


INTER-OFFICE MEMO

A20021750

TO: Steve Floyd, Superintendent of Water and Wastewater Operations

1ST QTR 15

FROM: Don Clover, Biologist 

DATE: February 19, 2015

RE: Biomonitoring Results - Massard Plant

Please find below the chronic biomonitoring results for the first quarter of 2015. Lethal and sub-lethal toxicity were not experienced in the low-flow dilution of 8% effluent for the *Ceriodaphnia dubia* test organism. The test therefore passes at the low-flow dilution of 8% effluent for lethal and sub-lethal effects. Lethal and sub-lethal toxicity were not experienced in the low-flow dilution of 8% effluent for the fathead minnow (*Pimephales promelas*) test. The test therefore passes at the low-flow dilution of 8% effluent for lethal and sub-lethal effects.

Parameter #TGP3B- 0

Parameter #TGP6C- 0

Parameter #TLP3B- 0

Parameter #TLP6C- 0

Parameter #TOP3B- 11%

Parameter # TOP6C- 11%

Parameter #TPP3B- 11%

Parameter #TPP6C- 11%

Parameter #TQP3B- 15.39%

Parameter #TQP6C- 9.87%

Prepared By: Don Clover Date: 2/19/15

Reviewed By: Jenny Date: 02/23/15



Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

February 11, 2015

Lance McAvoy
City of Fort Smith
3900 Kelley Hwy.
Fort Smith, AR 72904

RE: Project: MASSARD BIOMONTORING
Pace Project No.: 60186956

Dear Lance McAvoy:

Enclosed are the analytical results for sample(s) received by the laboratory on January 27, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Alice Flanagan
alice.flanagan@pacelabs.com
Project Manager

Enclosures

cc: Dan Clover, City of Fort Smith, AR



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CERTIFICATIONS

Project: MASSARD BIOMONTORING

Pace Project No.: 60186956

Southeast Kansas Certification IDs

808 West McKay, Frontenac, KS 66763

Arkansas Certification #: 13-012-0

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Oklahoma Certification #: 2012-051

Texas Certification #: T104704407-13-4

Utah Certification #: KS000212013-3

Minnesota Certification #: 495004

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SAMPLE SUMMARY

Project: MASSARD BIOMONTORING
Pace Project No.: 60186956

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60186956001	MASSARD EFFLUENT	Water	01/26/15 08:00	01/27/15 13:30

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SAMPLE ANALYTE COUNT

Project: MASSARD BIOMONTORING
Pace Project No.: 60186956

Lab ID	Sample ID	Method	Analysts	Analytes Reported
60186956001	MASSARD EFFLUENT	EPA 821/R-02/013	TDH	1

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ANALYTICAL RESULTS

Project: MASSARD BIOMONTORING

Pace Project No.: 60186956

Sample: MASSARD EFFLUENT	Lab ID: 60186956001	Collected: 01/26/15 08:00	Received: 01/27/15 13:30	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Chronic Toxicity	Analytical Method: EPA 821/R-02/013							
Toxicity, Chronic	Complete		1.0	1		01/27/15 14:00		

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QUALIFIERS

Project: MASSARD BIOMONTORING
Pace Project No.: 60186956

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: MASSARD BIOMONTORING
Pace Project No.: 60186956

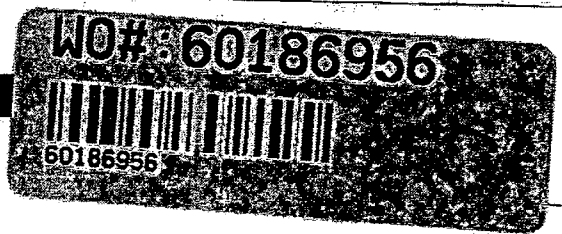
Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60186956001	MASSARD EFFLUENT	EPA 821/R-02/013	BIO/1781		

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Sample Condition Upon Receipt



Client Name: FTSMITH

Courier: Fed Ex UPS USPS Client Commercial Pace Other

Tracking #: _____ Pace Shipping Label Used? Yes No

Custody Seal on Cooler/Box Present: Yes No Seals intact: Yes No

Packing Material: Bubble Wrap Bubble Bags Foam None Other

Thermometer Used: T-243 Type of Ice: Wet Blue None Samples received on ice, cooling process has begun: _____
Cooler Temperature: 2.0 (circle one)

Optional
Proj Due Date:
Proj Name:

Temperature should be above freezing to 6°C Date and initials of person examining contents: 1/27/15 13:30 TK

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	1.
Chain of Custody filled out:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	2.
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	3.
Sampler name & signature on COC:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	5.
Short Hold Time analyses (<72hr):	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	6.
Rush Turn Around Time requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	7.
Sufficient volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	8.
Correct containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	9.
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	9.
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	10.
Unpreserved 5035A soils frozen w/in 48hrs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	11.
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	12.
Sample labels match COC:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Includes date/time/ID/analyses Matrix: <u>WT</u>		13.
All containers needing preservation have been checked.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
All containers needing preservation are found to be in compliance with EPA recommendation.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	14.
Exceptions: VOA, coliform, TOC, O&G, WI-DRO (water), Phenolics	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	initial when completed
Trip Blank present	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Lot # of added preservative
Pace Trip Blank lot # (if purchased):		15.
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
		16.
Project sampled in USDA Regulated Area:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	17. List State:

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager: Review: _____ Date: _____



REFERENCE #60186956

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February 4, 2015

Lance McAvoy
City of Fort Smith (Massard)
3900 Kelley HWY
Fort Smith, AR 72904

Re: Lab Project Number: 60186956
Client Project ID: Wet Test

Dear:

Enclosed are the analytical results for sample(s) received by the laboratory. The results relate only to the samples included in this report. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

If you have any question concerning this report, please feel free to contact me.

