



Ecotoxicology Research Facility



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June 14, 2012

Myra Taylor
City Water & Light
PO Box 1289
Jonesboro, AR 72403

Dear Myra,

Please find enclosed the results of the 7-day chronic tests using water collected from Jonesboro's East plant facility during the week of June 4th. Neither lethal nor sublethal effects measured in either *Pimephales promelas* or *Ceriodaphnia dubia* exposed to the critical flow concentration (100%) from this outfall. All test conditions and acceptability criteria as suggested by our laboratory and the US EPA were met during these tests.

Please call if you have any questions regarding this particular test series or any other tests conducted in the past.

Sincerely,

Jennifer L. Bouldin, PhD
Director Ecotoxicology Research Facility
PO Box 847
Arkansas State University
State University, AR 72467

Arkansas State University Ecotoxicology Research Facility

Laboratory Report

Facility Director / Lab Contact: Jennifer Bouldin
 Phone: (870) 972-2570

Client: City Water & Light
 P.O. Box 1289
 Jonesboro, AR 72403

Contact: Myra Taylor
 (870)935-5581
 (870)931-9846 fax

NPDES Permit #: AR0043401 AFIN#: 16-00152

Effluent Sampling Point/Type: East Facility/24hr Composite

Samples Collected:

Sample #	Sampling Times	Received	Arrival Temp
E-01	06/03/12 1000 hrs to 06/04/12 0900 hrs	06/04/12 1113 hrs	5.5°C
E-02	06/05/12 1000 hrs to 06/06/12 0900 hrs	06/06/12 1116 hrs	8.5°C
E-03	06/07/12 1000 hrs to 06/08/12 0900 hrs	06/08/12 1112 hrs	8.0°C

Test Methods:

7-Day Chronic Toxicity, Static renewal, Fathead minnow, EPA 821/R-02/013, Section 11

7-Day Chronic Toxicity, Static renewal, Cladoceran, EPA 821/R-02/013, Section 13

Organisms: *P. promelas* <24hrs, *C. dubia* <24hrs

Culture Source: ASU Ecotox

Dilutions: 0%, 32%, 42%, 56%, 75%, 100%

Critical Dilution: 100%

Statistical Method: Toxcalc 5.0.25

Results:	<i>P. promelas</i>	<i>C. dubia</i>
NOEC Survival:	100%	100%
Pass/Fail (0=pass, 1=fail):	0	0
NOEC Growth/Reproduction:	100%	100%
Pass/Fail (0=pass, 1=fail):	0	0
Control Survival:	100%	100%
Control % CV Growth/Reproduction:	13.5	11.0
Critical Dilution % CV Growth/Reproduction:	5.3	10.9
Mean Weight/ # Neonates in Control:	0.3393 mg	24.4
Mean Weight/ # of Neonates in Critical Dilution:	0.4333 mg	30.2
MSDp	0.1846	0.1387
Daily Average Minimum NOEC:	100%	100%
7-Day Minimum NOEC:	100%	100%

Results Summary: Effluent did not induce lethal or sublethal toxicity to *P. promelas*.
 Effluent did not induce lethal or sublethal toxicity to *C. dubia*.

QA/Reference Testing: Data attached

Reviewed By:

 Jennifer L. Bouldin, Director ASU Ecotoxicology Research Facility

Toxicity Test Performed: 7-day *Pimephales promelas* Survival and Growth
 Effluent Sampling Point: Jonesboro CWL East Plant
 Date Test Started: 06/05/12 *P. promelas*
 Time Test Started: 1055 *P. promelas*
 Date Test Terminated: 06/12/12 *P. promelas*
 Time Test Terminated: 1100 *P. promelas*
 Laboratory Analyst: Rosado-Berrios

Toxicity Test Performed: 7-day *Ceriodaphnia dubia* Survival and Reproduction
 Effluent Sampling Point: Jonesboro CWL East Plant
 Date Test Started: 06/05/12 *C. dubia*
 Time Test Started: 1000 *C. dubia*
 Date Test Terminated: 06/12/12 *C. dubia*
 Time Test Terminated: 1045 *C. dubia*
 Laboratory Analyst: Griffin

I. Test Methods

A. Physical and Chemical Testing - APHA, Standard Methods for the Examination of Water and Wastewater; Vol. 21, 2005.

<u>Test</u>	<u>Method</u>
Alkalinity	2320B
Conductivity	2510B
Dissolved Oxygen (mg/L, DO)	4500-O-G
Hardness (mg/L CaCO ₃)	2340C
pH	4500-H ⁺ B
Temperature (°C)	2550B

B. Toxicity Testing – EPA 821/R-02/013: Short Term Methods for Estimating the Chronic Toxicity of Effluents to Freshwater Organisms

<u>Test</u>	<u>Method</u>
Fathead Minnow Survival and Growth	Section 11
Cladoceran Survival and Reproduction	Section 13

II. Test Organisms

- A. Name: *Pimephales promelas* (Fathead minnow)
 Source: Laboratory Culture
 Age: <24 hours
 Life Stage: Larval

- B. Name: *Ceriodaphnia dubia* (Cladoceran)
Source: Laboratory Culture
Age: <24 hours
Life Stage: Neonate

III. External Factors

A. Incubator

Temperature (°C)

Average: 24.7

Range: 24.5 – 25.0

Light Cycle: 16 hours light/ 8 hours dark

Light Intensity: 100 footcandles

Control Water: Moderately Hard Synthetic Water (#865/866)

B. *Pimephales promelas*

Test Chambers: 250 ml storage dishes

Volume per Chamber: 200 ml

Number of Organisms per Chamber: 8

Number of Replicates per Concentration: 5

Acclimation: Laboratory control water was added to cultures until >50% of the culture water consisted of control water.

Food: Larval fish were fed 0.15ml of laboratory-cultured *Artemia* brine shrimp one hour prior to test setup and then 3X daily thereafter.

C. *Ceriodaphnia dubia*

Test Chambers: 30 ml Solo cups

Volume per Chamber: 15-20 ml

Number of Organisms per Chamber: 1

Number of Replicates per Concentration: 10

Acclimation: Laboratory control water was added to cultures until >50% of the culture water consisted of control water.

Food: Cladocera were fed *Selenastrum* (#ABS 052412) and yeast/cereal/trout chow mix (#YCT 041012-9/10/11) one hour prior to test setup and once daily thereafter.

IV. Quality Assurance

- A. Standard Toxicant: Sodium Chloride

B. Organism: *Pimephales promelas*

Date of Reference Toxicant Test

Start: 06/07/12

Terminated: 06/14/12

Time of Reference Toxicant Test

Start: 1410

Terminated: 1425

Laboratory Analyst: Freyaldenhoven

Dilution Water Used: Moderately Hard Synthetic Water #866

Results: Survival and Growth within control limits

Survival

LOEC: 5.63 g/L NaCl

EC50: 5.50 g/L NaCl

Growth

LOEC: >7.50 g/L NaCl

IC25: >7.50 g/L NaCl

C. Organism: *Ceriodaphnia dubia*

Date and time of Reference Toxicant Test

Start: 06/05/12

Terminated: 06/12/12

Time of Reference Toxicant Test

Start: 1615

Terminated: 1630

Laboratory Analyst: Freyaldenhoven

Dilution Water Used: Moderately Hard Synthetic Water #866

Results: Survival EC50 within 3 standard deviations

Reproduction within control limits

Survival

LOEC: 1.82 g/L NaCl

EC50: 1.40 g/L NaCl

Reproduction

LOEC: 1.27 g/L NaCl

IC25: 1.28 g/L NaCl

V. Physical and Chemical Data - See Attached

VI. Survival and Growth Data - See Attached

VII. Statistical Methods - See Attached

VIII. NPDES Permit Results - See Attached

SUMMARY REPORTING FORM

WET Testing

Fathead Minnow Larvae (*Pimephales promelas*) Survival and Growth

Permittee: Jonesboro CWL East Plant

NPDES No.: AR0043401

		<u>Time</u>	<u>Date</u>		<u>Time</u>	<u>Date</u>
Composite 1:	Collected from	1000	06/03/12	to	0900	06/04/12
Composite 2:	Collected from	1000	06/05/12	to	0900	06/06/12
Composite 3:	Collected from	1000	06/07/12	to	0900	06/08/12

Test Initiated: 1055

Date: 06/05/12

Time Terminated: 1100

Date: 06/12/12

Dilution H₂O: MH 865/866

DATA TABLE FOR GROWTH

<u>Effluent</u> <u>Conc %</u>	<u>Average Dry Weight in</u> <u>Replicate Chambers (mg)</u>					<u>Mean Dry</u> <u>Weight (mg)</u>	<u>CV%</u>
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>		
Control	0.3575	0.2837	0.4063	0.3175	0.3313	0.3393	13.5
32	0.3138	0.3743	0.3475	0.3150	0.3313	0.3364	7.5
42	0.3780	0.3812	0.4329	0.3786	0.3400	0.3821	8.7
56	0.2913	0.4150	0.3586	0.4087	0.4043	0.3756	13.9
75	0.4063	0.2850	0.4367	0.3475	0.3912	0.3733	15.8
100	0.4514	0.4162	0.4014	0.4457	0.4517	0.4333	5.3

DATA TABLE FOR SURVIVAL

<u>Effluent</u> <u>Conc. %</u>	<u>% Survival in</u> <u>Replicate Chambers</u>					<u>Mean % Survival</u>			<u>CV%</u>
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>24h</u>	<u>48h</u>	<u>7days</u>	
Control	100	100	100	100	100	100	100	100	0.0
32	100	87.5	100	100	100	97.5	97.5	97.5	6.1
42	62.5	100	87.5	87.5	100	100	97.5	87.5	16.1
56	100	100	87.5	100	87.5	97.5	97.5	95	7.6
75	100	100	100	75	100	97.5	97.5	97.5	11.7
100	87.5	100	87.5	87.5	75	100	95	87.5	10.1

Coefficient of Variation = Standard Deviation x 100/Mean

Fathead Minnow Larvae (*Pimephales promelas*) Survival and Growth

1. FISHER'S EXACT TEST:

Is the mean survival for the critical dilution (100%) at 7 days significantly different ($p=0.05$) than the control survival?

____ Yes X No

2. DUNNETT'S PROCEDURE OR STEEL'S MANY-ONE RANK TEST AS APPROPRIATE:

Is the mean growth by *P. promelas* in the critical dilution (100%) significantly different ($p=0.05$) than the growth in control exposures?

____ Yes X No

3. If the NOEC for survival is less than the critical dilution, enter [1], otherwise enter [0] for parameter #TGP6C: 0

4. If the NOEC for growth is less than the critical dilution, enter [1], otherwise enter [0] for parameter #TLP6C: 0

5. Report the NOEC value for survival, Parameter #TOP6C:
NOEC survival 100 % effluent

6. Report the NOEC value for growth, Parameter #TPP6C:
NOEC growth 100 % effluent

7. Report the % coefficient of variation (largest of low flow and control dilutions), Parameter #TQP6C: CV % growth 13.5 % (control)

Whole Effluent Lethality Values

1. Report the Whole Effluent Lethality values for the 30-Day average minimum, Parameter #22414:

Daily Average Minimum NOEC: 100%

2. Report the Whole Effluent Lethality values for the 7-day minimum, Parameter #22414:

7-Day Minimum NOEC: 100%

WET Testing Summary Form
Fathead Minnow Larvae (*Pimephales promelas*)
Chemical Parameters Chart

Permittee: Jonesboro CWL East Plant

Sample No. 1 Collected Ending Date: 06/04/12 Time: 0900

NPDES No.: AR0043401

Sample No. 2 Collected Ending Date: 06/06/12 Time: 0900

Contact: Myra Taylor

Sample No. 3 Collected Ending Date: 06/08/12 Time: 0900

Analyst: Rosado-Berrios

Test Begin: Date: 06/05/12 Time: 1055 Test End: Date: 06/12/12 Time: 1100

Initial Water Chemistry for Chronic Tests

Project: CWL EAST (Jonesboro) – *P. promelas*

Test day		1	2	3	4	5	6	7
Date		6/5/2012	6/6/2012	6/7/2012	6/8/2012	6/9/2012	6/10/2012	6/11/2012
H ₂ O #		MH 865	MH 866	MH 866	MH 866	MH 866	MH 866	MH 866
Temp (°C)	Control	23.7	23.0	24.0	23.5	24.0	23.8	24.2
	32%	23.7	23.0	24.0	23.5	24.0	23.8	24.5
	42%	23.8	23.1	24.0	23.7	24.0	23.9	24.5
	56%	23.9	23.1	24.0	23.9	24.1	23.9	25.0
	75%	23.9	23.0	24.0	23.9	24.1	24.0	25.0
	100%	23.9	23.0	24.0	24.0	24.1	24.0	25.0
pH (Standard Units)	Control	7.88	7.77	7.83	7.81	7.86	7.85	7.71
	32%	7.70	7.70	7.85	7.73	7.80	7.96	7.71
	42%	7.68	7.73	7.89	7.72	7.79	7.89	7.74
	56%	7.63	7.73	7.92	7.69	7.76	7.89	7.73
	75%	7.57	7.95	7.76	7.73	7.75	7.90	7.78
	100%	7.50	7.90	7.78	7.79	7.68	7.94	7.79
DO (mg/L)	Control	7.5	8.0	8.4	7.8	7.7	7.9	7.6
	32%	7.4	8.6	7.6	8.1	8.1	7.7	7.9
	42%	7.0	8.6	7.7	8.1	7.7	7.8	7.8
	56%	7.0	8.7	7.7	8.1	7.7	7.5	8.0
	75%	7.4	8.1	7.9	8.0	7.9	7.4	7.8
	100%	7.5	8.1	7.7	7.9	7.9	7.2	7.8
Cond (µS/cm)	Control	319	321	320	320	318	319	325
	32%	453	439	428	426	438	447	447
	42%	492	486	460	464	476	479	484
	56%	557	546	517	514	533	532	537
	75%	635	624	594	585	612	610	613
	100%	743	731	690	678	726	716	708
Alk (mg/L)	Control	60		64		64		
	100%	134		120		120		
Hard (mg/L)	Control	90		90		90		
	100%	110		100		100		

WET Testing Summary Form
Fathead Minnow Larvae (*Pimephales promelas*)

