Sanitary Sewer Overflow Monthly Report

Facility Name: Arkadelphia Water & Sewer Utilities **Permit Number:** AR0020605 **Reporting Period(Month/Year):** 06/2014

No Sanitary Sewer Overflows This Monitoring Period

Summary Report Code Descriptions

Cause(s) of SSO		SSO Impact	Action(s) Taken	Ultimate Discharge Location
CO-Construction	D-Debris	NEAH-No Evidence of Adverse Health or Environmental Impact	WO-Work Order	CR-Creek/Stream/River (please specify)
E-Equipment Failure	G-Grease	OEHC-Observed or Evidence of Human Contact	EC-Environmental Cleanup	DI-Ditch
HC-Hydro Clean	LF-Line Failure/Break	EFK-Evidence of Fish Kill	HC-Hydro Cleaned	DR-Drop Inlet
R-Rainfall	RG-Roots & Grease		HR-Hand Rodded	GR-Ground Surface
RO-Roots	V-Vandalism		EN-Referred to Engineering	PA-Paved Area
			PN-Public Notification	CB-Contained in Building

Location	Manhole #	Start Date of SSO	End Date of SSO	Estimated Volume (in gallons)	Cause of SSO	Environmental Impact	Action (s) Taken to Address SSO	Ultimate Discharge Location
		6-20-14	6-21-2014	10,000	LF	NEAH	Repair Line	River

David Thomason
Signature of Cognizant or Ranking Official

7-24-2014
Date

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Arkansas Analytical, Inc.

Toxicity Test Results

City of Arkadelphia
Permit Number: AR0020605
AFIN # 10-00463
Second Quarter 2014

Fathead Minnow, *Pimephales promelas,* Larval Survival and Growth Test
Test 1000.0

Ceriodaphnia dubia, Survival and Reproduction Test
Test 1002.0

Prepared for: **Kristy Daniel**
City of Arkadelphia
P.O. Box 495
Arkadelphia, Arkansas 71923

Prepared by: Arkansas Analytical, Inc.
11701 I-30, Bldg 1 Suite 115
Little Rock, Arkansas 72209
Lab Number K1405005

Wednesday, May 28, 2014

Introduction

This report contains test results for toxicity testing for the City of Arkadelphia WWTP. The NPDES permit number is AR0020605. The facility is located as follows: west off of S. 3rd St. approximately 2.6 miles south of intersection of 3rd St. and Arkansas State Hwy 7 in Arkadelphia in Clark County, Arkansas.

The permit requires chronic biomonitoring testing for *Pimephales promelas* and *Ceriodaphnia dubia* once per quarter, but has been reduced to semiannual. These results represent the first half of 2014.

Plant Operations

To be provided by permittee.

Source of Effluent and Dilution Water

Effluent samples were collected as follows:

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	5-18-14, 0800	5-19-14, 0800
Sample #2:	5-20-14, 0800	5-21-14, 0800
Sample #3:	5-22-14, 0800	5-23-14, 0800

Samples were composites collected at the final discharge of Outfall 001, City of Arkadelphia effluent.

The following information was collected upon immediate receipt of the samples at the laboratory:

Sample Receiving Information:	Date, Time Sample(s) Received	Temperature (˚C) upon receipt
Sample #1:	5-19-14, 1423	4
Sample #2:	5-22-14, 0955	4
Sample #3:	5-23-14, 1310	4

Chain of custody documentation is located in Appendix A.

The dilution water used in the toxicity tests was moderately hard synthetic . It was prepared using Elga Maxima ultra pure water according to EPA specifications. Each batch was analyzed for pH, hardness, total alkalinity, and conductivity. Results are provided in Appendix B.

Dilution Series

Five dilutions in addition to a control (0% effluent) were used in the toxicity tests. The dilutions, which were made with synthetic water, were 2.5%, 3.4%, 4.5%, 6%, and 8%. The low-flow effluent concentration (**critical dilution**) was defined as **6% effluent**.

Test Methods

EPA Method 1000.0, Fathead Minnow, *Pimephales promelas,* Larval Survival and Growth Test, was used in this bioassay. Larvae are exposed in a static renewal system for seven days and the results are based on the survival and growth (increase in weight) of the larvae. There were no deviations from the reference method. The test chambers were 500 ml plastic cups, and each chamber contained ten organisms in a test solution volume of 250 mls. The test temperature was 25 degrees Centigrade. Raw data and statistics are provided in Appendix C.

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia,* Survival and Reproduction Test, was used. Neonates are exposed in a static renewal system until at least 60% of the control organisms have produced a third brood. Results are based on the survival and reproduction of the organisms. One neonate was placed in each of ten replicate chambers using a randomizing template. Test chambers were 30 ml plastic cups filled with 15 mls of test solution. The test temperature was 25 degrees Centigrade. Raw data and statistics are provided in Appendix D.