Sincerely,

Tim Harrell
Tim.Harrell@pacelabs.com
Technical Director

REPORT OF LABORATORY ANALYSIS

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**CHRONIC TOXICITY TEST FOR
CITY OF FORT SMITH (Massard)**

PERMIT # AR 0021750
AFIN # 66-00226

PERFORMED ON:

Pimephales promelas

and

Ceriodaphnia dubia

PREPARED FOR:

Lance McAvoy
City of Fort Smith (Massard)
3900 Kelley HWY
Fort Smith, AR 72904

PREPARED BY:
Pace Analytical Services, Inc.
808 West McKay
Frontenac, KS 66763
1-620-235-0003

February 4, 2015

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SUMMARY

A Chronic Whole Effluent Toxicity Test using the 7-day chronic fathead minnows (Pimephales promelas), static renewal larval survival and growth test, and three brood 7-day chronic Cladoceran (Ceriodaphnia dubia), static renewal survival and reproduction test, was conducted on effluent discharge water collected at the CITY OF FORT SMITH (Massard) effluent discharge from January 26, 2015 to January 30, 2015. All the test methods followed are as listed in EPA 821-R-02-013, "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms."

Statistically significant ($p < 0.05$) mortality is determined by Dunnet's procedure using average percent survival of each test concentration versus the average survival of the controls. If significant mortality occurs, median lethal concentrations (LC50) are calculated using effluent concentrations and their corresponding percent mortality data. The LC50's and the 95% confidence intervals are calculated where appropriate by the Spearman-Kärber method. Statistical analysis is accomplished by following steps in EPA 821-R-02-013, November 2002 and by use of Toxstat version 3.4.

In minnow section of testing, it was observed that the effluent had no significant effect on the survival of the larvae at the 11% concentration. No significant mortality was observed in the other effluent concentrations after the 7-day exposure period. The No Observed Effect Concentration (NOEC) was determined to be 11% for survival. The LC50 was estimated to be >11% effluent. No significant reduction in growth was observed in the 11% effluent concentration. The Toxic Units is <1. The IC25 is >11. The NOEC for growth in effluent was determined to be 11%. The PMSD is 14.9.

In Cladoceran section of testing, it was observed that the effluent had no significant effect on the survival of the organisms in the 11% effluent concentration. No significant mortality was observed in the other effluent concentrations after the 7-day exposure period. The No Observed Effect Concentration (NOEC) was determined to be 11% for survival. The LC50 was estimated to be >11% effluent. No significant reduction in reproduction was observed in the 11% effluent concentrations. The Toxic Units is <1. The IC25 is >11. The NOEC for reproduction in effluent was determined to be 11%. The PMSD is 17.0.

The chronic toxicity exhibited by the fathead minnows and the Ceriodaphnia treated by the effluent sampled from January 26 to January 30 from the CITY OF FORT SMITH (Massard) effluent discharge, is acceptable as described in EPA 821-R-02-013.

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INTRODUCTION

Pace Analytical was contracted to perform this chronic toxicity test on effluent from the CITY OF FORT SMITH (Massard) effluent discharge. Chronic toxicity was measured using the Pimephales promelas at larval for survival and growth test and the Ceriodaphnia dubia survival and reproduction test described in EPA 821-R-02-013, "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms." The raw data of the study is stored at Pace Analytical Services, INC. 808 West McKay, Frontenac, KS 66763.

TEST MATERIAL

City of Fort Smith (Massard) personnel collected sampling of the effluent. A sample of the effluent was delivered to Pace by commercial carrier on 1-27-15. Subsequent samples followed by delivery on 1-29-15 and on 1-31-15. All samples were stored at $\leq 6^{\circ}$ Celsius. Moderately Hard Synthetic Water was used as a control and also to make the required dilutions in the test as described in EPA 821-R-02-013.

TEST METHODS

Pace used EPA test method 1000.0 for conducting the Fathead Minnow, Pimephales promelas, Larval Survival and Growth Test. EPA test method 1002.0 was used for conducting the Cladoceran, Ceriodaphnia dubia, Survival and Reproduction Test. The tests were conducted to estimate the LC50, NOEC, and LOEC for survival, growth, and reproduction of these test species.

The Pimephales and Ceriodaphnia tests were initiated on 1-27-15 and carried out until 2-3-15. The Pimephales tests were conducted in 500 ml plastic jars with 250 ml of test solution. Eight larvae were placed in each of at least 5 replicates to make a total of 40 larvae per sample concentration. The Ceriodaphnia tests were carried out in 35ml vials containing 25 ml of test solution. One Neonate was placed in each of 10 replicates to make a total of 10 neonates per sample concentration.

TEST ORGANISMS

Organisms used in these tests were cultured at Pace under controlled temperature and photo period conditions and/or were purchased from an external supplier. Pace maintains records of culture techniques for all organisms, whether produced in-house or purchased.

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RESULTS

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Permittee: CITY OF FORT SMITH (Massard) Effluent discharge.

FATHEAD MINNOW SURVIVAL

Conc. %	Percent Survival in Replicate Chambers					Mean Percent Survival			CV %
	A	B	C	D	E	24hr	48hr	7 day	
Control 0%	100	100	100	100	100	100	100	100	0.00
Dilution 1 3%	100	100	100	100	100	100	100	100	0.00
Dilution 2 5%	87.9	100	100	100	100	100	100	97.5	4.79
Dilution 3 6%	100	87.5	100	100	100	100	100	97.5	4.79
Dilution 4 8%	100	100	100	100	87.5	100	100	97.5	4.79
Dilution 5 11%	100	87.5	100	100	100	100	100	97.5	4.79

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Permittee: CITY OF FORT SMITH (Massard) Effluent discharge.