Chemical Parameters Chart

Permittee: Jonesboro CWL East Plant

Sample No. 1 Collected Ending Date: 06/04/12 Time: 0900

NPDES No.: AR0043401

Sample No. 2 Collected Ending Date: 06/06/12 Time: 0900

Contact: Myra Taylor

Sample No. 3 Collected Ending Date: 06/08/12 Time: 0900

Analyst: Rosado-Berrios

Test Begin: Date: 06/05/12 Time: 1055 Test End: Date: 06/12/12 Time: 1100

Final Water Chemistry for Chronic Tests								
Project: CWL EAST (Jonesboro)– <i>P. promelas</i>								
Test day		1	2	3	4	5	6	7
Date		6/6/2012	6/7/2012	6/8/2012	6/9/2012	6/10/2012	6/11/2012	6/12/2012
H ₂ O #		MH 865	MH 866	MH 866	MH 866	MH 866	MH 866	MH 866
Temp (°C)	Control	24.0	23.0	23.0	24.0	24.0	24.5	23.2
	32%	24.0	23.0	23.5	24.0	24.0	24.8	23.3
	42%	24.0	23.0	23.9	24.0	24.0	24.9	23.2
	56%	24.0	23.5	24.0	24.0	24.1	24.9	23.2
	75%	24.0	23.5	24.0	24.0	24.1	24.9	23.2
	100%	24.0	24.0	24.0	24.0	24.1	24.9	23.2
pH (Standard Units)	Control	7.19	7.50	7.39	7.38	7.30	7.35	7.18
	32%	7.35	7.61	7.58	7.53	7.45	7.54	7.40
	42%	7.43	7.68	7.64	7.57	7.61	7.60	7.49
	56%	7.50	7.75	7.70	7.64	7.60	7.61	7.56
	75%	7.54	7.78	7.76	7.74	7.69	7.68	7.64
	100%	7.60	7.85	7.79	7.80	7.73	7.83	7.70
DO (mg/L)	Control	8.8	6.9	7.3	6.8	6.7	6.3	5.7
	32%	8.7	6.8	7.2	7.0	6.0	6.1	5.8
	42%	8.7	6.8	7.2	6.6	6.8	6.1	5.6
	56%	8.7	7.0	7.2	6.3	6.7	6.2	5.5
	75%	8.7	6.6	7.0	6.7	6.5	6.2	5.1
	100%	8.7	6.6	6.6	6.5	6.4	6.3	5.5

SUMMARY REPORTING FORM
WET Testing
Ceriodaphnia dubia Survival and Reproduction

Permittee: Jonesboro CWL East Plant

NPDES No.: AR0043401

		<u>Time</u>	<u>Date</u>		<u>Time</u>	<u>Date</u>
Composite 1:	Collected from	1000	06/03/12	to	0900	06/04/12
Composite 2:	Collected from	1000	06/05/12	to	0900	06/06/12
Composite 3:	Collected from	1000	06/07/12	to	0900	06/08/12

Test Initiated: 1000

Date: 06/05/12

Time Terminated: 1045

Date: 06/12/12

Dilution H₂O: MH 865/866

PERCENT SURVIVAL
Percent Effluent

<u>Time of Reading</u>	<u>Control</u>	<u>32%</u>	<u>42%</u>	<u>56%</u>	<u>75%</u>	<u>100%</u>
24h	100	100	100	100	100	100
48h	100	100	100	100	100	100
7 day	100	100	100	100	100	100

NUMBER OF YOUNG/FEMALE @ 7 DAYS

REP	<u>0%</u>	<u>32%</u>	<u>42%</u>	<u>56%</u>	<u>75%</u>	<u>100%</u>
A	26	26	24	32	24	34
B	27	28	26	33	30	32
C	26	29	22	32	29	27
D	20	18	28	21	28	34
E	21	25	30	28	29	34
F	24	31	26	28	27	25
G	24	22	27	23	30	29
H	26	29	27	26	29	29
I	28	28	30	26	29	27
J	22	32	32	31	32	31
Mean	24.4	26.8	27.2	28.0	28.7	30.2
CV%*	11.0	15.8	10.9	14.5	7.4	10.9

*Coefficient of Variation% = Standard Deviation x 100/Mean

***Ceriodaphnia dubia* Survival and Reproduction**

1. FISHER'S EXACT TEST:
Is the mean survival for the critical dilution (100%) at 7 days significantly different ($p=0.05$) than the control survival?
 Yes X No

2. DUNNETT'S PROCEDURE OR STEEL'S MANY-ONE RANK TEST AS APPROPRIATE:
Is the mean number of young produced per female by the critical dilution (100%) significantly different ($p=0.05$) than the control's number of young per female?
 Yes X No

3. If the NOEC for survival is less than the critical dilution, enter [1], otherwise enter [0] for parameter #TGP3B: 0

4. If the NOEC for reproduction is less than the critical dilution, enter [1], otherwise enter [0] for parameter #TLP3B: 0

5. Report the NOEC value for survival, Parameter #TOP3B:
NOEC survival 100 % effluent

6. Report the NOEC value for reproduction, Parameter #TPP3B:
NOEC reproduction 100 % effluent

7. Report the % coefficient of variation (largest of low flow and control dilutions), Parameter #TQP3B:
CV % reproduction 11.0% (control)

Whole Effluent Lethality Values for *Ceriodaphnia dubia*

1. Report the Whole Effluent Lethality values for the 30-Day average minimum, Parameter #22414:
Daily Average Minimum NOEC: 100%

2. Report the Whole Effluent Lethality values for the 7-day minimum, Parameter #22414: 7-Day
Minimum NOEC: 100%

WET Testing Summary Form
***Ceriodaphnia dubia* (Cladoceran)**
Chemical Parameters Chart

Permittee: Jonesboro CWL East Plant
 NPDES No.: AR0043401
 Contact: Myra Taylor
 Analyst: Griffin

Sample No. 1 Collected Ending Date: 06/04/12 Time: 0900
 Sample No. 2 Collected Ending Date: 06/06/12 Time: 0900
 Sample No. 3 Collected Ending Date: 06/07/12 Time: 0900
 Test Begin: Date: 06/05/12 Time: 1000 Test End: Date: 06/12/12 Time: 1045

Initial Water Chemistry for Chronic Tests

Project: CWL EAST (Jonesboro) – <i>C. dubia</i>								
Test day		1	2	3	4	5	6	7
Date		6/5/2012	6/6/2012	6/7/2012	6/8/2012	6/9/2012	6/10/2012	6/11/2012
H ₂ O #		MH 865	MH 866	MH 866	MH 866	MH 866	MH 866	MH 866
Temp (°C)	Control	23.7	23.0	24.0	23.5	24.0	23.8	24.2
	32%	23.7	23.0	24.0	23.5	24.0	23.8	24.5
	42%	23.8	23.1	24.0	23.7	24.0	23.9	24.5
	56%	23.9	23.1	24.0	23.9	24.1	23.9	25.0
	75%	23.9	23.0	24.0	23.9	24.1	24.0	25.0
	100%	23.9	23.0	24.0	24.0	24.1	24.0	25.0
pH (Standard Units)	Control	7.88	7.77	7.83	7.81	7.86	7.85	7.71
	32%	7.70	7.70	7.85	7.73	7.80	7.96	7.71
	42%	7.68	7.73	7.89	7.72	7.79	7.89	7.74
	56%	7.63	7.73	7.92	7.69	7.76	7.89	7.73
	75%	7.57	7.95	7.76	7.73	7.75	7.90	7.78
	100%	7.50	7.90	7.78	7.79	7.68	7.94	7.79
DO (mg/L)	Control	7.5	8.0	8.4	7.8	7.7	7.9	7.6
	32%	7.4	8.6	7.6	8.1	8.1	7.7	7.9
	42%	7.0	8.6	7.7	8.1	7.7	7.8	7.8
	56%	7.0	8.7	7.7	8.1	7.7	7.5	8.0
	75%	7.4	8.1	7.9	8.0	7.9	7.4	7.8
	100%	7.5	8.1	7.7	7.9	7.9	7.2	7.8
Cond (µS/cm)	Control	319	321	320	320	318	319	325
	32%	453	439	428	426	438	447	447
	42%	492	486	460	464	476	479	484
	56%	557	546	517	514	533	532	537
	75%	635	624	594	585	612	610	613
	100%	743	731	690	678	726	716	708
Alk (mg/L)	Control	60		64		64		
	100%	134		120		120		
Hard (mg/L)	Control	90		90		90		
	100%	110		100		100		

WET Testing Summary Form
***Ceriodaphnia dubia* (Cladoceran)**
Chemical Parameters Chart

Permittee: Jonesboro CWL East Plant
 NPDES No.: AR0043401
 Contact: Myra Taylor
 Analyst: Griffin

Sample No. 1 Collected Ending Date: 06/04/12 Time: 0900
 Sample No. 2 Collected Ending Date: 06/06/12 Time: 0900
 Sample No. 3 Collected Ending Date: 06/07/12 Time: 0900
 Test Begin: Date: 06/05/12 Time: 1000 Test End: Date: 06/12/12 Time: 1045

Final Water Chemistry for Chronic Tests								
Project: CWL EAST (Jonesboro) – <i>C. dubia</i>								
Test day		1	2	3	4	5	6	7
Date		6/6/2012	6/7/2012	6/8/2012	6/9/2012	6/10/2012	6/11/2012	6/12/2012
H ₂ O #		MH 865	MH 866	MH 866	MH 866	MH 866	MH 866	MH 866
Temp	Control	23.0	24.0	24.2	24.5	24.0	24.9	24.7
	32%	23.0	24.0	24.0	24.6	24.0	25.0	24.5
	42%	22.9	24.0	24.0	24.6	24.0	25.0	23.9
	56%	23.0	24.0	24.0	24.5	24.0	25.0	23.8
	75%	22.9	24.0	24.0	24.6	24.0	25.0	24.2
	100%	23.0	24.0	24.0	24.6	24.0	25.0	24.6
pH (Standard Units)	Control	7.74	7.93	7.68	8.02	8.00	7.82	7.84
	32%	7.94	8.05	7.82	8.01	8.10	7.79	7.82
	42%	8.05	8.21	7.88	8.05	8.19	8.11	8.08
	56%	8.04	8.12	7.94	8.04	8.18	8.13	8.02
	75%	8.20	8.30	8.06	8.18	8.28	8.17	8.11
	100%	8.18	8.23	8.07	8.12	8.24	8.20	8.05
DO (mg/L)	Control	8.1	7.5	7.7	8.1	8.3	7.6	7.4
	32%	8.3	7.7	7.9	8.2	8.3	8.3	7.5
	42%	8.1	7.5	8.5	8.2	8.3	8.1	7.6
	56%	8.2	7.7	8.5	8.3	8.0	7.1	7.8
	75%	8.8	7.7	8.0	8.5	7.2	7.9	7.4
	100%	8.3	8.3	8.0	8.1	8.1	7.9	7.5

Larval Fish Growth and Survival Test-7 Day Survival

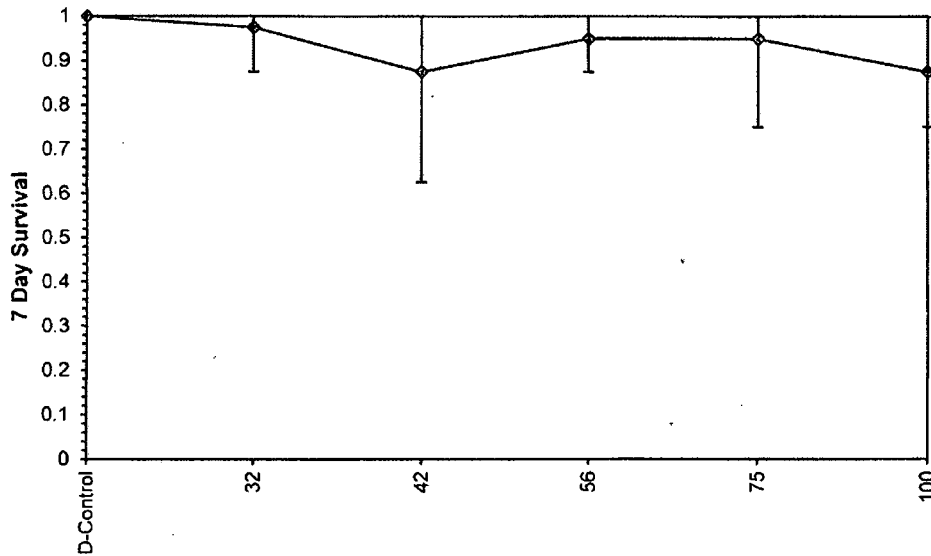
Start Date: 6/5/2012 10:55	Test ID: Jun-12	Sample ID: NPDES Permit #AR0043401
End Date: 6/12/2012 11:00	Lab ID: ASU ERF	Sample Type: EFF1-POTW
Sample Date: 6/4/2012	Protocol: EPAF 02-EPA Freshwater	Test Species: PP-Pimephales promelas
Comments: 2nd Quarter WET Testing		

Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
32	1.0000	0.8750	1.0000	1.0000	1.0000
42	0.6250	1.0000	0.8750	0.8750	1.0000
56	1.0000	1.0000	0.8750	1.0000	0.8750
75	1.0000	1.0000	0.7500	1.0000	1.0000
100	0.8750	1.0000	0.8750	0.8750	0.7500

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					N	Rank Sum	1-Tailed Critical
			Mean	Min	Max	CV%				
D-Control	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5			
32	0.9750	0.9750	1.3564	1.2094	1.3931	6.055	5	25.00	16.00	
42	0.8750	0.8750	1.2234	0.9117	1.3931	16.097	5	20.00	16.00	
56	0.9500	0.9500	1.3196	1.2094	1.3931	7.623	5	22.50	16.00	
75	0.9500	0.9500	1.3239	1.0472	1.3931	11.684	5	25.00	16.00	
100	0.8750	0.8750	1.2137	1.0472	1.3931	10.087	5	17.50	16.00	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01) Equality of variance cannot be confirmed	0.88461	0.9	-1.08279	1.57591
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	>100		1

Dose-Response Plot



Larval Fish Growth and Survival Test-7 Day Growth

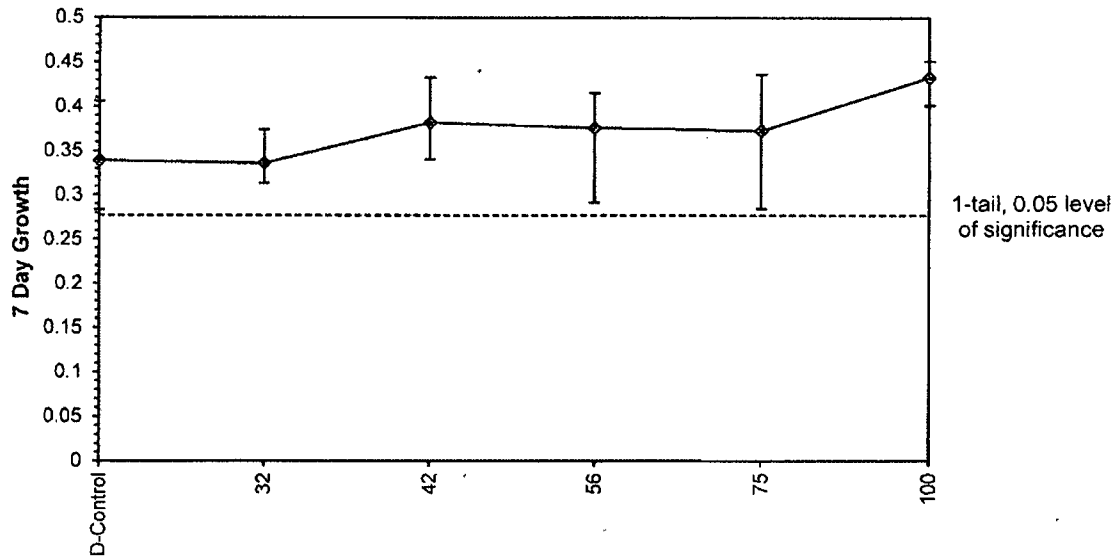
Start Date: 6/5/2012 10:55	Test ID: Jun-12	Sample ID: NPDES Permit #AR0043401
End Date: 6/12/2012 11:00	Lab ID: ASU ERF	Sample Type: EFF1-POTW
Sample Date: 6/4/2012	Protocol: EPAF 02-EPA Freshwater	Test Species: PP-Pimephales promelas
Comments: 2nd Quarter WET Testing		

