecial Studies		
Receiv	e Date:	25 Mar-20 15:0	00	Source:	Discharge M	onitoring Re	port	1 10,	cc . 0	pecial Otables	•	
Sample	e Age:	NA		Station:	Effluent							
Linear	Interpol	lation Options										
X Fram	sform	Y Transforn	n	Seed	Resamples	Exp 95	% CL Met	hod				
Linear	<u> </u>	Linear		1392438	200	Yes	Two	-Point Interp	olation			
Point E	stimate	s							 .			
Level	mg/L	95% LCL	95% เ	JCL	•							
LC5	22.75	21.92	23.74									
LC10	25.49	23.84	27.48									
LC15	28.24	25.77	31.22									
LC20 LC25	30.98 33.73	27.69	34.96									
LC40	41.97	29.61 35.38	38.7 49.93	-								
LC50	47.46	39.22	59.4									
ra sarv C-mg/L		te Summary	0				culated Varia					
0- 1119/L 0		ontrol Type lution Water	Count 4	t Mean 0.975	Min 0.9	Max	Std Err	Std Dev	CV%	%Effect	<u>A</u>	В
5	D.	idilon water	4	1	0.9 1	1 1	0.025 0	0.05	5.13%	0.0%	39	40
20			4	1	1	1	0	0 0	0.0% 0.0%	-2.56%	40	40
50			4	0.45	0.3	0.6	0.06455	0 0.1291	0.0% 28.7%	-2.56% 52.8%	40	40
100			4	0	0.5	0.0	0.00433	0.1291	20.176	53.8% 100.0%	18	40
200			4	0	0	0	0	0		100.0%	0 0	40 40
7d Surv	vival Rat	te Detail	·									
C-mg/L		ontrol Type	Rep 1	Rep 2	Rep 3	Rep 4						
0		lution Water	0.9	1	1	1						
5			1	1	1	1						
20			1	1	1	1						
50			0.3	0.5	0.6	0.4						
100			0	0	0	0						
200			0	0	0	0						
7d Surv	ival Rat	te Binomials										
C-mg/L		Control Type	Rep 1	Rep 2	Rep 3	Rep 4						
		Dilution Water	9/10	10/10	10/10	10/10						
)		.ab Water	10/10	10/10	10/10	9/10						
)	L			40/40	10/10	10/10						
	L		10/10	10/10	10/10	10/10						
)	L		10/10 10/10	10/10	10/10	10/10						
) 5	L											
) 5 20	L		10/10	10/10	10/10	10/10						

Report Date: Test Code:

06 Apr-20 08:54 (p 2 of 2) 474-exp | 03-4558-8240

Fathead Minnow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

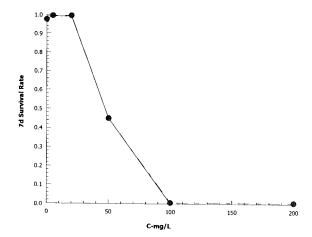
Analysis ID: Analyzed:

13-7830-0865 06 Apr-20 8:54 Endpoint: 7d Survival Rate

Analysis: Linear Interpolation (ICPIN) **CETIS Version:** Official Results: Yes

CETISv1.8.7

Graphics



Report Date:

10 Apr-20 10:29 (p 1 of 2)

Test Code: 474-exp | 03-4558-8240

Fathead Mir	now 7-d Larva	Surviva	al and Growt	h Test						TRE Env	rironment	al Strategi
Analysis ID: Analyzed:	00-4158-939 10 Apr-20 10	_	Endpoint: Analysis:	Mean Dry Bio Nonparametri		_	Treatments		TIS Vers		1.8.7	
Batch ID:	13-5729-941	2	Test Type:	Growth-Surviv					alyst:			
Start Date:	25 Mar-20 15	5:00	Protocol:	EPA/821/R-02		0021			-	Lab Tech rGSL		
Ending Date	: 01 Apr-20 15	:25	Species:	Artemia franc		JUL,						
Duration:	7d 0h		Source:	In-House Cult				Age		Crystal Sea 48h		
Sample ID:	01-8576-919	1	Code:	B129CE7						Notre Dame		
	: 25 Mar-20 15		Material:	Arsenic						Special Studies	_	
Receive Date	e: 25 Mar-20 15	:00	Source:	Discharge Mo	nitoring i	Repo	ort		,,001.	opeolal Studies	•	
Sample Age:	: NA 		Station:	Effluent		•						
Data Transfo		Zeta	Alt H	yp Trials	Seed			PMSD	NOEL	LOEL	TOEL	TU
Untransforme	ed	NA	C > T	NA	NA		-	19.8%	20	50	31.62	10
Steel Many-C	ne Rank Sum	Test										
Control	vs C-mg/L	·	Test S	Stat Critical	Ties	DF	P-Value	P-Type	Decie	ion(α:5%)		
Lab Water	5		14	10	0	6	0.2626	Asymp		ignificant Effec	+	
	20		14	10	0	6	0.2626	Asymp		ignificant Effec		
	50*		10	10	0	6	0.0276	Asymp		cant Effect		
ANOVA Table	•			· · · · · · · · · · · · · · · · · · ·								
Source	Sum Sq	uares	Mean	Square	DF		F Stat	P-Value	Decisi	ion(a:5%)		
Between	0.09445		0.0314		3		38.44	<0.0001		cant Effect		
Error	0.009828		0.0008	190624	12				3	2011 211000		
Total ————	0.104284	14			15							
Distributiona	l Tests											
Attribute	Test			Test Stat	Critica	al	P-Value	Decision	(a:1%)			
Variances			of Variance	9.149	11.3		0.0274	Equal Var				· · · · · · · · · · · · · · · · · · ·
Distribution	Shapiro-	-Wilk W I	Vormality	0.834	0.841		0.0080	Non-norm		oution		
	mass-mg Sum	mary										
C-mg/L	Control Type	Count	t Mean	95% LCL	95% U	ICL	Median	Min	Max	Std Err	CV%	%Effect
) .	Lab Water	4	0.234	0.1506	0.3174	1	0.25	0.158	0.278	0.02619	22.4%	0.0%
5 20		4	0.2237	0.1993	0.2482	2	0.2275	0.202	0.238	0.007685	6.87%	4.38%
50 50		4	0.209	0.191	0.227		0.211	0.194	0.22	0.005672		10.7%
00		4	0.046	0.02542	0.0665	8	0.0505	0.027	0.056	0.006468		80.3%
200		4 4	0	0	0		0	0	0	0		100.0%
			0	0	0		0	0	0	0		100.0%
nean Dry Biol C-mg/L	mass-mg Detail											
,-ing/L	Control Type Lab Water	Rep 1 0.252	Rep 2	Rep 3	Rep 4							
	-ab Water		0.248	0.278	0.158							
0		0.238	0.202	0.226	0.229							
0		0.22	0.194	0.215	0.207							
00		0.027	0.056	0.05	0.051							
00		0	0	0	0							
00		0	0	0	0							

4/10/10 Analyst: M7 QA: WW Page 19 of 22

Report Date:

10 Apr-20 10:29 (p 2 of 2)

Test Code:

474-exp | 03-4558-8240

Fathead Minnow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

Analysis ID: Analyzed:

00-4158-9396 10 Apr-20 10:29

Endpoint: Mean Dry Biomass-mg

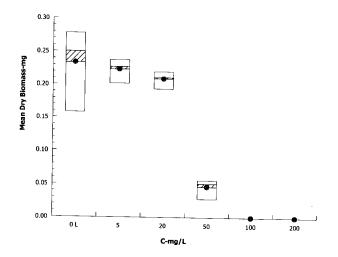
Nonparametric-Control vs Treatments

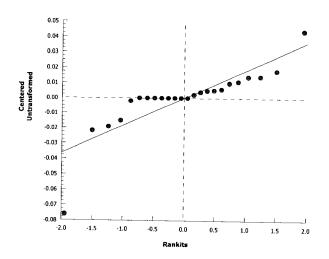
CETIS Version:

CETISv1.8.7

Analysis: Official Results: Yes

Graphics





Report Date:

10 Apr-20 10:30 (p.1 of 2)

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Fathon	d Minn	ou 7 dl1							est Code	<u>: </u>	474-exp 03-4558-8240
autea	iu wiinn	ow 7-d Larval S	ourvival	and Growt	th Test						TRE Environmental Strategies
Analys		05-0372-0767		Endpoint:	Mean Dry Bio			C	ETIS Ver	sion:	CETISv1.8.7
Analyz	.ea: 	10 Apr-20 10:3	30 .	Analysis:	Linear Interpo	olation (ICF	PIN)	0	fficial Re	sults:	
Batch I	•	13-5729-9412		Test Type:	Growth-Survi	val (7d)		Α	nalyst:	Lab 1	Tech
Start D	ate:	25 Mar-20 15:0	00	Protocol:	EPA/821/R-0	2-013 (200)2)		iluent:	rGSL	
Ending	Date:	01 Apr-20 15:2	:5	Species:	Artemia franc		,	_	rine:		al Sea
Duratio	on:	7d 0h	;	Source:	In-House Cul	ture			ge:	48h	ai Jea
Sample	e ID:	01-8576-9191		Code:	B129CE7				lient:	Notre	Dame
		25 Mar-20 15:0	-	Material:	Arsenic			=	roject:		ial Studies
Receive	e Date:	25 Mar-20 15:0	00 :	Source:	Discharge Mo	onitoring Re	eport	• '	oject.	Opec	iai Studies
Sample	e Age:	NA	;	Station:	Effluent	Ü					
Linear	Interpo	lation Options									
X Trans	sform	Y Transforn	ո	Seed	Resamples	Exp 9	5% CL N	/lethod			
Linear		Linear	1	1452613	200	Yes		wo-Point Inte	erpolation		
Point E	stimate	es									
Level	mg/L	95% LCL	95% U	CL							
IC5	6.475	N/A	31.23								
IC10	18.37	N/A	27.21								
IC15	21.86	N/A	28.24								
IC20	24.01	2.478	30.06								
IC25	_26.17	18.02	_31.89								
IC40	32.63	26.09	37.49								
IC50	36.93	31.18	41.41								
Mean D	ry Bion	nass-mg Summ	ary				Calculated	Variate			
C-mg/L	Co	ontrol Type	Count	Mean	Min	Max	Std Er		v CV%		%Effect
)	La	b Water	4	0.234	0.158	0.278	0.0261				76ETTECT

Mean Dry	Biomass-mg Sum	mary			С	alculated Vai	riate		
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
)	Lab Water	4	0.234	0.158	0.278	0.02619	0.05238	22.4%	0.0%
		4	0.2237	0.202	0.238	0.007685	0.01537	6.87%	4.38%
0		4	0.209	0.194	0.22	0.005672	0.01134	5.43%	10.7%
0		4	0.046	0.027	0.056	0.006468	0.01294	28.1%	80.3%
00		4	0	0	0	0	0		100.0%
200 ————		4	0	0	0	0	0		100.0%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Water	0.252	0.248	0.278	0.158
5		0.238	0.202	0.226	0.229
20		0.22	0.194	0.215	0.207
50		0.027	0.056	0.05	0.051
100		0	0	0	0
200		0	0	0	0

Report Date:

10 Apr-20 10:30 (p 2 of 2)

Test Code:

474-exp | 03-4558-8240

Fathead Minnow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

Analysis ID: Analyzed:

05-0372-0767 10 Apr-20 10:30 Endpoint: Mean Dry Biomass-mg Analysis:

Linear Interpolation (ICPIN)

CETIS Version:

CETISv1.8.7

Official Results: Yes

Graphics