CERIODAPHNIA SURVIVAL AND REPRODUCTION

DATA TABLE FOR CERIODAPHNIA YOUNG PRODUCTION

Replicate	Control 0%	Dilution 1 3%	Dilution 2 5%	Dilution 3 6%	Dilution 3 8%	Dilution 4 11%
1	20	19	22	17	23	14
2	21	24	21	22	21	24
3	21	19	18	25	19	18
4	23	17	23	22	17	20
5	16	23	22	19	15	21
6	21	18	15	25	23	23
7	17	22	23	18	20	25
8	15	24	26	16	24	18
9	22	18	21	20	23	21
10	16	22	19	24	25	26
Mean	19.2	20.6	21.0	20.8	21.0	21.0
SD	2.898	2.675	3.055	3.293	3.232	3.682
CV %	15.10	12.99	14.55	15.83	15.39	17.53

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Permittee: CITY OF FORT SMITH (Massard) Effluent discharge.

CERIODAPHNIA MEAN PERCENT SURVIVAL

Percent Effluent (%)						
Time Elapsed	Control 0%	Dilution 1 3%	Dilution 2 5%	Dilution 3 6%	Dilution 4 8%	Dilution 5 11%
24 hrs	100	100	100	100	100	100
48 hrs	100	100	100	100	100	100
7-day	100	100	100	100	100	100
SD	0.0	0.0	0.0	0.0	0.0	0.0
CV %	0.0	0.0	0.0	0.0	0.0	0.0

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TABLE 2
SUMMARY OF TEST CONDITIONS FOR THE FATHEAD MINNOW
(*Pimephales promelas*) LARVAL SURVIVAL AND GROWTH TEST

1. Test type	Static renewal
2. Temperature	25 degrees Celsius
3. Light quality	Ambient laboratory light
4. Light intensity	Ambient laboratory levels
5. Photoperiod	16 hr light, 8 hr dark
6. Test chamber size	500 ml
7. Test solution volume	250 ml
8. Renewal of test concentrations	Daily
9. Age of test organism	< 24 hours
10. No. larvae/chamber	8
11. No. replicates/concentration	5
12. No. larvae/concentration	40
13. Feeding regime	Feed 0.1 ml newly hatched brine shrimp nauplii three times daily. Larvae are not fed 12 hours prior to termination of test.
15. Cleaning	Siphon daily, immediately before test solution renewal
15. Aeration	None

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TABLE 2 (CONT.)

16. Dilution Water	Moderately Hard Synthetic Water prepared with MILLI-Q deionized water and reagent grade chemicals
17. Effluent concentrations	0%, 3%, 5%, 6%, 8%, 11%
18. Test duration	7 days
19. Endpoints	Survival and growth
20. Test acceptability	80% or greater survival in the controls, Average dry weight in controls >0.25 mg, Coefficient of variation in the control must not exceed 40%.

TABLE 2 (CONT.)

SUMMARY OF TEST CONDITIONS FOR THE CLADOCERAN (*Ceriodaphnia dubia*) SURVIVAL AND REPRODUCTION TEST

1. Test type	Static renewal
2. Temperature	25 degrees Celsius
3. Light quality	Ambient laboratory light
4. Light intensity	Ambient laboratory levels
5. Photoperiod	16 hr light, 8 hr dark
6. Test chamber size	30 ml
7. Test solution volume	25 ml

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TABLE 2 (CONT.)

8. Renewal of test concentrations	Daily
9. Age of test organism	< 24 hours
10. No. larvae/chamber	1
11. No. replicates/concentration	10
12. No. larvae/concentration	10
13. Feeding regime	Feed 0.1 ml YCT three times daily. Larvae are not fed 12 hours prior to termination of test.
15. Cleaning	Siphon daily, immediately before test solution renewal
15. Aeration	None
16. Dilution Water	Moderately Hard Synthetic Water prepared with MILLI-Q deionized water and reagent grade chemicals
17. Effluent concentrations	0%, 3%, 5%, 6%, 8%, 11%
18. Test duration	Until 60% or more surviving control females have three broods or a maximum of 8 days.
19. Endpoints	Survival and Reproduction
20. Test acceptability	80% or greater survival in the controls, Average reproduction rate of 15 young / adult. Coefficient of variation in the control must not exceed 40%.

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TABLE 2 (SECTION 2)

**BIOMONITORING CHRONIC TOXICITY REPORT
 FATHEAD MINNOW (Pimephales promelas)
 CHEMICAL PARAMETERS CHART**

Permittee: CITY OF FORT SMITH (Massard). Effluent discharge.