Conc-%	1	2	3	4	5
D-Control	0.3575	0.2837	0.4063	0.3175	0.3313
32	0.3138	0.3743	0.3475	0.3150	0.3313
42	0.3780	0.3812	0.4329	0.3786	0.3400
56	0.2913	0.4150	0.3586	0.4087	0.4043
75	0.4063	0.2850	0.4367	0.3475	0.3912
100	0.4514	0.4162	0.4014	0.4457	0.4517

Conc-%	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%					
D-Control	0.3393	1.0000	0.3393	0.2837	0.4063	13.540	5				
32	0.3364	0.9915	0.3364	0.3138	0.3743	7.515	5	0.109	2.360	0.0626	
42	0.3821	1.1264	0.3821	0.3400	0.4329	8.658	5	-1.616	2.360	0.0626	
56	0.3756	1.1071	0.3756	0.2913	0.4150	13.886	5	-1.369	2.360	0.0626	
75	0.3733	1.1005	0.3733	0.2850	0.4367	15.782	5	-1.284	2.360	0.0626	
100	0.4333	1.2772	0.4333	0.4014	0.4517	5.321	5	-3.543	2.360	0.0626	

Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	0.96732	0.9	-0.46619	0.20357						
Bartlett's Test indicates equal variances ($p = 0.41$)	5.07805	15.0863								
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.06264	0.18463	0.00621	0.00176	0.01571	5, 24

Dose-Response Plot



CHRONIC TEST DATA SHEET

Pimephales promelas

060512

Project: CWL EAST (Jonesboro) Beginning Date: _____ Time: 1055 Test Species: P. promelas

Dilution H₂O: MH865 ~~1:1000~~ Ending Date: 061212 Time: 1100 Age: > 24hrs

Test Type: (*)Static Renewal () Flowthrough Toxicant/Effluent: _____

Conc.	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Pan #
Control	1	8/0	8/0	8/0	8/0	8/0	8/0	8/0	1
	2	8/0	8/0	8/0	8/0	8/0	8/0	8/0	2
	3	8/0	8/0	8/0	8/0	8/0	8/0	8/0	3
	4	8/0	8/0	8/0	8/0	8/0	8/0	8/0	4
	5	8/0	8/0	8/0	8/0	8/0	8/0	8/0	5
32%	1	8/0	8/0	8/0	8/0	8/0	8/0	8/0	6
	2	8/1	7/0	7/0	7/0	7/0	7/0	7/0	7
	3	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8
	4	8/0	8/0	8/0	8/0	8/0	8/0	8/0	9
	5	8/0	8/0	8/0	8/0	8/0	8/0	8/0	10
42%	1	8/0	8/0	8/0	8/0	8/0	8/3	5/0	11
	2	8/0	8/0	8/0	8/0	8/0	8/0	8/0	12
	3	8/0	8/0	8/0	8/0	8/0	8/0	8/1	13
	4	8/0	8/1	7/0	7/0	7/0	7/0	7/0	14
	5	8/0	8/0	8/0	8/0	8/0	8/0	8/0	15
56%	1	8/0	8/0	8/0	8/0	8/0	8/0	8/0	16
	2	8/0	8/0	8/0	8/0	8/0	8/0	8/0	17
	3	8/1	7/0	7/0	7/0	7/0	7/0	7/0	18
	4	8/0	8/0	8/0	8/0	8/0	8/0	8/0	19
	5	8/0	8/0	8/0	8/0	8/0	8/0	8/1	20
Date		060612	060712	060812	060912	061012	061112	061212	
Initials		CRB	VF	CRB	LMG	CRB	VF	CRB	

CHRONIC TEST DATA SHEET
Pimephales promelas

Project: CWL (Jonesboro) Beginning Date: 060512 Time: 1055 Test Species: *P. promelas*
 Dilution H₂O: MH 8/65 Ending Date: 061212 Time: 1100 Age: 424h

Test Type: (*)Static Renewal () Flowthrough Toxicant/Effluent: _____

Conc.	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Pan #
75%	1	8/0	8/0	8/0	8/0	8/0	8/0	8/0	21
	2	8/0	8/0	8/0	8/0	8/0	8/0	8/0	22
	3	8/1	8/1	7/0	7/0	7/0	7/0	7/1	23
	4	8/0	8/0	8/0	8/0	8/0	8/0	8/0	24
	5	8/0	8/0	8/0	8/0	8/0	8/0	8/0	25
100%	1	8/0	8/0	8/0	8/0	8/0	8/0	8/1	26
	2	8/0	8/0	8/0	8/0	8/0	8/0	8/0	27
	3	8/0	8/0	8/1	7/0	7/0	7/0	7/0 ^{COB}	28
	4	8/0	8/0	8/1	7/0	7/0	7/0	7/0	29
	5	8/0	8/2	6/0	6/0	6/0	6/0	6/0	30
Date		060612	060712	060812	060912	061012	061112	061212	
Initials		CARB		CARB	LM4	CARB	HP	CARB	

Ceriodaphnia Survival and Reproduction Test-7 Day Survival

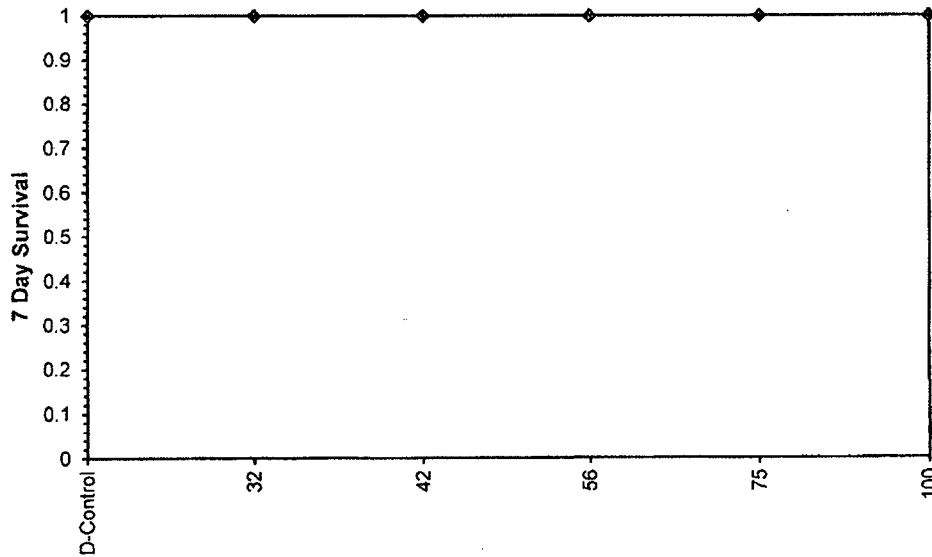
Start Date: 6/5/2012 10:00	Test ID: Jun-12	Sample ID: NPDES Permit #AR0043401
End Date: 6/12/2012 10:45	Lab ID: ASU ERF	Sample Type: EFF1-POTW
Sample Date: 6/4/2012	Protocol: EPAF 02-EPA Freshwater	Test Species: CD-Ceriodaphnia dubia
Comments: 2nd Quarter WET Testing		

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
32	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
42	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
75	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
D-Control	1.0000	1.0000	0	10	10	10		
32	1.0000	1.0000	0	10	10	10	1.0000	0.0500
42	1.0000	1.0000	0	10	10	10	1.0000	0.0500
56	1.0000	1.0000	0	10	10	10	1.0000	0.0500
75	1.0000	1.0000	0	10	10	10	1.0000	0.0500
100	1.0000	1.0000	0	10	10	10	1.0000	0.0500

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Fisher's Exact Test	100	>100		1

Dose-Response Plot



Ceriodaphnia Survival and Reproduction Test-Reproduction

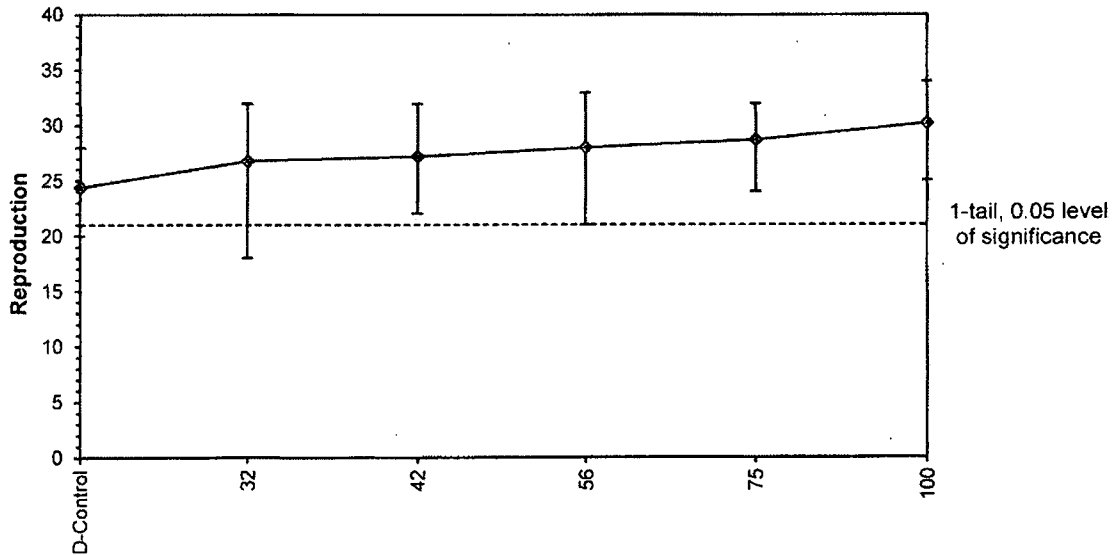
Start Date: 6/5/2012 10:00	Test ID: Jun-12	Sample ID: NPDES Permit #AR0043401
End Date: 6/12/2012 10:45	Lab ID: ASU ERF	Sample Type: EFF1-POTW
Sample Date: 6/4/2012	Protocol: EPAF 02-EPA Freshwater	Test Species: CD-Ceriodaphnia dubia
Comments: 2nd Quarter WET Testing		

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	26.000	27.000	26.000	20.000	21.000	24.000	24.000	26.000	28.000	22.000
32	26.000	28.000	29.000	18.000	25.000	31.000	22.000	29.000	28.000	32.000
42	24.000	26.000	22.000	28.000	30.000	26.000	27.000	27.000	30.000	32.000
56	32.000	33.000	32.000	21.000	28.000	28.000	23.000	26.000	26.000	31.000
75	24.000	30.000	29.000	28.000	29.000	27.000	30.000	29.000	29.000	32.000
100	34.000	32.000	27.000	34.000	34.000	25.000	29.000	29.000	27.000	31.000

Conc-%	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%					
D-Control	24.400	1.0000	24.400	20.000	28.000	10.963	10				
32	26.800	1.0984	26.800	18.000	32.000	15.811	10	-1.622	2.287	3.384	
42	27.200	1.1148	27.200	22.000	32.000	10.934	10	-1.892	2.287	3.384	
56	28.000	1.1475	28.000	21.000	33.000	14.483	10	-2.433	2.287	3.384	
75	28.700	1.1762	28.700	24.000	32.000	7.355	10	-2.906	2.287	3.384	
100	30.200	1.2377	30.200	25.000	34.000	10.904	10	-3.919	2.287	3.384	

Auxiliary Tests		Statistic	Critical	Skew	Kurt						
Kolmogorov D Test indicates normal distribution (p > 0.01)		0.54127	1.035	-0.52721	-0.0988						
Bartlett's Test indicates equal variances (p = 0.35)		5.57893	15.0863								
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test		100	>100		1	3.38396	0.13869	38.31	10.95	0.00822	5, 54

Dose-Response Plot



CHRONIC TEST DATA SHEET

Ceriodaphnia dubia

Project: CWL EAST (Jonesboro) Beginning Date: 060512 Time: 1000 Test Species: C. dubia

Dilution H₂O: MH665 Ending Date: 061212 Time: 1045 Age: < 24h
MH966

Test Type: (*)Static Renewal () Flowthrough Toxicant/Effluent

Conc.	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Neonates
Control	1	0	0	0	5	8	0	13	26
	2	↓	↓	↓	3	0	10	14	27
	3	↓	↓	↓	3	2	9	12	26
	4	↓	↓	↓	4	4	0	12	20
	5	↓	↓	↓	3	0	9	9	21
	6	↓	↓	↓	3	0	8	13	24
	7	↓	↓	↓	4	7	0	13	24
	8	↓	↓	↓	4	0	9	13	26
	9	↓	↓	↓	4	0	11	13	28
	10	↓	↓	↓	3	6	0	13	22
32%	1	0	0	0	4	0	9	13	26
	2	↓	↓	↓	6	0	9	13	28
	3	↓	↓	↓	6	9	0	14	29
	4	↓	↓	↓	5	2	0	11	18
	5	↓	↓	↓	4	6	0	15	26 ^{HF} ₂₅
	6	↓	↓	↓	5	0	11	15	31
	7	↓	↓	↓	3	7	0	12	22
	8	↓	↓	↓	6	10	0	13	29
	9	↓	↓	↓	4	0	11	13	28
	10	↓	↓	↓	6	0	11	15	32
Date		060612	060712	060812	060912	061012	061112	061212	061312
Initials		MG	MG	TJS	P	P	MG	HF	MG

CHRONIC TEST DATA SHEET

Ceriodaphnia dubia

Project: CWL EAST (Jonesboro) Beginning Date: 060512 Time: 1000 Test Species: C. dubia

Dilution H₂O: MH965 Ending Date: 061212 Time: 1045 Age: <24
MH966

Test Type: (*)Static Renewal () Flowthrough Toxicant/Effluent: _____

Conc.	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Neonates
42%	1	0	0	0	4	0	8	12	24
	2	↓	↓	↓	4	10	0	12	26
	3	↓	↓	↓	4	5	0	13	22
	4	↓	↓	↓	4	5	5	14	28
	5	↓	↓	↓	5	10	0	15	30
	6	↓	↓	↓	5	9	0	12	26
	7	↓	↓	↓	6	5	0	16	27
	8	↓	↓	↓	3	0	11	13	27
	9	↓	↓	↓	6	0	10	14	30
	10	↓	↓	↓	6	0	11	15	32
56%	1	0	0	0	5	12	0	15	32
	2	↓	↓	↓	6	10	0	17	33
	3	↓	↓	↓	5	12	0	15	32
	4	↓	↓	↓	3	7	0	11	21
	5	↓	↓	↓	5	0	9	14	28
	6	↓	↓	↓	6	5	0	17	28
	7	↓	↓	↓	5	5	0	13	23
	8	↓	↓	↓	0	0	13	13	26
	9	↓	↓	↓	4	7	0	15	26
	10	↓	↓	↓	6	0	11	14	31
Date		060612	060712	060812	060912	061012	061112	061212	061312
Initials		MG	MG	TB	P	P	MG	HP	MG