Test Organisms

The organisms used in Test 1000.0 were < 48 hour old Fathead Minnows, *Pimephales promelas*, which were purchased from Aquatox; a copy of the organism history is provided in Appendix E.

The organisms used in Test 1002.0 were < 24 hour old *Ceriodaphnia dubia* neonates, (all born within the same eight hours), obtained from an in-house culture. An organism history is provided in Appendix E.

Quality Assurance

Test Acceptability

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	15.2	X	
At least 60% of surviving females should have produced 3 broods	90%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	26.1%	X	

TEST ACCEPTANCE CRITERIA for *Pimephales promelas*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	96%	X	
The percent coefficient of variation between replicates must be 40% or less for survival	5.71%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.679	X	
The percent coefficient of variation between replicates must be 40% or less for growth	15.2%	X	

Reference Toxicant

The reference toxicant used was Potassium Chloride prepared in-house. The tests were performed using moderately hard synthetic as dilution water. The results of the reference toxicant were:

REFERENCE TOXICANT

Ceriodaphnia dubia 4/22/14 – 4/29/14		*Pimephales promelas* 4/22/14 – 4/29/14	
NOEC Survival:	250 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	500 ppm KCl	LOEC Survival:	1000 ppm KCl
NOEC Reproduction:	250 ppm KCl	NOEC Growth:	500 ppm KCl
LOEC Reproduction:	500 ppm KCl	LOEC Growth:	1000 ppm KCl

Quality Assurance charts are provided in Appendix F.

Summary of Results
City of Arkadelphia

Ceriodaphnia dubia		*Pimephales promelas*	
NOEC / LOEC Survival	8% / NA	NOEC / LOEC survival	8% / NA
NOEC / LOEC Reproduction	8% / NA	NOEC / LOEC growth	8% / NA
Mean number of neonates (critical dilution)	14.5	%CV survival (critical dilution)	0%
%CV Reproduction (critical dilution)	36.2%	Mean dry weight (critical dilution) in milligrams	0.625
		%CV growth (critical dilution)	12.0%
PMSD Reproduction	25.5%	PMSD Growth	19.7%

Conclusion

Chronic static renewal larval survival and growth test using fathead minnow, *Pimephales promelas*, (Method 1000.0)

The permit issued to the City of Arkadelphia, specifies that the **critical dilution is 6% effluent**. The effluent samples **did not** exhibit lethal or sublethal effects at the critical dilution, and, as such, **passed** both portions of the test.

Chronic static renewal survival and reproduction test using *Ceriodaphnia dubia,* (Method 1002.0)

The permit issued to the City of Arkadelphia, specifies that the **critical dilution is 6% effluent**. The effluent samples **did not** exhibit lethal or sublethal effects at the critical dilution, and, as such, **passed** both portions of the test.

Biomonitoring Analyst:

Ryan Hudgin

Reviewed by:

Tracy Bounds

Tracy Bounds, lab manager

SUMMARY REPORTING FOR CHRONIC BIOMONITORING

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

PIMEPHALES PROMELAS

PERMITTEE: City of Arkadelphia

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	5-18-14, 0800	5-19-14, 0800
Sample #2:	5-20-14, 0800	5-21-14, 0800
Sample #3:	5-22-14, 0800	5-23-14, 0800

Test initiated (date, time): 5-20-14, 1140 Test terminated (date, time): 5-27-14, 1145

Dilution water used: Moderately Hard Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

	Percent Survival in Replicate Chambers						Mean Percent Survival			
Effluent Conc %	A	B	C	D	E		24 hours	48 hours	7 days	CV %
0%	90	100	100	90	100		100	98	96	5.71
2.5%	100	100	100	100	100		100	100	100	
3.4%	100	100	100	90	100		100	100	98	
4.5%	100	90	100	100	100		100	100	98	
6%	100	100	100	100	100		100	100	100	0.00
8%	100	100	100	100	100		100	100	100	

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

	Average Dry Weight in milligrams in replicate chambers							
Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.598	0.613	0.821	0.606	0.758		0.679	15.2%
2.5%	0.766	0.616	0.611	0.684	0.646		0.665	
3.4%	0.577	0.742	0.743	0.563	0.672		0.659	
4.5%	0.517	0.750	0.620	0.653	0.757		0.659	
6%	0.590	0.676	0.554	0.730	0.573		0.625	12.0%
8%	0.749	0.485	0.711	0.692	0.645		0.656	