ANALYSTS: Pace Analytical Services, Inc.
 Timothy Harrell
 Mike Bollin

SAMPLE NO. 1 COLLECTED: DATE: 1-26-15

SAMPLE NO. 2 COLLECTED: DATE: 1-28-15

SAMPLE NO. 3 COLLECTED: DATE: 1-30-15

**TABLE 2 (SECTION 2)
 INITIAL WATER QUALITY
 EFFLUENT CONCENTRATION**

	Control	100%
PH	7.50	7.46
D.O.	8.20	8.50
Temp	25.0	25.0
Alk	62	110
Hard	98	92
Cond	354	487
Chlorine	<0.1	<0.1

- * D.O. is reported as mg/L
- Alkalinity is reported as mg/L CaCO₃
- Hardness is reported as mg/L CaCO₃
- Conductance is reported as umhos
- Chlorine is reported as mg/L

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TEST WATER QUALITY

24-Hour Water Quality Measurements

Effluent Concentration (%)	PH	D.O. (mg/l)	Temperature (C)
0% Control	7.74	7.20	24.8
3% Effluent	7.75	7.20	24.8
5% Effluent	7.76	7.30	24.8
6% Effluent	7.76	7.30	24.8
8% Effluent	7.77	7.30	24.8
11% Effluent	7.77	7.30	24.8

48-Hour Water Quality Measurements

Effluent Concentration (%)	PH	D.O. (mg/l)	Temperature (C)
0% Control	7.72	6.70	24.7
3% Effluent	7.72	6.80	24.7
5% Effluent	7.75	6.90	24.7
6% Effluent	7.76	6.90	24.7
8% Effluent	7.78	6.90	24.7
11% Effluent	7.80	7.00	24.7

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FINAL WATER QUALITY

EFFLUENT CONCENTRATION

	Control	11%
pH	7.66	7.78
D.O.	6.90	6.80
Temp	25.1	25.1
Alk	64	70
Hard	92	96
Cond	412	722

- * D.O. is reported as mg/L
- Alkalinity is reported as mg/L CaCO₃
- Hardness is reported as mg/L CaCO₃
- Conductance is reported as umhos

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REFERENCE #60186956

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
Phone: 913.599.5665
Fax: 913.599.1759

TEST VALIDITY

The Pimephales promelas control survival rate was 100%. The mean dry weight (growth) of the Pimephales promelas was determined at 0.448 mg/organism in the controls. The percent coefficient of variation (%CV) values for the fathead minnow control for survival and growth were 0.00 and 9.87. The Ceriodaphnia dubia survival rates were 100 in the control. The Ceriodaphnia in the control produced an average of 19.2 young over the seven-day exposure period. Percent CV values for Ceriodaphnia dubia control survival and reproduction was 0.00 and 15.10. Control data met or exceeded all criteria set out by EPA 821-R-02-013 for test acceptance.

CONCLUSIONS

The No Observed Effect Concentration (NOEC) for Pimephales promelas was 11% for survival and 11% for growth. The No Observed Effect Concentration (NOEC) for Ceriodaphnia dubia was 11% for Survival and 11% for Reproduction. The tests were ran using a synthetic control against effluent concentrations of 3%, 5%, 6%, 8%, and 11%. The effluent sampled on 1-26-15, 1-28-15, and 1-30-15 exhibited acceptable chronic toxicity in Pimephales promelas and in Ceriodaphnia dubia during the exposure period as described in EPA 821-R-02-013.

REPORT OF LABORATORY ANALYSIS

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60186956 Ft Smith FATHEAD SURVIVAL

File: 6186956A Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.010	7.260	11.460	7.260	2.010
OBSERVED	4	0	26	0	0

Calculated Chi-Square goodness of fit test statistic = 36.9480

Table Chi-Square value (alpha = 0.01) = 13.277

Data FAIL normality test. Try another transformation.

Warning - The first three homogeneity tests are sensitive to non-normal data and should not be performed.

60186956 Ft Smith FATHEAD SURVIVAL

File: 6186956A

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.043

W = 0.596

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data FAIL normality test. Try another transformation.

Warning - The first three homogeneity tests are sensitive to non-normal data and should not be performed.

60186956 Ft Smith FATHEAD SURVIVAL

File: 6186956A

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	5	1.107	1.107	1.107
2	3%	5	1.107	1.107	1.107
3	5%	5	0.991	1.107	1.084
4	6%	5	0.991	1.107	1.084
5	8%	5	0.991	1.107	1.084
6	11%	5	0.991	1.107	1.084

60186956 Ft Smith FATHEAD SURVIVAL

File: 6186956A

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	CONTROL	0.000	0.000	0.000	0.00
2	3%	0.000	0.000	0.000	0.00
3	5%	0.003	0.052	0.023	4.79
4	6%	0.003	0.052	0.023	4.79
5	8%	0.003	0.052	0.023	4.79
6	11%	0.003	0.052	0.023	4.79

60186956 Ft Smith FATHEAD SURVIVAL

File: C:\TOXSTAT\6186956A.

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.043

W = 0.596

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data FAIL normality test. Try another transformation.

Warning - The first three homogeneity tests are sensitive to non-normal data and should not be performed.

60186956 Ft Smith FATHEAD SURVIVAL

File: C:\TOXSTAT\6186956A.

Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance

Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.

Additional transformations are useless.

60186956 Ft Smith FATHEAD SURVIVAL

File: C:\TOXSTAT\6186956A.

Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	1.107				
2	3%	1.107	27.50	16.00	5.00	
3	5%	1.084	25.00	16.00	5.00	
4	6%	1.084	25.00	16.00	5.00	
5	8%	1.084	25.00	16.00	5.00	
6	11%	1.084	25.00	16.00	5.00	

Critical values use $k = 5$, are 1 tailed, and $\alpha = 0.05$

60186956 Ft Smith FATHEAD GROWTH
File: 6186956B Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.048

W = 0.959

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data PASS normality test at P=0.01 level. Continue analysis.