CHRONIC TEST DATA SHEET

Ceriodaphnia dubia

Project: CWLEAST (Jonesboro) Beginning Date: 060512 Time: 1000 Test Species: C. dubia

Dilution H₂O: MH065 Ending Date: 061212 Time: 1045 Age: <24h
MH064

Test Type: (*)Static Renewal () Flowthrough Toxicant/Effluent: _____

Conc.	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Neonates
75%	1	0	0	0	2	9	0	13	24
	2	↓	↓	↓	5	9	0	16	30
	3	↓	↓	↓	4	0	11	14	29
	4	↓	↓	↓	3	0 + 2p	11	14	28
	5	↓	↓	↓	6	10	0	13	29
	6	↓	↓	↓	4	10	0	13	27
	7	↓	↓	↓	3	0	12	15	30
	8	↓	↓	↓	3	11	0	15	29
	9	↓	↓	↓	5	0	10	14	29
	10	↓	↓	↓	6	0	11	15	32
100%	1	0	0	0	7	10	0	17	34
	2	↓	↓	↓	7	9	0	15 + 1p	32
	3	↓	↓	↓	4	8	0	18 + 1p	27
	4	↓	↓	↓	6	9	1	20 + 1p	34
	5	↓	↓	↓	3	0	11	15 + 1p	34
	6	↓	↓	↓	4	10	0	11	25
	7	↓	↓	↓	5	8	0	16	29
	8	↓	↓	↓	5	11	0	13	29
	9	↓	↓	↓	6	9	12	0	27
	10	↓	↓	↓	7	8	0	16	31
Date		060612	060712	060812	060912	061012	061112	061212	061312
Initials		MG	MG	TB	J	J	MG	HF	MG

Initial Water Chemistry for Chronic Tests
Project: CWL EAST (Jonesboro) - *C.dubia*/*P. promelas*

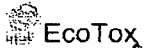
Test Day:	0	1	2	3	4	5	6	
Date:	6/5/12	06.06.12	06.07.12	06.08.12	06.09.12	06.10.12	06.11.12	
H ₂ O Batch #:	MH865	MH866	MH866	MH866	MH866	MH866	MH866	
Temp. (°C)	Control	23.7	23.0	24.0	23.5	24.0	23.8	24.2
	32%	23.7	23.0	24.0	23.5	24.0	23.8	24.5
	42%	23.9	23.1	24.0	23.7	24.0	23.9	24.5
	56%	23.9	23.1	24.0	23.9	24.1	23.9	25.0
	75%	23.9	23.0	24.0	23.9	24.1	24.0	25.0
	100%	23.9	23.0	24.0	24.0	24.1	24.0	25.0
pH	Control	7.88	7.77	7.83	7.88	7.86	7.85	7.71
	32%	7.70	7.70	7.85	7.73	7.80	7.96	7.71
	42%	7.68	7.73	7.89	7.72	7.79	7.89	7.74
	56%	7.63	7.73	7.92	7.69	7.76	7.89	7.73
	75%	7.57	7.95	7.76	7.73	7.75	7.90	7.78
	100%	7.50	7.90	7.78	7.79	7.68	7.94	7.79
DO (mg/L)	Control	7.5	8.0	8.4	7.8	7.7	7.9	7.6
	32%	7.4	8.6	7.6	8.1	8.1	7.7	7.9
	42%	7.0	8.6	7.7	8.1	7.7	7.8	7.8
	56%	7.0	8.7	7.7	8.1	7.7	7.5	8.0
	75%	7.4	8.1	7.9	8.0	7.9	7.4	7.8
	100%	7.5	8.1	7.7	7.9	7.9	7.2	7.9
Cond. (µS/cm)	Control	319	321	320	320	318	319	325
	32%	453	439	428	420	438	447	447
	42%	492	486	460	464	476	479	484
	56%	557	546	517	514	533	532	537
	75%	635	624	594	585	612	610	613
	100%	743	731	690	678	726	716	708
Alk. (mg/L)	Control	60		64		64		
	100%	134		120		120		
Hard. (mg/L)	Control	90		90		90		
	100%	110		100		100		
Initials		JMB HF	MG	TB JB	JP	JP	LMG	

Final Water Chemistry for Chronic Tests
Project: CWL EAST (Jonesboro) - *P. promelas*

Test Day:		1	2	3	4	5	6	7
Date:		060612	060712	060812	060912	061012	061112	061212
H ₂ O Batch #:		MA865	MA866	MA866	MA866	MA866	MA866	MA866
Temp. (°C)	Control	24.0	23.0	23.0	24.0	24.0	24.5	23.2
	32%	24.0	23.0	23.5	24.0	24.0	24.8	23.3
	42%	24.0	23.0	23.9	24.0	24.0	24.9	23.2
	56%	24.0	23.5	24.0	24.0	24.1	24.9	23.2
	75%	24.0	23.5	24.0	24.0	24.1	24.9	23.2
	100%	24.0	24.0	24.0	24.0	24.1	24.9	23.2
pH	Control	7.19	7.50	7.39	7.38	7.30	7.35	7.18
	32%	7.35	7.61	7.58	7.53	7.45	7.54	7.40
	42%	7.43	7.68	7.64	7.57	7.61	7.60	7.49
	56%	7.50	7.75	7.70	7.64	7.60	7.61	7.56
	75%	7.54	7.78	7.74	7.74	7.69	7.68	7.64
	100%	7.60	7.85	7.79	7.80	7.73	7.83	7.70
DO (mg/L)	Control	8.8	6.9	7.3	6.8	6.7	6.3	5.7
	32%	8.7	6.8	7.1	7.0	6.0	6.1	5.8
	42%	8.7	6.8	7.2	6.6	6.8	6.1	5.6
	56%	8.7	7.0	7.2	6.3	6.7	6.2	5.5
	75%	8.7	6.6	7.0	6.7	6.5	6.2	5.1
	100%	8.7	6.6	6.6	6.5	6.4	6.3	5.5
Initials		MR	MR	MR/ARB	TB	ARB	MR/TB	ARB

Final Water Chemistry for Chronic Tests
Project: CWL EAST (Jonesboro) - *C. dubia*

Test Day:	1	2	3	4	5	6	7	
Date:	060612	060712	060812	060912	061012	061112	062112	
H ₂ O Batch #:	MH865	MH866	MH866	MH866	MH866	MH866	MH866	
Temp. (°C)	Control	23.0	24.0	24.2	24.5	24.0	24.9	24.7
	32%	23.0	24.0	24.0	24.6	24.0	25.0	24.5
	42%	22.9	24.0	24.0	24.6	24.0	25.0	23.9
	56%	23.0	24.0	24.0	24.5	24.0	25.0	23.8
	75%	22.9	24.0	24.0	24.6	24.0	25.0	24.2
	100%	23.0	24.0	24.0	24.6	24.0	25.0	24.6
pH	Control	7.74	7.93	7.68	8.02	8.00	7.82	7.84
	32%	7.94	8.05	7.82	8.01	8.10	7.79	7.82
	42%	8.05	8.21	7.88	8.05	8.19	8.11	8.08
	56%	8.04	8.12	7.94	8.09	8.18	8.13	8.02
	75%	8.20	8.30	8.06	8.18	8.28	8.17	8.11
	100%	8.18	8.23	8.07	8.12	8.24	8.20	8.05
DO (mg/L)	Control	8.1	7.5	7.7	8.1	8.3	7.6	7.4
	32%	8.3	7.7	7.9	8.2	8.3	8.3	7.5
	42%	8.1	7.5	8.5	8.2	8.3	8.1	7.6
	56%	8.2	7.7	8.5	8.3	8.0	7.1	7.8
	75%	8.8	7.7	8.0	8.5	7.2	7.9	7.4
	100%	8.3	8.3	8.0	8.1	8.1	7.9	7.5
Initials	MG	MG	JB	J	J/IF	MG/JB	IF	



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Arkansas State University

2645 Caddo Drive

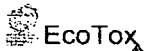
State University, AR 72467

(870) 972-2570 Fax (870) 972-2577

CHAIN OF CUSTODY RECORD



Client Name Jonesboro City Water & Light			Phone: 870-930-3389			Analyses (List Below)						
			Fax: 870-931-9846									
Project #			PO #:			Chronic C. dubia	Chronic P. promelas					
Sampler (sign) <i>[Signature]</i>			Remarks: TRC = 40.1									
			Contact: Myra Taylor									
Cont.#	Sample ID Number	Location		Sample Date	Sample Time	Sample Type		Matrix				
						Comp	Grab	Aqueous	Soil	Other		
1	Effluent	EAST	Plant	6/3-4/12	10:00 - 9:00am	X		X			X	X
Ice Present at Delivery <u>Yes</u> <u>No</u> <i>[Signature]</i> Initials												
Temp: East <u>5.5</u> C West <u>—</u> C <i>[Signature]</i> Initials												
1. Relinquished By (sign) <i>[Signature]</i>			Date	Time	1. Received By (sign) <i>[Signature]</i>			Date	Time			
			6/4/12	11:13 A				6/4/12	11:13			
2. Relinquished By (sign)			Date	Time	2. Received By (sign)			Date	Time			



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Arkansas State University

2645 Caddo Drive

State University, AR 72467

(870) 972-2570 Fax (870) 972-2577

CHAIN OF CUSTODY RECORD



Client Name			Phone: 870-930-3389				Analyses (List Below)						
Jonesboro City Water & Light			Fax: 870-931-9846										
Project #			PO #:				Chronic C. dubia	Chronic P. promelas					
Sampler (sign)			Remarks: TRC = 0.03										
Contact: Myra Taylor													
Cont.#	Sample ID Number	Location	Sample Date	Sample Time	Sample Type		Matrix						
					Comp	Grab	Aqueous	Soil	Other				
1	EFFLUENT	EAST PLANT	6/5-6/12	9:00am	24HR					X	X		
Ice Present at Delivery			<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No MG Initials										
Temp: East 8.5 C West C			MG Initials										
1. Relinquished By (sign)			Date	Time	1. Received By (sign)			Date	Time				
			6/6/12	11:17				06/06/12	11:16				
2. Relinquished By (sign)			Date	Time	2. Received By (sign)			Date	Time				

See other form



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 Arkansas State University
 2645 Caddo Drive
 State University, AR 72467
 (870) 972-2570 Fax (870) 972-2577

CHAIN OF CUSTODY RECORD



Client Name Jonesboro City Water & Light			Phone: 870-930-3389			Analyses (List Below)							
			Fax: 870-931-9846										
Project # <i>Bio-monitoring - Chronic</i>			PO #:			Chronic <i>C. dubia</i>	Chronic <i>P. promelas</i>						
Sampler (sign) <i>R. Stephenson</i>			Remarks: Contact: Myra Taylor										
Cont.#	Sample ID Number	Location	Sample Date	Sample Time	Sample Type		Matrix						
					Comp	Grab	Aqueous	Soil	Other				
	<i>East Effluent</i>		<i>6/7-8/12</i>		<i>2hr</i>		<i>X</i>			<i>X</i>	<i>X</i>		
Ice Present at Delivery <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <i>W</i> Initials													
Temp: East <i>82</i> C West <i>C</i> Initials													
1. Relinquished By (sign)			Date	Time	1. Received By (sign) <i>Racy Woodhull</i>			Date	Time				
2. Relinquished By (sign)			Date	Time	2. Received By (sign) <i>[Signature]</i>			Date <i>6/8/12</i>	Time <i>11:2</i>				



CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: CITY WATER & Light			PO No.		No of BOTTLES	Analyses Requested												AIC Control No:						
Project Reference: BIOMONITORING - CHRONIC			Sample Matrix			WATER	SOIL	3	X	X									AIC Proposal No:					
Project Manager: MYRA TAYLOR																								
Sampled By: R. STEPHENSON			G	C															Received Temperature °C 8°C					
AIC No.	Sample Identification	Date/Time Collected	R	O	A	S													Remarks					
	EAST EFFLUENT	6/7-8/12																	TRC = 0.02					
																			Field pH calibration on _____ @ _____					
																			Buffer:					
G = Glass P = Plastic			V = VOA vials			H = HCl to pH2			T = Sodium Thiosulfate															
NO = none S = Sulfuric acid pH2			N = Nitric acid pH2			B = NaOH to pH12			Z = Zinc acetate															
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN _____ DAYS					Relinquished By: <i>[Signature]</i>					Date/Time: 060812 1112					Received By: <i>[Signature]</i>					Date/Time: 060812 1112				
Expedited results requested by: _____					Relinquished By: _____					Date/Time: _____					Received in Lab By: _____					Date/Time: _____				
Who should AIC contact with questions: _____					Comments: 8°C ice present																			
Phone: _____ Fax: _____																								
Report Attention to: _____																								
Report Address to: _____																								



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SAMPLE CHECK IN

2012-19A

Sample ID Number: CWL-E 1

Fill out this information with each effluent or river water sample coming in for testing. Keep completed sheets with test data and file with the lab QA/QC officer.

Date: 6/4/12 Sampling Date: 6/4/12 Arrival Time: 1113

Field Identification Number: _____ Description: POTW effluent

Shipped by: Federal Express _____ UPS _____ Hand delivered by: CWL personal

Drop-Off Location: ASU-ERF

Storage While Shipped: cooler w/ ice

Analysis Requested: Chemical debris / P sample

Initial Water Chemistry Analysis:

Sample Received by: JP

Temperature (°C): 5.5 Ice Present upon delivery: YES NO

Date: 6/4/12

Quality Assurance	Initial	Date	Yes	No
Chain of Custody	<u>JP</u>	<u>6/4/12</u>	<u>JP</u>	
Refrigerated at 4°C	<u>JP</u>	<u>6/4/12</u>	<u>JP</u>	
Field Record Received	<u>JP</u>	<u>6/4/12</u>	<u>JP</u>	<u>JP</u>
Sample Label Affixed Properly	<u>JP</u>	<u>6/4/12</u>	<u>JP</u>	
Project Leader Informed	<u>JP</u>	<u>6/4/12</u>	<u>JP</u>	

Comments: _____



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SAMPLE CHECK IN

Sample ID Number: 2012-19B

Fill out this information with each effluent or river water sample coming in for testing. Keep completed sheets with test data and file with the lab QA/QC officer.