60186956 Ft Smith FATHEAD GROWTH

File: 6186956B

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	5	0.401	0.509	0.448
2	3%	5	0.404	0.450	0.430
3	5%	5	0.357	0.535	0.474
4	6%	5	0.410	0.529	0.462
5	8%	5	0.380	0.452	0.421
6	11%	5	0.350	0.462	0.422

60186956 Ft Smith FATHEAD GROWTH

File: 6186956B

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	CONTROL	0.002	0.044	0.020	9.87
2	3%	0.000	0.018	0.008	4.11
3	5%	0.005	0.068	0.031	14.41
4	6%	0.002	0.046	0.021	9.98
5	8%	0.001	0.031	0.014	7.27
6	11%	0.002	0.044	0.020	10.46

60186956 Ft Smith FATHEAD GROWTH
File: 6186956B Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 6.31

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

60186956 Ft Smith FATHEAD GROWTH
 File: 6186956B Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	0.448	0.448		
2	3%	0.430	0.430	0.645	
3	5%	0.474	0.474	-0.915	
4	6%	0.462	0.462	-0.496	
5	8%	0.421	0.421	0.950	
6	11%	0.422	0.422	0.922	

Dunnett table value = 2.36 (1 Tailed Value, P=0.05, df=24,5)

60186956 Ft Smith FATHEAD GROWTH
 File: 6186956B Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	5			
2	3%	5	0.067	14.9	0.018
3	5%	5	0.067	14.9	-0.026
4	6%	5	0.067	14.9	-0.014
5	8%	5	0.067	14.9	0.027
6	11%	5	0.067	14.9	0.026

60186956 Ft Smith FATHEAD GROWTH
File: 6186956B Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.012	0.002	1.219
Within (Error)	24	0.048	0.002	
Total	29	0.060		

Critical F value = 2.62 (0.05,5,24)
Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

60186956 Ft Smith FATHEAD GROWTH

File: C:\TOXSTAT\6186956B.

Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.012	0.002	1.219
Within (Error)	24	0.048	0.002	
Total	29	0.060		

Critical F value = 2.62 (0.05,5,24)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

60186956 Ft Smith FATHEAD GROWTH

File: C:\TOXSTAT\6186956B.

Transform: NO TRANSFORM

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	0.448	0.448		
2	3%	0.430	0.430	0.645	
3	5%	0.474	0.474	-0.915	
4	6%	0.462	0.462	-0.496	
5	8%	0.421	0.421	0.950	
6	11%	0.422	0.422	0.922	

Dunnett table value = 2.36 (1 Tailed Value, P=0.05, df=24,5)

60186956 Ft Smith FATHEAD GROWTH

File: C:\TOXSTAT\6186956B.

Transform: NO TRANSFORM

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	5			
2	3%	5	0.067	14.9	0.018
3	5%	5	0.067	14.9	-0.026
4	6%	5	0.067	14.9	-0.014
5	8%	5	0.067	14.9	0.027
6	11%	5	0.067	14.9	0.026

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
3%	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=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	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
5%	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=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	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6%	10	0	10

60186956 Ft Smith FATHEAD GROWTH

File: C:\TOXSTAT\6186956B. .

Transform: NO TRANSFORM

STEEL'S MANY-ONE RANK TEST

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	0.448				
2	3%	0.430	26.00	16.00	5.00	
3	5%	0.474	32.00	16.00	5.00	
4	6%	0.462	31.00	16.00	5.00	
5	8%	0.421	23.00	16.00	5.00	
6	11%	0.422	24.00	16.00	5.00	

Critical values use $k = 5$, are 1 tailed, and $\alpha = 0.05$

TOTAL 20 0 20

CRITICAL FISHER'S VALUE (10,10,10) (p=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	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
8%	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=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	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
11%	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=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 TESTS

NUMBER NUMBER SIG

GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	3%	10	0	
2	5%	10	0	
3	6%	10	0	
4	8%	10	0	
5	11%	10	0	

60186956 Ft Smith CERIODAPHNIA DUBIA REPRODU
File: 6186956E Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 1.06

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

60186956 Ft Smith CERIODAPHNIA DUBIA REPRODU
File: 6186956E Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	10	15.000	23.000	19.200
2	3%	10	17.000	24.000	20.600
3	5%	10	15.000	26.000	21.000
4	6%	10	16.000	25.000	20.800
5	8%	10	15.000	25.000	21.000
6	11%	10	14.000	26.000	21.000

60186956 Ft Smith CERIODAPHNIA DUBIA REPRODU
File: 6186956E Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	CONTROL	8.400	2.898	0.917	15.10
2	3%	7.156	2.675	0.846	12.99
3	5%	9.333	3.055	0.966	14.55
4	6%	10.844	3.293	1.041	15.83
5	8%	10.444	3.232	1.022	15.39
6	11%	13.556	3.682	1.164	17.53

60186956 Ft Smith CERIODAPHNIA DUBIA REPRODU
File: 6186956E Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	24.800	4.960	0.498
Within (Error)	54	537.600	9.956	
Total	59	562.400		

Critical F value = 2.45 (0.05,5,40)
Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

60186956 Ft Smith CERIODAPHNIA DUBIA REPRODU
 File: 6186956E Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	19.200	19.200		
2	3%	20.600	20.600	-0.992	
3	5%	21.000	21.000	-1.276	
4	6%	20.800	20.800	-1.134	
5	8%	21.000	21.000	-1.276	
6	11%	21.000	21.000	-1.276	

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

60186956 Ft Smith CERIODAPHNIA DUBIA REPRODU
 File: 6186956E Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	3%	10	3.260	17.0	-1.400
3	5%	10	3.260	17.0	-1.800
4	6%	10	3.260	17.0	-1.600
5	8%	10	3.260	17.0	-1.800
6	11%	10	3.260	17.0	-1.800

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	3	5	6	8	11
Response 1	.436	.404	.357	.440	.410	.432
Response 2	.509	.438	.500	.410	.412	.350
Response 3	.476	.435	.535	.529	.452	.414
Response 4	.401	.450	.497	.485	.451	.462
Response 5	.417	.421	.479	.445	.380	.451

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: Ft Smith

Test Start Date: 1/27/15 Test Ending Date: 2/3/15

Test Species: Fathead

Test Duration: 7 Day

DATA FILE:

Conc. ID	Number Replicates	Concentration	Response Means	Std. Dev.	Pooled Response Means
1	5	0.000	0.448	0.044	0.453
2	5	3.000	0.430	0.018	0.453
3	5	5.000	0.474	0.068	0.453
4	5	6.000	0.462	0.046	0.453
5	5	8.000	0.421	0.031	0.421
6	5	11.000	0.422	0.044	0.421

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	3	5	6	8	11
Response 1	20	19	22	17	23	14
Response 2	21	24	21	22	21	24
Response 3	21	19	18	25	19	18
Response 4	23	17	23	22	17	20
Response 5	16	23	22	19	15	21
Response 6	21	18	15	25	23	23
Response 7	17	22	23	18	20	25
Response 8	15	24	26	16	24	18
Response 9	22	18	21	20	23	21
Response 10	16	22	19	24	25	26

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: Ft Smith

Test Start Date: 1/27/15 Test Ending Date: 2/3/15

Test Species: Dubia

Test Duration: 7 Day

DATA FILE:

Conc. ID	Number Replicates	Concentration	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	19.200	2.898	20.600
2	10	3.000	20.600	2.675	20.600
3	10	5.000	21.000	3.055	20.600
4	10	6.000	20.800	3.293	20.600
5	10	8.000	21.000	3.232	20.600
6	10	11.000	21.000	3.682	20.600

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.



REFERENCE #60186956

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APPENDIX B
CHAIN OF CUSTODY FORMS

REPORT OF LABORATORY ANALYSIS

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Lenexa, KS 66219
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APPENDIX C

REFERENCE TOXICANTS SUMMARY

REPORT OF LABORATORY ANALYSIS

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 Lenexa, KS 66219
 Phone: 913.599.5665
 Fax: 913.599.1759

The absence of significant control mortality during this test indicated the health of the organisms and indicated that any significant mortality in the test concentrations was not due to contaminants or variations in testing conditions.

Reference toxicity testing is routinely performed by staff members in our biomonitoring - bioassay laboratory.

Start: 1/13/15 14:45 End: 1/20/15 13:00

Reference Toxicant (NaCl) Pimephales promelas

Concentration of Toxicant	Avg. # of Live Organisms/replicate			
	0 hrs	24 hrs	48 hrs	7 days
10 g/l	40	7	2	0
8 g/l	40	32	22	4
6 g/l	40	38	33	26
4 g/l	40	40	40	40
2 g/l	40	40	40	39

IC25 (5.28 g/l Sodium Chloride)

Survival NOEC: 4.0 g/l

Reference Toxicant (NaCl) Ceriodaphnia Dubia

Concentration of Toxicant	Avg. # of Live Organisms/replicate			
	0 hrs	24 hrs	48 hrs	7 days
2.5 g/l	10	4	0	0
2.0 g/l	10	10	9	2
1.5 g/l	10	10	10	10
1.0 g/l	10	10	10	10
0.5 g/l	10	10	10	10

IC25 (1.22 g/l Sodium Chloride)

Survival NOEC: 1.5 g/l

Submitted By: Tim Harrell
 Timothy Harrell, Technical Director

REPORT OF LABORATORY ANALYSIS

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APPENDIX D
STATE AGENCY FORMS

REPORT OF LABORATORY ANALYSIS

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**Biomonitoring Form
Chronic Toxicity Summary Form
Pimephales promelas
Chemical Parameters Chart**

Permittee: City of Fort Smith
NPDES No.: AR 0021750
Contact: Lance McAvoy
Analyst: Tim Harrell
Mike Bollin

Sample No. 1 Collected: Date: 1/26/2015 Time: 8:00
Sample No. 2 Collected: Date: 1/28/2015 Time: 8:00
Sample No. 3 Collected: Date: 1/30/2015 Time: 8:00
Test Begin: Date: 1/27/2015 Time: 14:00
Test End: Date: 2/3/2015 Time: 13:00

Dilution: 0									Dilution: 6								
Day:									Day:								
	1	2	3	4	5	6	7	Comments		1	2	3	4	5	6	7	Comments
Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1		Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1	
DO Initial	8.2	7.6	8.1	8	7.9	8.2	7.9		DO Initial		7.6	8.1	8	8	6.8	7.9	
DO Final	7.2	6.7	7.1	7	7.2	6.7	6.9		DO Final	7.3	6.9	7.2	7	7.2	7.9	6.9	
pH Initial	7.5	7.48	7.58	7.52	7.44	7.56	7.69		pH Initial		7.55	7.64	7.55	7.52	7.75	7.71	
pH Final	7.74	7.72	7.64	7.6	7.7	7.76	7.66		pH Final	7.76	7.76	7.73	7.68	7.75	7.71	7.72	
Alkalinity	62								Alkalinity								
Hardness	98								Hardness								
Conductivity	354								Conductivity								
Chlorine	<1						<1		Chlorine								

Dilution: 3									Dilution: 8								
Day:									Day:								
	1	2	3	4	5	6	7	Comments		1	2	3	4	5	6	7	Comments
Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1		Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1	
DO Initial		7.6	8.1	8	7.9	8.2	7.9		DO Initial		7.7	8.1	8	8	8.3	7.9	
DO Final	7.2	6.8	7.1	7	7.2	6.7	6.9		DO Final	7.3	6.9	7.2	7.1	7.2	6.8	6.8	
pH Initial		7.52	7.63	7.54	7.49	7.62	7.2		pH Initial		7.55	7.66	7.56	7.52	7.65	7.72	
pH Final	7.75	7.72	7.68	7.63	7.73	7.76	7.69		pH Final	7.77	7.78	7.75	7.69	7.76	7.74	7.75	
Alkalinity									Alkalinity								
Hardness									Hardness								
Conductivity									Conductivity								
Chlorine									Chlorine								