Date: 06/06/12 Sampling Date: 06/5-6/12 Arrival Time: 1116

Field Identification Number: _____ Description: effluent

Shipped by: Federal Express _____ UPS _____ Hand delivered by: CWL personnel

Drop-Off Location: ASU-ERF

Storage While Shipped: cooler w/ice

Analysis Requested: chronic Cd, Cu, Pb + P. promelas

Initial Water Chemistry Analysis:

Sample Received by: LMG

Temperature (°C): 8.5 Ice Present upon delivery: YES NO

Date: 06/06/12

Quality Assurance	Initial	Date	Yes	No
Chain of Custody	<u>LMG</u>	<u>06/06/12</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Refrigerated at 4°C	↓	↓	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Field Record Received	↓	↓	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sample Label Affixed Properly	↓	↓	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Project Leader Informed	↓	↓	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments: _____



Ecotoxicology Research Facility

SAMPLE CHECK IN

Sample ID Number: 2012-19C

Fill out this information with each effluent or river water sample coming in for testing. Keep completed sheets with test data and file with the lab QA/QC officer.

Date: 060812 Sampling Date: 06/7-8/12 Arrival Time: 1112

Field Identification Number: _____ Description: effluent

Shipped by: Federal Express _____ UPS _____ Hand delivered by: CWL personnel

Drop-Off Location: ASU-ERF

Storage While Shipped: cool w/ice

Analysis Requested: chronic Cebra + P. promelas

Initial Water Chemistry Analysis:

Sample Received by: TW

Temperature (°C): 8.0°C Ice Present upon delivery: YES NO

Date: 060812

Quality Assurance	Initial	Date	Yes	No
Chain of Custody	TW	060812	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Refrigerated at 4°C	↓	↓	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Field Record Received	↓	↓	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sample Label Affixed Properly	↓	↓	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Project Leader Informed	↓	↓	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments: _____

June 21, 2012

Test Results of
Second Quarter
Chronic 7-Day Renewal
Biomonitoring Testing
for
East Effluent
Jonesboro, AR

Control No. 158253-1

Prepared for:

Ms. Myra Taylor
City Water & Light of Jonesboro
Post Office Box 1289
Jonesboro, AR 72403-1289

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

City Water & Light of Jonesboro
ATTN: Ms. Myra Taylor
Post Office Box 1289
Jonesboro, AR 72403-1289

Re: Chronic 7-Day Renewal utilizing *Pimephales promelas* (Fathead minnow) and *Ceriodaphnia dubia*
East Effluent - Jonesboro, AR
NPDES Permit No. AR0043401 AFIN16-00936

Dear Ms. Myra Taylor:

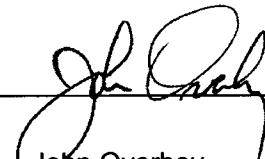
This report is the analytical results and supporting information for the samples submitted to American Interplex Corporation (AIC). The following results are applicable only to the sample identified by the control number referenced above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the laboratory director or qualified designee.

Testing procedures and Quality Assurance were in accordance with "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" EPA-821-R-02-013, Fourth Edition, October 2002. Test results are summarized below:

Method 1000.0 Chronic *Pimephales promelas* (Fathead minnow) Survival and Growth Test: The No Observable Effects Concentration (NOEC) for survival occurred at 100 % effluent, which is equal to the critical dilution of 100 %. Any statistical difference with sublethal effects cannot be considered toxic due to the minimum significant difference (PMSD) calculated result being below the lower PMSD bounds. **The sample, therefore PASSED both lethal and sub-lethal effects for the Fathead minnow test.**

Method 1002.0 Chronic *Ceriodaphnia dubia* Survival and Reproduction Test: Statistically significant differences were noted for reproduction at 42%, 56%, and 75% effluent. However, no statistically significant difference was noted at 100% effluent. This interrupted dose-response for reproduction was reviewed with Ms. Barnett at ADEQ. This review concluded the test to be invalid and an additional test needs to be conducted. The data is enclosed for your review.

AMERICAN INTERPLEX CORPORATION


John Overbey
Laboratory Director

PDF cc: City Water & Light of Jonesboro
ATTN: Ms. Myra Taylor
mtaylor@jonesborocwl.org

City Water & Light of Jonesboro
ATTN: Mr. Adam Saulsbury
asaulsbury@jonesborocwl.org

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

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 - III. Data Analysis
 - IV. Standard Reference Toxicants
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 - VII. Results Summary
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 - Ceriodaphnia dubia*
- Appendix A: Raw Data
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 - Pimephales promelas* (Fathead minnow) Survival and Growth
 - Test 1002.0
 - Ceriodaphnia dubia* Survival and Reproduction
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 - A3: Water Chemistry
 - A4: Reference Toxicant
- Appendix B: Chains of Custody

I. Control Acceptance Criteria

Pimephales promelas (Fathead minnow) Method 1000.0

CRITERIA	RESULTS	PASS/FAIL
Control Survival > or = 80%	100	PASS
Control Growth > or = 0.25 mg per Surviving minnow	0.594	PASS
Control Growth CV < or = 40%	7.76	PASS
Growth Minimum Significant Difference 12 to 30%	11.3	BELOW
Critical Dilution CV < or = 40%	1.27	PASS

Ceriodaphnia dubia Method 1002.0

CRITERIA	RESULTS	PASS/FAIL
Control Survival > or = 80%	100	PASS
Control Reproduction > or = 15 per Surviving Female	21.7	PASS
Control CV < or = 40% per Surviving Female	12.1	PASS
Reproduction Minimum Significant Difference 13 to 47%	15.8	PASS
Critical Dilution CV < or = 40%	9.16	PASS

II. Outlined Report

A. Introduction

1. Permit Number: AR0043401 AFIN16-00936
2. Test Requirements: Test Methods 1000.0 and 1002.0
3. Receiving Stream:

B. Source of Effluent/Dilution Water

1. Effluent Samples:
 - a. Sampling Point: East Effluent
 - b. Chemical Data:

Analysis	Sample 1	Sample 2	Sample 3
Dissolved oxygen (mg/l)	7.8	7.4	6.5
pH (standard units)	8.0	8.0	8.3
Alkalinity (mg/l as CaCO ₃)	140	140	140
Hardness (mg/l as CaCO ₃)	110	93	97
Conductivity (umhos/cm)	470	530	440
Residual Chlorine (mg/l)	<0.05	<0.05	<0.05
Ammonia as N (mg/l)	0.60	0.76	0.20

2. Dilution Water Samples: Synthetic Moderate Hard Water #3878

- a. Dates Prepared: May 23 through June 6, 2012
- b. Chemical Data:

Analysis	Sample 1	Sample 2	Sample 3
Dissolved oxygen (mg/l)	7.4	7.7	6.8
pH (standard units)	8.2	7.8	8.2
Alkalinity (mg/l as CaCO ₃)	58	58	58
Hardness (mg/l as CaCO ₃)	84	85	85
Conductivity (umhos/cm)	190	200	200
Residual Chlorine (mg/l)	<0.05	<0.05	<0.05

C. Test Methods

1. Test methods used:

Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013; test Methods 1000.0 and 1002.0, Fathead Minnow Survival and Growth and *Ceriodaphnia dubia* Survival and Reproduction.

2. Endpoint: No Observable Effects Concentration (NOEC)

3. Test Conditions:

Pimephales promelas (Fathead minnow) Survival and Growth Method 1000.0

Date & Time Test Initiated: June 5, 2012 at 1145
Date & Time Test Terminated: June 12, 2012 at 1220
Type & Volume of Test Chamber: 500 ml disposable beaker
Volume of Sample: 250 ml
Number of Organisms per replicate: 8
Number of Replicates per dilution: 5

Ceriodaphnia dubia Survival and Growth Method 1002.0

Date & Time Test Initiated: June 5, 2012 at 1420
Date & Time Test Terminated: June 12, 2012 at 1340
Type & Volume of Test Chamber: 30 ml disposable beaker
Volume of Sample: 15 ml
Number of Organisms per replicate: 1
Number of Replicates per dilution: 10

4. Acclimation of test organisms: Obtained from in-house cultures

5. Test Temperature: 25 +/- 1 degree Celsius

D. Test Organisms

1. Scientific Name

- a. Test 1000.0 *Pimephales promelas*
- b. Test 1002.0 *Ceriodaphnia dubia*

III. Data Analysis

The data was analyzed using American Interplex Corporation's Laboratory Information Management Software based on Toxstat.

Pimephales promelas (Fathead minnow) survival data was transformed using the Arc Sine transformation. Normality and homogeneity of variance were checked using Shapiro-Wilk's. The survival data was then analyzed using Steel's Many-One Rank Test to determine the No Observable Effects Concentration (NOEC).

Fathead minnow growth data was analyzed for normality and homogeneity of variance using Shapiro-Wilk's and Bartlett's test. Steel's Many-One Rank test was used to determine the No Observable Effects Concentration (NOEC) for growth. Dunnett's Test was used to calculate the PMSD.

Ceriodaphnia dubia survival data was analyzed with Fisher's Exact Test. Reproduction data was analyzed using Kolmogorov's Test for Normality and analyzed with Steel's Many-One Rank Test to determine the No Observable Effects Concentration (NOEC) for Reproduction. Dunnett's Test was used to calculate the PMSD.

IV. Standard Reference Toxicants

American Interplex Corporation has an ongoing test organism culturing program. The sensitivity of the offspring is determined by performing a standard reference toxicant test with each effluent test. Sodium chloride in synthetic moderately hard water is used as prescribed in EPA-821-R-02-013.

Pimephales promelas (Fathead minnow)

Chronic reference tests are performed monthly.

A chronic reference test was performed on May 8, 2012 at 1645 to May 15, 2012 at 1505

The results were as follows: (Control No. 157572-2.)

Survival LC-50: 5482.6 mg/l

Growth IC-25: 4443 mg/l

Growth PMSD: 18.7

Ceriodaphnia dubia

Chronic reference tests are performed monthly.

A chronic reference test was performed on May 8, 2012 at 1435 to May 15, 2012 at 1510

The results were as follows: (Control No. 157572-1.)

Survival LC-50: 1673 mg/l

Growth IC-25: 1086 mg/l

Growth PMSD: 31.2

V. Chemical Analysis/Quality Control

Parameter	Method	% Recovery	Relative % Difference
Alkalinity	SM 2320 B	NA	0.00
Hardness	EPA 200.7	103	1.31
pH	SM 4500-H+ B	99.7	0.271
Conductivity	EPA 120.1	101	0.471

VI. Organism History

Pimephales promelas (Fathead minnow)

Date: June 5, 2012

Age: <24 hours

Source: In-house culture

Water Chemistry Record:

Alkalinity: 57-64 mg/l

Hardness: 80-100 mg/l

Temperature: 25 deg.C

Ceriodaphnia dubia

Date: June 5, 2012

Age: <24 hours

Source: In-house culture

Water Chemistry Record:

Alkalinity: 57-64 mg/l

Hardness: 80-100 mg/l

Temperature: 25 deg.C

VII. Results Summary *Pimephales promelas*, Fathead minnow Larval Survival and Growth Test -- Method 1000.0

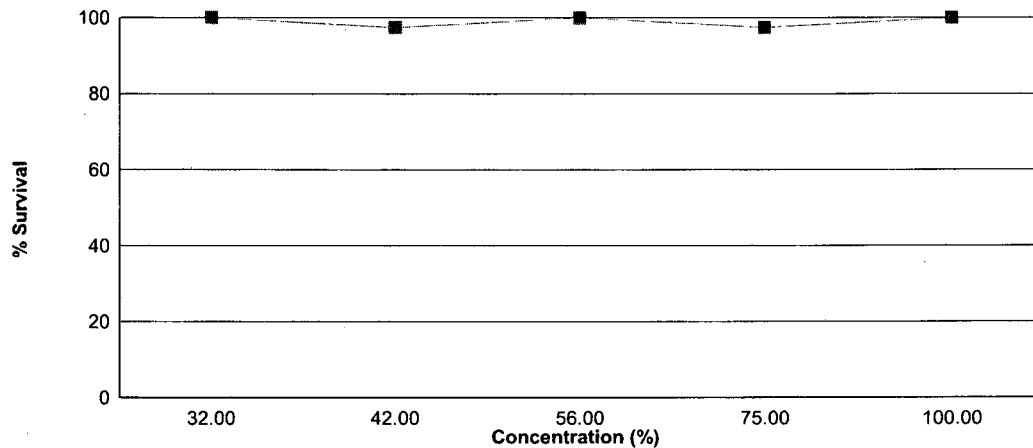
Larvae are exposed in a static renewal system for seven days to different concentrations of effluent with dilution water. Test results are based on the survival and growth (increase in weight) of the larvae.

Effluent dilutions for this test were 32 %, 42 %, 56 %, 75 %, 100 % in accordance with the NPDES permit.

The low flow or 'critical' dilution is specified in the NPDES permit as 100 % effluent.

The test was initiated on June 5, 2012 at 1145 and continued through June 12, 2012 at 1220. Statistical analyses were performed on the observed data and the no observable effects concentrations (NOECs) were as follows:

- a.) NOEC survival = 100 % effluent
- b.) NOEC growth = 100 % effluent



Summary of the 7-day Fathead Minnow Survival and Growth		
Concentration	Percent Survival	Mean Growth (mg)
Control	100	0.594
32 %	100	0.612
42 %	97.5	0.607
56 %	100	0.591
75 %	97.5	0.585
100 %	100	0.600

VII. Results Summary *Ceriodaphnia dubia*, Cladoceran Survival and Reproduction Test -- Method 1002.0

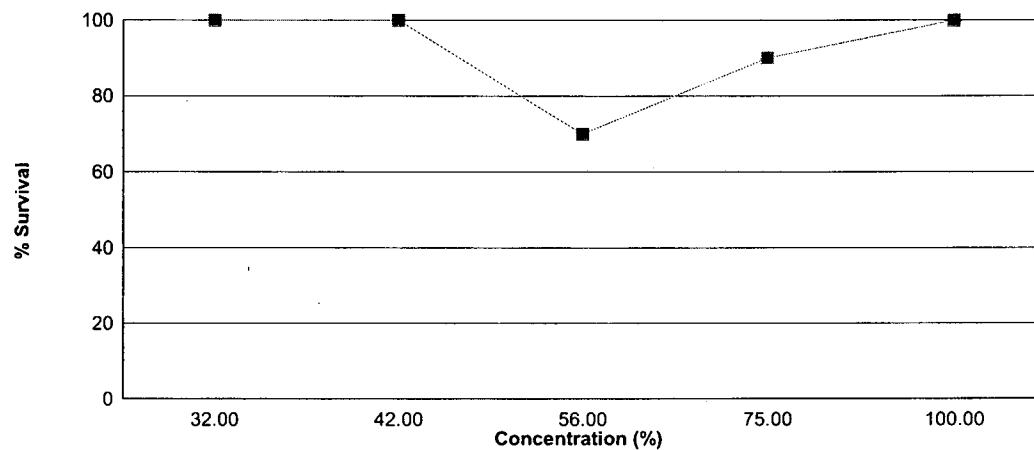
Neonates are exposed in a static renewal system to different concentrations of effluent with dilution water until 60% of surviving control organisms have three broods of offspring with an average of at least 15 young per female.