Dilution: 5									Dilution: 11								
Day:									Day:								
	1	2	3	4	5	6	7	Comments		1	2	3	4	5	6	7	Comments
Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1		Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1	Init. 100%
DO Initial		7.6	8.1	8	7.9	8.2	7.9		DO Initial		7.7	8.1	8.1	8	8.3	7.9	
DO Final	7.3	6.9	7.1	7	7.2	6.8	6.9		DO Final	7.3	7	7.2	7.1	7.2	6.8	6.8	
pH Initial		7.53	7.64	7.55	7.51	7.64	7.71		pH Initial		7.57	7.68	7.58	7.55	7.67	7.74	
pH Final	7.76	7.75	7.72	7.65	7.75	7.75	7.72		pH Final	7.77	7.8	7.76	7.71	7.79	7.75	7.78	
Alkalinity									Alkalinity								110
Hardness									Hardness								92
Conductivity									Conductivity								487
Chlorine									Chlorine							<1	<1

**Summary Reporting Forms Chronic Biomonitoring
Fathead Minnow Larvae Growth and Survival
(Pimephales promelas)**

Permittee: City of Fort Smith

NPDES No.:

AR 0021750

	From	Time:	Date:	To	Time:	Date:
Composite 1 Collected		8:00	1/25/2015		8:00	1/26/2015

	From	Time:	Date:	To	Time:	Date:
Composite 2 Collected		8:00	1/27/2015		8:00	1/28/2015

	From	Time:	Date:	To	Time:	Date:
Composite 3 Collected		8:00	1/29/2015		8:00	1/30/2015

Test initiated: am/pm 14:00 AM date 1/27/2015

Test terminated: am/pm 13:00 AM date 2/3/2015

Dilution water used: Receiving Reconstituted X

Data Table for Survival

Effluent Conc. %	Percent Survival in Replicate Chambers					Mean Percent Survival			CV%*
	A	B	C	D	E	24h	48h	7 days	
Syn 0 %	100	100	100	100	100	100	100	100	0
3%	100	100	100	100	100	100	100	100	0
5%	87.5	100	100	100	100	100	100	97.5	4.79
6%	100	87.5	100	100	100	100	100	97.5	4.79
8%	100	100	100	100	87.5	100	100	97.5	4.79
11%	100	87.5	100	100	100	100	100	97.5	4.79

Data Table for Survival

Effluent Conc. %	Average Dry Weight in milligrams in Replicate Chambers					Mean Dry Weight mg	CV%*
	A	B	C	D	E		
Syn. 0%	0.436	0.509	0.476	0.401	0.417	0.448	9.87
3%	0.404	0.438	0.435	0.45	0.421	0.43	4.11
5%	0.357	0.5	0.535	0.497	0.479	0.474	14.41
6%	0.44	0.41	0.529	0.485	0.445	0.462	9.98
8%	0.41	0.412	0.452	0.451	0.38	0.421	7.27
11%	0.432	0.35	0.414	0.462	0.451	0.422	10.46

*coefficient of variation = standard deviation x 100/mean.

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

1. Dunnett's Procedure or Steels Many-One Rank Test as appropriate:

Is the mean survival at 7 days significantly different ($p=.05$) than the control survival for the % effluent corresponding to:

- | | | | | |
|----------------------------------|---|-------|------|-------|
| a) Low Flow or Critical Dilution | (| 8 %): | Yes: | No: X |
| b) 1/2 Low Flow Dilution | (| %): | Yes: | No: |

2. Dunnett's Procedure (or appropriate test):

Is the mean dry weight (growth) of the effluent at 7 days significantly different ($p=0.05$) than the control's dry weight for the % effluent corresponding to (significant non-lethal effects):

- | | | | | |
|----------------------------------|---|-------|------|-------|
| a) Low Flow or Critical Dilution | (| 8 %): | Yes: | No: X |
| b) 1/2 Low Flow Dilution | (| %): | Yes: | No: |

3. If you answered NO to 1. a) and 2. a) enter (0) otherwise enter (1): 0

4. If you answered NO to 1. b) and 2. b) enter (0) otherwise enter (1):

5. Enter response to item 3 on DMR Form, parameter #TEP6C.

6. Enter response to item 4 on DMR Form, parameter #TFP6C.

7. Enter percent effluent corresponding to each NOEC below and circle lowest number:

- | | |
|-----------------------|---------------|
| a) NOEC survival: | 11 % effluent |
| b) NOEC reproduction: | 11 % effluent |

**Biomonitoring Form
Chronic Toxicity Summary Form
Ceriodaphnia dubia
Chemical Parameters Chart**

Permittee: City of Fort Smith
NPDES No.: AR 0021750
Contact: Lance McAvoyn
Analyst: Tim Harrell
Mike Bollin

Sample No. 1 Collected: Date: 1/26/2015 Time: 8:00
Sample No. 2 Collected: Date: 1/28/2015 Time: 8:00
Sample No. 3 Collected: Date: 1/30/2015 Time: 8:00
Test Begin: Date: 1/27/2015 Time: 14:00
Test End: Date: 2/3/2015 Time: 13:00