Effluent dilutions for this test were 32 %, 42 %, 56 %, 75 %, 100 % in accordance with the NPDES permit.

The low flow or 'critical' dilution is specified in the NPDES permit as 100 % effluent.

The test was initiated on June 5, 2012 at 1420 and continued through June 12, 2012 at 1340. Statistical analyses were performed on the observed data and the no observable effects concentrations (NOECs) were as follows:

- a.) NOEC survival = 100 % effluent
- b.) NOEC reproduction = 32 % effluent



Summary of the 7-day <i>Ceriodaphnia dubia</i> Survival and Reproduction Data		
Concentration	Percent Survival	Mean Reproduction
Control	100	21.7
32 %	100	19.8
42 %	100	17.8 *
56 %	70.0	11.6 *
75 %	90.0	15.7 *
100 %	100	19.3

*Significant difference when compared to the control (p=0.05)

Appendix A1: Test 1000.0

Pimephales promelas (Fathead Minnow) 7-Day Survival

Date and Time Test Initiated: June 5, 2012 at 1145
Date and Time Test Terminated: June 12, 2012 at 1220

Concentration	Replicate	Number of Survivors						
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Control	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
32 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
42 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	7	7	7	7
	E	8	8	8	8	8	8	8
56 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
75 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	7	7	7	7	7	7	7
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
100 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8

Appendix A1: Test 1000.0

Pimephales promelas (Fathead Minnow) 7-Day Growth

Test Initiated: June 5, 2012 at 1145
Test Terminated: June 12, 2012 at 1220

Drying Started: June 12, 2012 at 1015
Drying Ended: June 13, 2012 at 1100

Concentration	Replicate	Weight of pan	Weight of pan + fish	Total weight of fish (g)	Original # of fish	Mean dry weight (mg)
Control	A	.91742	.92253	0.00511	8	0.639
	B	.91679	.92111	0.00432	8	0.540
	C	.91662	.92117	0.00455	8	0.569
	D	.91613	.92129	0.00516	8	0.645
	E	.91433	.91894	0.00461	8	0.576
32 %	A	.91499	.91985	0.00486	8	0.608
	B	.91393	.91872	0.00479	8	0.599
	C	.91518	.92007	0.00489	8	0.611
	D	.91388	.91863	0.00475	8	0.594
	E	.91414	.91932	0.00518	8	0.648
42 %	A	.91527	.92005	0.00478	8	0.598
	B	.91512	.91965	0.00453	8	0.566
	C	.91482	.91984	0.00502	8	0.628
	D	.91563	.92039	0.00476	8	0.595
	E	.91561	.92078	0.00517	8	0.646
56 %	A	.91694	.92148	0.00454	8	0.568
	B	.91627	.92103	0.00476	8	0.595
	C	.91623	.92108	0.00485	8	0.606
	D	.91676	.92105	0.00429	8	0.536
	E	.91678	.92196	0.00518	8	0.648
75 %	A	.91958	.92424	0.00466	8	0.582
	B	.91998	.92534	0.00536	8	0.670
	C	.91993	.92361	0.00368	8	0.460
	D	.91937	.92390	0.00453	8	0.566
	E	.91935	.92451	0.00516	8	0.645
100 %	A	.91733	.92220	0.00487	8	0.609
	B	.91737	.92209	0.00472	8	0.590
	C	.91644	.92121	0.00477	8	0.596
	D	.91551	.92032	0.00481	8	0.601
	E	.91504	.91989	0.00485	8	0.606

Appendix A1: Test 1002.0

Ceriodaphnia dubia Survival and Reproduction

Date and Time Test Initiated: June 5, 2012 at 1420
Date and Time Test Terminated: June 12, 2012 at 1340

Concentration: Control														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
3	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
4	4	4	5	2	2	3	4	2	2	0	28	10	2.80	
5	8	7	0	7	8	7	0	8	9	7	61	10	6.10	
6	12	0	8	0	0	0	10	0	1	0	31	10	3.10	
7	0	9	11	9	11	10	10	13	13	11	97	10	9.70	
8														
TOTAL	24	20	24	18	21	20	24	23	25	18	217	10	21.7	

Concentration: 32 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
2	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
3	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
4	1	3	4	2	2	3	5	4	1	4	29	10	2.90	
5	5	6	0	8	5	6	0	8	6	7	51	10	5.10	
6	0	0	8	0	0	0	8	0	0	8	24	10	2.40	
7	11	11	12	8	10	12	9	9	12	0	94	10	9.40	
8														
TOTAL	17	20	24	18	17	21	22	21	19	19	198	10	19.8	

Concentration: 42 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
2	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
3	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
4	2	2	4	2	3	1	0	2	2	0	18	10	1.80	
5	6	6	0	6	7	7	6	8	6	7	59	10	5.90	
6	6	0	10	0	0	0	6	10	0	0	32	10	3.20	
7	0	12	10	8	12	9	0	0	9	9	69	10	6.90	
8														
TOTAL	14	20	24	16	22	17	12	20	17	16	178	10	17.8	

Appendix A1: Test 1002.0

Ceriodaphnia dubia Survival and Reproduction

Date and Time Test Initiated: June 5, 2012 at 1420
Date and Time Test Terminated: June 12, 2012 at 1340

Concentration: 56 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
2	0	0	X	0	0	0	0	0	0	0	0	0	9	0.00
3	0	X	X	0	0	0	0	0	X	0	0	7	0.00	
4	2	X	X	3	1	1	4	3	X	3	17	7	2.43	
5	6	X	X	6	6	4	0	7	X	7	36	7	5.14	
6	9	X	X	0	0	0	5	0	X	9	23	7	3.29	
7	0	X	X	10	9	2	9	10	X	0	40	7	5.71	
8														
TOTAL	17	0	0	19	16	7	18	20	0	19	116	10	11.6	

Concentration: 75 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
2	0	0	0	X	0	0	0	0	0	0	0	9	0.00	
3	0	0	0	X	0	0	0	0	0	0	0	9	0.00	
4	2	3	4	X	3	2	3	2	2	3	24	9	2.67	
5	8	4	0	X	6	7	0	6	8	6	45	9	5.00	
6	8	0	5	X	0	9	5	9	0	9	45	9	5.00	
7	0	11	8	X	12	0	2	11E	10	0	43	9	4.78	
8														
TOTAL	18	18	17	0	21	18	10	17	20	18	157	10	15.7	

E = Excluded fourth brood neonates

Concentration: 100 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
2	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
3	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
4	0	3	4	2	4	4	3	3	2	3	28	10	2.80	
5	7	6	0	6	7	6	0	6	7	5	50	10	5.00	
6	0	0	9	0	0	0	8	0	0	0	17	10	1.70	
7	10	12	10	10	9	9	9	10	9	10	98	10	9.80	
8														
TOTAL	17	21	23	18	20	19	20	19	18	18	193	10	19.3	

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Survival

Transformation of Data			Transform: Arc Sin(Square Root(Y))	
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.39310
1	Control	2	1.00000	1.39310
1	Control	3	1.00000	1.39310
1	Control	4	1.00000	1.39310
1	Control	5	1.00000	1.39310
2	32 %	1	1.00000	1.39310
2	32 %	2	1.00000	1.39310
2	32 %	3	1.00000	1.39310
2	32 %	4	1.00000	1.39310
2	32 %	5	1.00000	1.39310
3	42 %	1	1.00000	1.39310
3	42 %	2	1.00000	1.39310
3	42 %	3	1.00000	1.39310
3	42 %	4	0.87500	1.20940
3	42 %	5	1.00000	1.39310
4	56 %	1	1.00000	1.39310
4	56 %	2	1.00000	1.39310
4	56 %	3	1.00000	1.39310
4	56 %	4	1.00000	1.39310
4	56 %	5	1.00000	1.39310
5	75 %	1	1.00000	1.39310
5	75 %	2	1.00000	1.39310
5	75 %	3	0.87500	1.20940
5	75 %	4	1.00000	1.39310
5	75 %	5	1.00000	1.39310
6	100 %	1	1.00000	1.39310
6	100 %	2	1.00000	1.39310
6	100 %	3	1.00000	1.39310
6	100 %	4	1.00000	1.39310
6	100 %	5	1.00000	1.39310

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Survival

Shapiro - Wilk's Test for Normality		Transform: Arc Sin(Square Root(Y))
<p>D = 0.05399 W = 0.5466 Critical W = 0.9 (alpha = 0.01, N = 30) Critical W = 0.927 (alpha = 0.05, N = 30)</p> <p>Data FAIL normality test (alpha = 0.01).</p>		

Steel's Many-One Rank Test				Transform: Arc Sin(Square Root(Y))	
Ho:Control<Treatment					
Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	32 %	27.50	16.00	5.00	
3	42 %	25.00	16.00	5.00	
4	56 %	27.50	16.00	5.00	
5	75 %	25.00	16.00	5.00	
6	100 %	27.50	16.00	5.00	
Critical values are 1 tailed (k=5)					

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Growth

Shapiro - Wilk's Test for Normality		No Transformation
<p>D = 0.04826 W = 0.9491 Critical W = 0.9 (alpha = 0.01, N = 30) Critical W = 0.927 (alpha = 0.05, N = 30)</p> <p>Data PASS normality test (alpha = 0.01).</p>		

Bartlett's Test for Homogeneity of Variance		No Transformation
<p>Calculated B1 statistic = 16.92 Critical B = 15.086 (alpha = 0.01, df = 5)</p> <p>Data FAIL B1 homogeneity test at 0.01 level.</p>		

Steel's Many-One Rank Test					No Transformation
Ho:Control<Treatment					
Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	32 %	32.00	16.00	5.00	
3	42 %	30.00	16.00	5.00	
4	56 %	27.00	16.00	5.00	
5	75 %	28.50	16.00	5.00	
6	100 %	30.00	16.00	5.00	
Critical values are 1 tailed (k=5)					

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Growth

ANOVA Table				No Transformation	
SOURCE	DF	SS	MS	F	
Between	5	0.002638	0.0005276	0.2624	
Within (Error)	24	0.04826	0.002011		
Total	29	0.0509			
Critical F = 3.9 (alpha = 0.01, df = 5,24)					
2.62 (alpha = 0.05, df = 5,24)					
Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)					

Dunnett's Test - Table 1 of 2					No Transformation
Ho:Control<Treatment					
Group	Identification	Transformed Mean	Mean In Original Units	T Stat	Sig 0.05
1	Control	0.5938	0.5938		
2	32 %	0.612	0.612	-0.6417	
3	42 %	0.6066	0.6066	-0.4513	
4	56 %	0.5906	0.5906	0.1128	
5	75 %	0.5846	0.5846	0.3244	
6	100 %	0.6004	0.6004	-0.2327	
Dunnett's critical value = 2.36 (1 Tailed, alpha = 0.05, df = 5,24)					

Dunnett's Test - Table 2 of 2					No Transformation
Ho:Control<Treatment					
Group	Identification	Num of Reps	Min Sig Diff (In Orig. Units)	% of Control	Difference From Control
1	Control	5			
2	32 %	5	0.06693	11.3	-0.0182
3	42 %	5	0.06693	11.3	-0.0128
4	56 %	5	0.06693	11.3	0.0032
5	75 %	5	0.06693	11.3	0.0092
6	100 %	5	0.06693	11.3	-0.0066

Appendix A2: Statistics

Ceriodaphnia dubia Survival

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
32 %	10	0	10
Total	20	0	20

Critical Fisher's value (10,10,10) (alpha=0.05) is 6. b value is 10. Since b is greater than 6 there is NO SIGNIFICANT DIFFERENCE between CONTROL and TREATMENT at the 0.05 level.

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
42 %	10	0	10
Total	20	0	20

Critical Fisher's value (10,10,10) (alpha=0.05) is 6. b value is 10. Since b is greater than 6 there is NO SIGNIFICANT DIFFERENCE between CONTROL and TREATMENT at the 0.05 level.

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
56 %	7	3	10
Total	17	3	20

Critical Fisher's value (10,10,10) (alpha=0.05) is 6. b value is 7. Since b is greater than 6 there is NO SIGNIFICANT DIFFERENCE between CONTROL and TREATMENT at the 0.05 level.

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
75 %	9	1	10
Total	19	1	20

Critical Fisher's value (10,10,10) (alpha=0.05) is 6. b value is 9. Since b is greater than 6 there is NO SIGNIFICANT DIFFERENCE between CONTROL and TREATMENT at the 0.05 level.

Appendix A2: Statistics

Ceriodaphnia dubia Survival

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
100 %	10	0	10
Total	20	0	20

Critical Fisher's value (10,10,10) (alpha=0.05) is 6. b value is 10. Since b is greater than 6 there is NO SIGNIFICANT DIFFERENCE between CONTROL and TREATMENT at the 0.05 level.

Summary of Fisher's Exact Test				
Group	Identification	Exposed	Dead	Sig 0.05
0	Control	10	0	
1	32 %	10	0	
2	42 %	10	0	
3	56 %	10	3	
4	75 %	10	1	
5	100 %	10	0	

Appendix A2: Statistics

Ceriodaphnia dubia Reproduction

Chi-Square Test for Normality	No Transformation
Chi-Square = 3.7501 Critical Chi-Square = 13.28	(alpha = 0.01, df = 4)
Data PASS normality test (alpha = 0.01).	

Kolmogorov Test for Normality	No Transformation
D = 0.1353 D* = 1.062 Critical D* = 1.035	(alpha = 0.01, N = 60)
Data FAIL normality test (alpha = 0.01).	

Steel's Many-One Rank Test				No Transformation	
Ho:Control<Treatment					
Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	32 %	84.50	75.00	10.00	
3	42 %	73.50	75.00	10.00	*
4	56 %	63.00	75.00	10.00	*
5	75 %	66.50	75.00	10.00	*
6	100 %	78.00	75.00	10.00	

Critical values are 1 tailed (k=5)

Appendix A2: Statistics

Ceriodaphnia dubia Reproduction

Dunnett's Test for PMSD Calculation (excluding deaths if applicable)

ANOVA Table				No Transformation	
SOURCE	DF	SS	MS	F	
Between	5	157.2	31.44	3.482	
Within (Error)	50	451.4	9.028		
Total	55	608.6			

Critical F = 3.41 (alpha = 0.01, df = 5,50)
2.4 (alpha = 0.05, df = 5,50)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

Dunnett's Test - Table 1 of 2					No Transformation
Ho:Control<Treatment					
Group	Identification	Transformed Mean	Mean In Original Units	T Stat	Sig 0.05
1	Control	21.7	21.7		
2	32 %	19.8	19.8	1.414	
3	42 %	17.8	17.8	2.902	*
4	56 %	16.571	16.571	3.464	*
5	75 %	17.444	17.444	3.083	*
6	100 %	19.3	19.3	1.786	

Dunnett's critical value = 2.31 (1 Tailed, alpha = 0.05, df [used] = 5,40) (Actual df = 5,50)
WARNING - Unequal replicate sizes. Critical values assuming equal replicate sizes have been used.

Dunnett's Test - Table 2 of 2					No Transformation
Ho:Control<Treatment					
Group	Identification	Num of Reps	Min Sig Diff (In Orig. Units)	% of Control	Difference From Control
1	Control	10			
2	32 %	10	3.104	14.3	1.9
3	42 %	10	3.104	14.3	3.9
4	56 %	7	3.42	15.8	5.129
5	75 %	9	3.189	14.7	4.256
6	100 %	10	3.104	14.3	2.4

Appendix A3: Water Chemistry

Routine Chemical and Physical Data

Date and Time Test Initiated: June 5, 2012 at 0809
Date and Time Test Terminated: June 12, 2012 at 1340

Effluent Conc.: Control		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.4	7.3	7.7	7.4	6.8	7.2	7.7
	Final *1	7.0	6.5	6.8	6.4	6.8	6.2	7.7
	Final *2	7.7	7.9	7.8	7.3	8.0	7.8	7.9
pH, units	Initial	8.2	8.0	7.8	8.3	8.2	8.4	8.2
	Final *1	7.8	7.6	7.7	7.8	8.0	7.6	7.9
	Final *2	8.3	7.9	8.1	8.4	8.5	8.3	8.1
Alkalinity, mg CaCO ₃ /l		58	NA	58	NA	58	NA	NA
Hardness, mg CaCO ₃ /l		84	NA	85	NA	85	NA	NA
Conductivity, umhos/cm		190	220	200	200	200	200	250
Res. Chlorine, mg/l		<0.05	NA	<0.05	NA	<0.05	NA	NA

Effluent Conc.: 32 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.5	7.7	7.7	7.2	6.6	7.1	7.6
	Final *1	7.0	6.0	6.6	6.2	6.7	5.9	7.7
	Final *2	7.7	7.6	7.5	7.0	7.6	7.8	7.9
pH, units	Initial	8.0	7.8	7.9	8.1	8.1	8.4	8.0
	Final *1	7.8	7.5	7.8	7.8	8.0	7.7	7.8
	Final *2	8.4	8.2	8.3	8.4	8.6	8.5	8.2

Effluent Conc.: 42 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.8	7.4	7.4	7.0	6.5	7.4	7.4
	Final *1	7.0	6.3	6.8	6.2	6.6	6.1	7.2
	Final *2	7.7	7.7	7.3	7.1	7.6	8.0	7.8
pH, units	Initial	8.0	7.8	7.9	8.0	8.2	8.4	8.0
	Final *1	7.8	7.6	7.8	7.8	8.0	7.9	7.8
	Final *2	8.4	8.2	8.3	8.5	8.6	8.5	8.3

Appendix A3: Water Chemistry

Routine Chemical and Physical Data

Date and Time Test Initiated: June 5, 2012 at 0809
Date and Time Test Terminated: June 12, 2012 at 1340

Effluent Conc.: 56 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.7	7.4	7.5	7.2	6.8	7.4	7.6
	Final *1	7.0	6.4	6.7	6.3	6.7	6.2	7.5
	Final *2	7.8	8.0	7.4	7.2	7.8	8.0	7.9
pH, units	Initial	8.0	7.8	8.0	8.0	8.2	8.4	7.9
	Final *1	7.9	7.8	7.8	7.9	8.0	7.9	7.8
	Final *2	8.4	8.3	8.4	8.5	8.6	8.6	8.3

Effluent Conc.: 75 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.6	7.3	7.5	7.1	6.4	7.4	7.5
	Final *1	7.1	6.6	6.6	5.7	7.0	6.7	7.6
	Final *2	7.8	7.7	7.3	7.2	7.9	7.6	7.9
pH, units	Initial	8.0	7.9	8.0	8.0	8.2	8.4	8.0
	Final *1	7.9	7.9	7.9	7.9	8.2	8.1	7.9
	Final *2	8.4	8.4	8.5	8.5	8.6	8.6	8.4

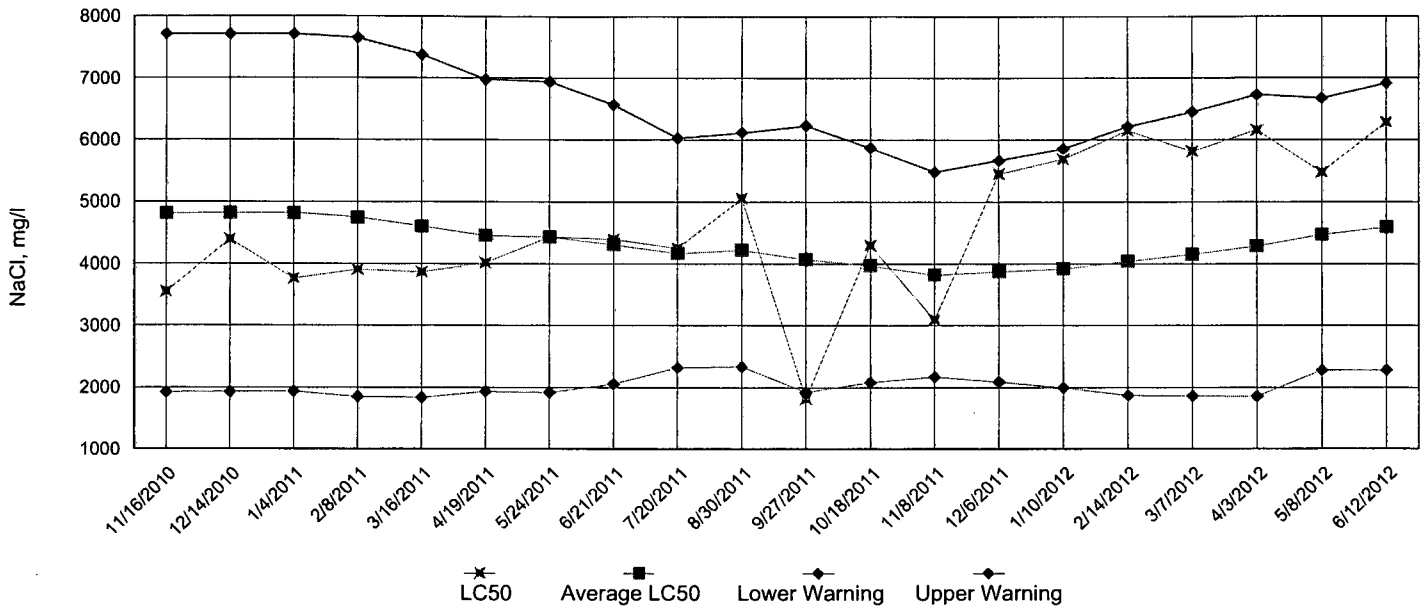
Effluent Conc.: 100 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.8	7.4	7.4	7.1	6.5	7.3	7.3
	Final *1	6.8	6.6	6.8	6.2	6.7	6.1	7.9
	Final *2	7.5	7.7	7.1	7.1	7.7	8.2	7.9
pH, units	Initial	8.0	7.8	8.0	7.9	8.3	8.5	7.8
	Final *1	8.0	8.0	8.1	8.0	8.1	8.0	8.1
	Final *2	8.5	8.5	8.6	8.6	8.7	8.6	8.5
Alkalinity, mg CaCO ₃ /l		140	NA	140	NA	140	NA	NA
Hardness, mg CaCO ₃ /l		110	NA	93	NA	97	NA	NA
Conductivity, umhos/cm		470	550	530	450	440	420	560
Res. Chlorine, mg/l		<0.05	NA	<0.05	NA	<0.05	NA	NA

*1 = data from the *Pimephales promelas* (Fathead Minnow) test *2 = data from the *Ceriodaphnia dubia* test

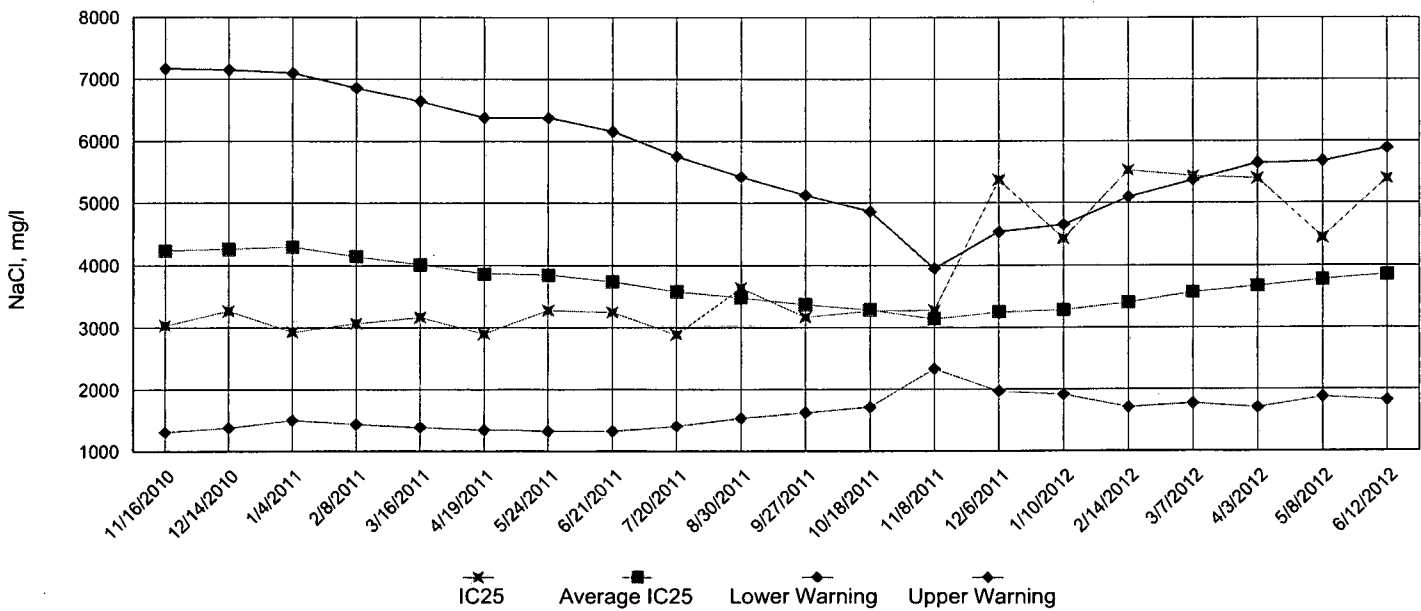
Appendix A4: Test 1000.0

Chronic Reference Toxicant, *Pimephales promelas* (Fathead Minnow)

LC50 Survival Data

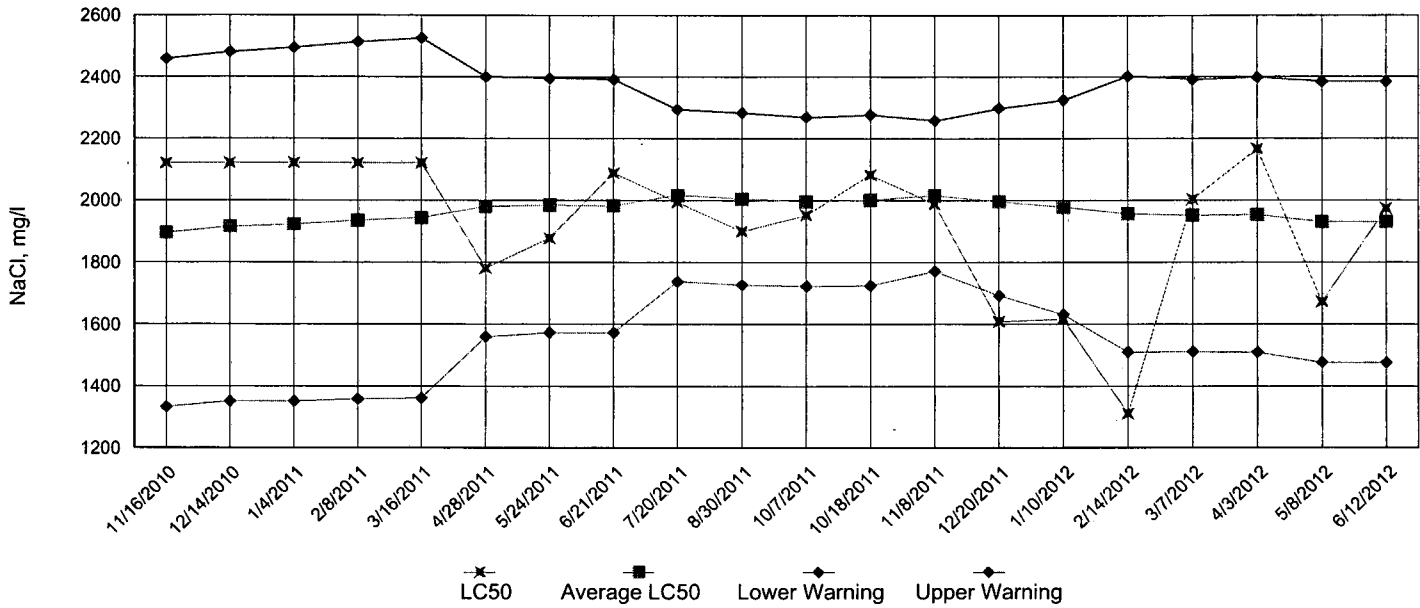


IC25 Growth Data

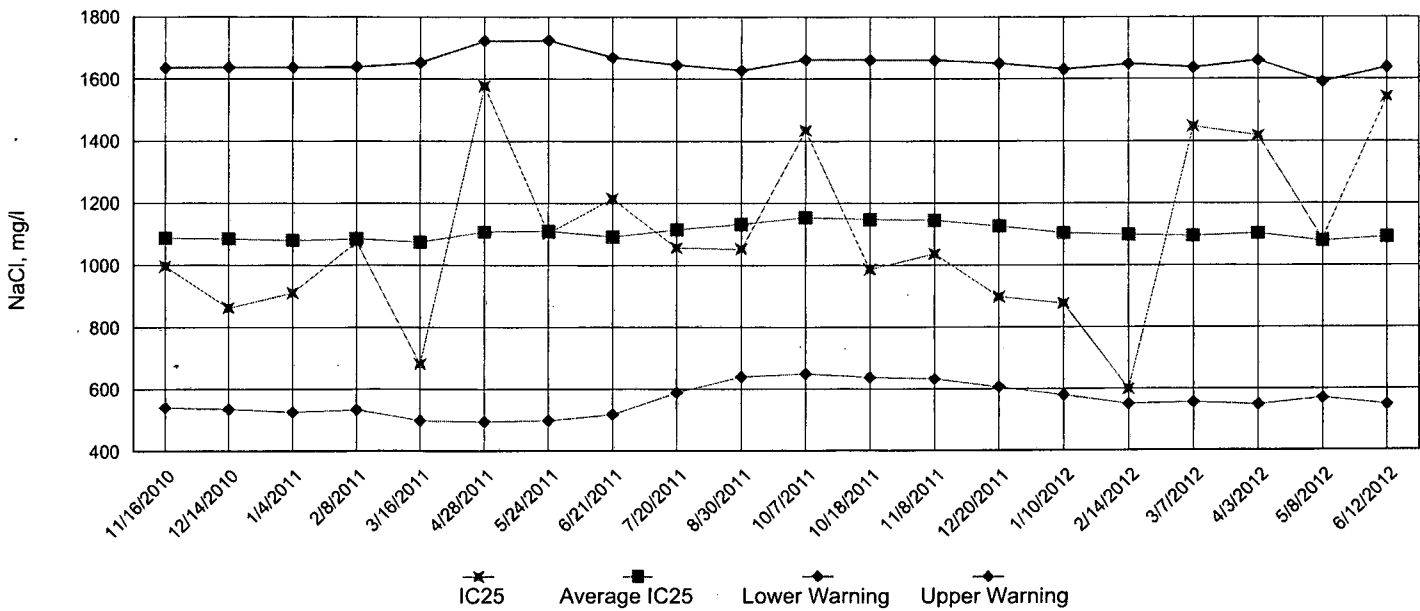


Appendix A4: Test 1002.0
Chronic Reference Toxicant, *Ceriodaphnia dubia*

LC50 Survival Data



IC25 Reproduction Data



Appendix B: Test 1000.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Pimephales promelas (Fathead Minnow)
SURVIVAL AND GROWTH