Dilution: 0 Day:									Dilution: 6 Day:								
	1	2	3	4	5	6	7	Comments		1	2	3	4	5	6	7	Comments
Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1		Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1	
DO Initial	8.2	7.6	8.1	8	7.9	8.2	7.9		DO Initial		7.6	8.1	8	8	6.8	7.9	
DO Final	7.2	6.7	7.1	7	7.2	6.7	6.9		DO Final	7.3	6.9	7.2	7	7.2	7.9	6.9	
pH Initial	7.5	7.48	7.58	7.52	7.44	7.56	7.69		pH Initial		7.55	7.64	7.55	7.52	7.75	7.71	
pH Final	7.74	7.72	7.64	7.6	7.7	7.76	7.66		pH Final	7.76	7.76	7.73	7.68	7.75	7.71	7.72	
Alkalinity	62								Alkalinity								
Hardness	98								Hardness								
Conductivity	354								Conductivity								
Chlorine	<1						<1		Chlorine								

Dilution: 3 Day:									Dilution: 8 Day:								
	1	2	3	4	5	6	7	Comments		1	2	3	4	5	6	7	Comments
Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1		Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1	
DO Initial		7.6	8.1	8	7.9	8.2	7.9		DO Initial		7.7	8.1	8	8	8.3	7.9	
DO Final	7.2	6.8	7.1	7	7.2	6.7	6.9		DO Final	7.3	6.9	7.2	7.1	7.2	6.8	6.8	
pH Initial		7.52	7.63	7.54	7.49	7.62	7.2		pH Initial		7.55	7.66	7.56	7.52	7.65	7.72	
pH Final	7.75	7.72	7.68	7.63	7.73	7.76	7.69		pH Final	7.77	7.78	7.75	7.69	7.76	7.74	7.75	
Alkalinity									Alkalinity								
Hardness									Hardness								
Conductivity									Conductivity								
Chlorine									Chlorine								

Dilution: 5 Day:									Dilution: 11 Day:								
	1	2	3	4	5	6	7	Comments		1	2	3	4	5	6	7	Comments
Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1		Temp (C)	24.8	24.7	24.9	25	24.9	24.8	25.1	Init. 100%
DO Initial		7.6	8.1	8	7.9	8.2	7.9		DO Initial		7.7	8.1	8.1	8	8.3	7.9	
DO Final	7.3	6.9	7.1	7	7.2	6.8	6.9		DO Final	7.3	7	7.2	7.1	7.2	6.8	6.8	
pH Initial		7.53	7.64	7.55	7.51	7.64	7.71		pH Initial		7.57	7.68	7.58	7.55	7.67	7.74	
pH Final	7.76	7.75	7.72	7.65	7.75	7.75	7.72		pH Final	7.77	7.8	7.76	7.71	7.79	7.73	7.78	
Alkalinity									Alkalinity								110
Hardness									Hardness								92
Conductivity									Conductivity								487
Chlorine									Chlorine							<1	<1

**Summary Reporting Forms
Chronic Biomonitoring**

Ceriodaphnia dubia Survival and Reproduction

Permittee: City of Fort Smith

NPDES No.:

AR 0021750

	Time:	Date:		Time:	Date:
Composite 1 Collected	From 8:00	1/25/2015	To	8:00	1/26/2015

Composite 2 Collected	From 8:00	1/27/2015	To	8:00	1/28/2015
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Composite 3 Collected	From 8:00	1/29/2015	To	8:00	1/30/2015
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Test initiated: am/pm 14:00 AM date 1/27/2015
 Test terminated: am/pm 13:00 AM date 2/3/2015

Dilution water used: Receiving Reconstituted X

Percent Survival

Time of Reading	Percent Effluent					
	0	3	5	6	8	11
24h	100	100	100	100	100	100
48h	100	100	100	100	100	100
End of test	100	100	100	100	100	100

Number of Young Produced per Female @ End of Test

Rep	0	3	5	6	8	11
A	20	19	22	17	23	14
B	21	24	21	22	21	24
C	21	19	18	25	19	18
D	23	17	23	22	17	20
E	16	23	22	19	15	21
F	21	18	15	25	23	23
G	17	22	23	18	20	25
H	15	24	26	16	24	18
I	22	18	21	20	23	21
J	16	22	19	24	25	26
Mean	19.2	20.6	21	20.8	21	21
CV%*	15.1	12.99	14.55	15.83	15.39	17.53

*coefficient of variation = standard deviation x 100/mean.

Ceriodaphnia dubia
Survival and Reproduction (cont)

1. Fisher's Exact Test:

Is the mean survival at the end of the test significantly different ($p=.05$) than the control survival for the % effluent corresponding to (lethality):

a) Low Flow or Critical Dilution	(8 %):	Yes:	No: X
b) 1/2 Low Flow Dilution	(%):	Yes:	No:

2. Dunnett's Procedure or Steel's Many-One Rank Test as appropriate:

Is the mean number of young produced per female significantly different ($p=.05$) than the control's number of young per female for the % effluent corresponding to (significant non-lethal effects):

a) Low Flow or Critical Dilution	(8 %):	Yes:	No: X
b) 1/2 Low Flow Dilution	(%):	Yes:	No:

3. If you answered NO to 1. a) and 2. a) enter (0) otherwise enter (1): 0

4. If you answered NO to 1. b) and 2. b) enter (0) otherwise enter (1):

5. Enter response to item 3 on DMR Form, parameter #TEP3B.

6. Enter response to item 4 on DMR Form, parameter #TFP3B.

7. Enter percent effluent corresponding to each NOEC below and circle lowest number:

a) NOEC survival:	11 % effluent
b) NOEC reproduction:	11 % effluent