Permittee: City Water & Light of Jonesboro

NPDES No.: AR0043401 AFIN16-00936

Date and Time Test Initiated: June 5, 2012 at 1145

Date and Time Test Terminated: June 12, 2012 at 1220

Dilution water used: Synthetic Moderate Hard Water #3878

DATA TABLE FOR SURVIVAL

Effluent Conc. %	Percent Survival in replicate chambers					Mean percent survival			CV%
	A	B	C	D	E	24 hr	48 hr	7 days	
Control	100	100	100	100	100	100	100	100	0.00
32 %	100	100	100	100	100	100	100	100	0.00
42 %	100	100	100	87.5	100	100	100	97.5	5.73
56 %	100	100	100	100	100	100	100	100	0.00
75 %	100	100	87.5	100	100	97.5	97.5	97.5	5.73
100 %	100	100	100	100	100	100	100	100	0.00

DATA TABLE FOR GROWTH

Effluent Conc. %	Average dry weight, mg replicate chambers					Mean dry weight, mg	CV%
	A	B	C	D	E		
Control	0.639	0.540	0.569	0.645	0.576	0.594	7.76
32 %	0.608	0.599	0.611	0.594	0.648	0.612	3.47
42 %	0.598	0.566	0.628	0.595	0.646	0.607	5.13
56 %	0.568	0.595	0.606	0.536	0.648	0.591	7.10
75 %	0.582	0.670	0.460	0.566	0.645	0.585	14.0
100 %	0.609	0.590	0.596	0.601	0.606	0.6	1.27

CV = Coefficient of variation = standard deviation * 100 / mean

Appendix B: Test 1000.0

SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Pimephales promelas (Fathead Minnow)
SURVIVAL AND GROWTH

1. Steel's Many-One Rank Test:

Is the mean survival significantly different ($p=0.05$) than the control survival for the % effluent corresponding to (lethality):

a.) LOW FLOW OR CRITICAL DILUTION	(100 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

2. Steel's Many-One Rank Test:

Is the mean dry weight (growth) significantly different ($p=0.05$) than the control's dry weight (growth) for the % effluent corresponding to (significant non-lethal effects):

a.) LOW FLOW OR CRITICAL DILUTION	(100 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

3. If you answered NO to 1.a) enter [0] otherwise enter [1]: 0 (TLP6C)

4. If you answered NO to 2.a) enter [0] otherwise enter [1]: 0 (TGP6C)

5. NOEC *Pimephales* Lethality: 100 % (TOP6C)

6. LOEC *Pimephales* Lethality: 100 % (TXP6C)

7. NOEC *Pimephales* Sublethality: 100 % (TPP6C)

8. LOEC *Pimephales* Sublethality: 100 % (TYP6C)

9. Coefficient of variation for *Pimephales* growth: 7.76 (TQP6C)

Appendix B: Test 1000.0

CHRONIC TOXICITY SUMMARY FORM
Pimephales promelas (Fathead minnow)
CHEMICAL PARAMETERS CHART

PERMITTEE: <u>City Water & Light of Jonesboro</u>	SAMPLE No. 1 COLLECTED ending: _____	DATE: <u>June 4, 2012</u>	TIME: <u>0900</u>
NPDES NO.: <u>AR0043401 AFIN16-00936</u>	SAMPLE No. 2 COLLECTED ending: _____	DATE: <u>June 6, 2012</u>	TIME: _____
CONTACT: <u>Ms. Myra Taylor</u>	SAMPLE No. 3 COLLECTED ending: _____	DATE: <u>June 8, 2012</u>	TIME: _____
ANALYST: <u>275, 280, 298, 304</u>	Test Initiated: DATE: <u>June 5, 2012</u>	TIME: <u>1145</u>	
	Test Terminated: DATE: <u>June 12, 2012</u>	TIME: <u>1220</u>	

DILUTION Control	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.4	7.3	7.7	7.4	6.8	7.2	7.7
Final	7.0	6.5	6.8	6.4	6.8	6.2	7.7
pH Initial	8.2	8.0	7.8	8.3	8.2	8.4	8.2
Final	7.8	7.6	7.7	7.8	8.0	7.6	7.9
Alkalinity	58	NA	58	NA	58	NA	NA
Hardness	84	NA	85	NA	85	NA	NA
Conductivity	190	220	200	200	200	200	250
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

DILUTION 32 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.5	7.7	7.7	7.2	6.6	7.1	7.6
Final	7.0	6.0	6.6	6.2	6.7	5.9	7.7
pH Initial	8.0	7.8	7.9	8.1	8.1	8.4	8.0
Final	7.8	7.5	7.8	7.8	8.0	7.7	7.8
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	280	330	310	280	270	270	350
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 42 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.4	7.4	7.0	6.5	7.4	7.4
Final	7.0	6.3	6.8	6.2	6.6	6.1	7.2
pH Initial	8.0	7.8	7.9	8.0	8.2	8.4	8.0
Final	7.8	7.6	7.8	7.8	8.0	7.9	7.8
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	310	360	340	310	300	300	380
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 56 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.7	7.4	7.5	7.2	6.8	7.4	7.6
Final	7.0	6.4	6.7	6.3	6.7	6.2	7.5
pH Initial	8.0	7.8	8.0	8.0	8.2	8.4	7.9
Final	7.9	7.8	7.8	7.9	8.0	7.9	7.8
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	350	410	390	340	340	340	420
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 75 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.6	7.3	7.5	7.1	6.4	7.4	7.5
Final	7.1	6.6	6.6	5.7	7.0	6.7	7.6
pH Initial	8.0	7.9	8.0	8.0	8.2	8.4	8.0
Final	7.9	7.9	7.9	7.9	8.2	8.1	7.9
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	410	480	450	390	380	360	490
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 100 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.4	7.4	7.1	6.5	7.3	7.3
Final	6.8	6.6	6.8	6.2	6.7	6.1	7.9
pH Initial	8.0	7.8	8.0	7.9	8.3	8.5	7.8
Final	8.0	8.0	8.1	8.0	8.1	8.0	8.1
Alkalinity	140	NA	140	NA	140	NA	NA
Hardness	110	NA	93	NA	97	NA	NA
Conductivity	470	550	530	450	440	420	560
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

Appendix B: Test 1002.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Ceriodaphnia dubia
SURVIVAL AND REPRODUCTION

Permittee: City Water & Light of Jonesboro

NPDES No.: AR0043401 AFIN16-00936

Date and Time Test Initiated: June 5, 2012 at 1420

Date and Time Test Terminated: June 12, 2012 at 1340

Dilution water used: Synthetic Moderate Hard Water #3878

PERCENT SURVIVAL

Time of Reading	Control	Percent Effluent				
		32 %	42 %	56 %	75 %	100 %
24 hour	100	100	100	100	100	100
48 hour	100	100	100	90.0	90.0	100
7 day	100	100	100	70.0	90.0	100

NUMBER OF YOUNG PRODUCED PER FEMALE @ 7 DAYS

Replicates	Control	Percent Effluent				
		32 %	42 %	56 %	75 %	100 %
A	24	17	14	17	18	17
B	20	20	20	0	18	21
C	24	24	24	0	17	23
D	18	18	16	19	0	18
E	21	17	22	16	21	20
F	20	21	17	7	18	19
G	24	22	12	18	10	20
H	23	21	20	20	17	19
I	25	19	17	0	20	18
J	18	19	16	19	18	18
Mean per Adult	21.7	19.8	17.8	11.6	15.7	19.3
Mean per Surviving Adult	21.7	19.8	17.8	16.6	17.4	19.3
CV %	12.1	11.4	20.7	26.7	17.7	9.16

CV = Coefficient of variation = standard deviation * 100 / mean
(calculated based on young produced by surviving females)

Appendix B: Test 1002.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Ceriodaphnia dubia
SURVIVAL AND REPRODUCTION

1. Fisher's Exact Test:

Is the mean survival significantly different ($p=0.05$) than the control survival for the % effluent corresponding to (lethality):

a.) LOW FLOW OR CRITICAL DILUTION	(100 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

2. Steel's Many-One Rank Test:

Is the mean number of young produced per female significantly different ($p=0.05$) than the control's number of young per female for the % effluent corresponding to (significant non-lethal effects):

a.) LOW FLOW OR CRITICAL DILUTION	(100 %)	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

3. If you answered NO to 1.a) enter [0] otherwise enter [1]: 0 (TLP3B)

4. If you answered NO to 2.a) enter [0] otherwise enter [1]: 1 (TGP3B)

5. NOEC Ceriodaphnia Lethality: 100 % (TOP3B)

6. LOEC Ceriodaphnia Lethality: 100 % (TXP3B)

7. NOEC Ceriodaphnia Sublethality: 32 % (TPP3B)

8. LOEC Ceriodaphnia Sublethality: 42 % (TYP3B)

9. Coefficient of variation for Ceriodaphnia Reproduction: 12.1 (TQP3B)

Appendix B: Test 1002.0
CHRONIC TOXICITY SUMMARY FORM
Ceriodaphnia dubia
CHEMICAL PARAMETERS CHART

PERMITTEE: City Water & Light of Jonesboro SAMPLE No. 1 COLLECTED ending: DATE: June 4, 2012 TIME: 0900
 NPDES NO.: AR0043401 AFIN16-00936 SAMPLE No. 2 COLLECTED ending: DATE: June 6, 2012 TIME: _____
 CONTACT: Ms. Myra Taylor SAMPLE No. 3 COLLECTED ending: DATE: June 8, 2012 TIME: _____
 ANALYST: 275, 280, 298, 304 Test Initiated: DATE: June 5, 2012 TIME: 1420
 Test Terminated: DATE: June 12, 2012 TIME: 1340

DILUTION Control	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.4	7.3	7.7	7.4	6.8	7.2	7.7
Final	7.7	7.9	7.8	7.3	8.0	7.8	7.9
pH Initial	8.2	8.0	7.8	8.3	8.2	8.4	8.2
Final	8.3	7.9	8.1	8.4	8.5	8.3	8.1
Alkalinity	58	NA	58	NA	58	NA	NA
Hardness	84	NA	85	NA	85	NA	NA
Conductivity	190	220	200	200	200	200	250
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

DILUTION 32 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.5	7.7	7.7	7.2	6.6	7.1	7.6
Final	7.7	7.6	7.5	7.0	7.6	7.8	7.9
pH Initial	8.0	7.8	7.9	8.1	8.1	8.4	8.0
Final	8.4	8.2	8.3	8.4	8.6	8.5	8.2
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	280	330	310	280	270	270	350
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 42 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.4	7.4	7.0	6.5	7.4	7.4
Final	7.7	7.7	7.3	7.1	7.6	8.0	7.8
pH Initial	8.0	7.8	7.9	8.0	8.2	8.4	8.0
Final	8.4	8.2	8.3	8.5	8.6	8.5	8.3
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	310	360	340	310	300	300	380
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 56 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.7	7.4	7.5	7.2	6.8	7.4	7.6
Final	7.8	8.0	7.4	7.2	7.8	8.0	7.9
pH Initial	8.0	7.8	8.0	8.0	8.2	8.4	7.9
Final	8.4	8.3	8.4	8.5	8.6	8.6	8.3
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	350	410	390	340	340	340	420
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 75 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.6	7.3	7.5	7.1	6.4	7.4	7.5
Final	7.8	7.7	7.3	7.2	7.9	7.6	7.9
pH Initial	8.0	7.9	8.0	8.0	8.2	8.4	8.0
Final	8.4	8.4	8.5	8.5	8.6	8.6	8.4
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	410	480	450	390	380	360	490
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 100 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.4	7.4	7.1	6.5	7.3	7.3
Final	7.5	7.7	7.1	7.1	7.7	8.2	7.9
pH Initial	8.0	7.8	8.0	7.9	8.3	8.5	7.8
Final	8.5	8.5	8.6	8.6	8.7	8.6	8.5
Alkalinity	140	NA	140	NA	140	NA	NA
Hardness	110	NA	93	NA	97	NA	NA
Conductivity	470	550	530	450	440	420	560
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

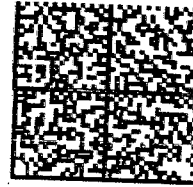
CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: <u>City Water & Light</u>			PO No.		No of BOTTLES	Analyses Requested												AIC Control No: <u>158253</u>					
Project Reference: <u>Biomonitoring - Chronic</u>			Sample Matrix															AIC Proposal No:					
Project Manager: <u>Myra Taylor</u>			WATER SOIL															Carrier:					
Sampled By: <u>R. Stephenson</u>			GRA B	COMP	WATER	SOIL	CD	FH													Received Temperature °C <u>2</u>		
AIC No.	Sample Identification	Date/Time Collected																			Remarks		
<u>3</u>	<u>East EBluent</u>	<u>6/7-8/12</u>		<u>24</u>	<u>X</u>		<u>3</u>	<u>X</u>	<u>X</u>													<u>TRC=0.02</u>	
															<u>Time as: 9:00A</u>								
															Field pH calibration								
															on _____ @ _____								
															Buffer:								
G = Glass NO = none			P = Plastic S = Sulfuric acid pH2			V = VOA vials N = Nitric acid pH2			H = HCl to pH2 B = NaOH to pH12			T = Sodium Thiosulfate Z = Zinc acetate											
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN _____ DAYS					Relinquished By: <u>[Signature]</u>			Date/Time <u>6/8/12 3:40pm</u>			Received By:			Date/Time									
Expedited results requested by: _____					Relinquished By:			Date/Time			Received in Lab By: <u>[Signature]</u>			Date/Time <u>6-8-12 1540</u>									
Who should AIC contact with questions: _____					Comments:																		
Phone: _____ Fax: _____																							
Report Attention to: _____																							
Report Address to: _____																							

City Water & Light
400 East Monroe
P. O. Box 1289
Jonesboro, AR 72403-1289



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