Coefficient of Variation = standard deviation / mean * 100

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

Pimephales promelas

1. Dunnett's procedure or Steel's Many-One Rank Test as appropriate:
   Is the mean survival at 7 days significantly different (p=0.05) than the control survival for:

   a) LOW FLOW OR CRITICAL DILUTION, (100%) YES _____ NO___**X**___

2. Dunnett's Procedure
   Is the mean dry weight (growth) at 7 days significantly different (p=0.05) than the control's dry weight (growth) for:

   a) LOW FLOW OR CRITICAL DILUTION, (100%) YES_____ NO___**X**___

3. If NO was answered to 1.a) enter [0] otherwise enter [1] (parameter TLP6C): _____**0**_____

4. If NO was answered to 2.a) enter [0] otherwise enter [1] (parameter TGP6C): _____**0**_____

5. Enter percentage corresponding to each parameter below:

   a) NOEC survival (parameter TOP6C)= _____**8**___% effluent

   b) NOEC growth (parameter TPP6C)= _____**8**____% effluent

   c) Coefficient of variation (parameter TQP6C)= _____**15.2**_____%

6. Enter Whole Effluent Toxicity: _____**8**___%

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
Ceriodaphnia dubia SURVIVAL AND REPRODUCTION

Permittee: City of Arkadelphia

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	5-18-14, 0800	5-19-14, 0800
Sample #2:	5-20-14, 0800	5-21-14, 0800
Sample #3:	5-22-14, 0800	5-23-14, 0800

Test initiated (date, time): 5-20-14, 1115 Test terminated (date, time): 5-27-14, 1045

Dilution water used: Moderately Hard Synthetic

Ceriodaphnia dubia SURVIVAL AND REPRODUCTION
NUMBER OF YOUNG PRODUCED PER FEMALE @ TEST TERMINATION

PERCENT EFFLUENT

Replicate	0%	2.5%	3.4%	4.5%	6%	8%
A	15	12	15	18	22	10
B	15	10	19	19	20	19
C	19	20	15	12	7	13
D	18	14	14	12	21	14
E	16	15	21	16	13	11
F	7	12	14	18	10	17
G	12	14	15	8	13	18
H	18	11	18	11	9	14
I	20	10	11	20	17	16
J	12	13	17	15	13	15
Mean	15.2	13.1	15.9	14.9	14.5	14.7
Mean/surviving female	15.2	13.1	15.9	14.9	14.5	14.7
CV%*	26.1				36.2	

X=Dead Adult; M= Male (Not considered in statistics)
*Coefficient of Variation = standard deviation/ mean * 100; CV% calculation based on young per surviving female

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
Ceriodaphnia dubia SURVIVAL AND REPRODUCTION

Permittee: City of Arkadelphia

PERCENT SURVIVAL

PERCENT EFFLUENT	0%	2.5%	3.4%	4.5%	6%	8%
Time of Reading: 24 HOURS	100	100	100	100	100	100
48 HOURS	100	100	100	100	100	100
Test termination	100	100	100	100	100	100

1. Fisher's Exact Test:
   Is the mean survival at test termination significantly different (p=0.05) than the control survival for:

   a) LOW FLOW OR CRITICAL DILUTION, (100%): YES_____ NO___**X**___

2. Dunnett's Procedure or Steel's Many One Rank Test:
   Is the mean number of young produced per female significantly different (p=0.05) than the controls number of young per female for:

   a) LOW FLOW OR CRITICAL DILUTION, (100%): YES_____ NO___**X**___

3. If NO was answered to 1.a) enter [0] otherwise enter [1] (parameter TLP3B):_____**0**_____

4. If NO was answered to 2.a) enter [0] otherwise enter [1] (parameter TGP3B):_____**0**_____

5. Enter percentage corresponding to each parameter below:

   a) NOEC survival (parameter TOP3B)= _____**8**____ % effluent

   b) NOEC reproduction (parameter TPP3B)= _____**8**_____% effluent

   c) Coefficient of variation (parameter TQP3B)= _____**36.2**_____%

6. Enter Whole Effluent Toxicity: _____**8**_____%

APPENDIX A

Chain of Custody Forms

8100 NATIONAL DRIVE, LITTLE ROCK, AR 72209
501-562-8139 800-331-8139
FAX 501-562-7025

CHAIN OF CUSTODY RECORD

TURN AROUND TIME
RUSH 24HR. 48 HR.
5 DAY REG
OTHER_____

FOR LAB/OFFICE USE ONLY
LAB # 17162-0001B - K1405005A
CLIENT # 1144
P.O.#_____

STANDARD METHODS PRESERVATION PER EPA 40 CFR
C 4= COOL TO 4.C
S<2= SULFURIC ACID TO pH<2
N<2= NITRIC ACID TO pH<2
T= THIOSULFATE FOR DECHLORINATION
W= WINKLER AZIDE MODIFICATION
P= MEMBRANE ELECTRODE
NaOH= pH >12

ME OF COMPANY, CITY, OR PROJECT: rkadelphia
PROJECT NO: 110913k2
SAMPLER(S) NAME: (PRINT): David Thomason

MPLE O:	SAMPLE ID AND/ OR COLLECTION LOCATION	START DATE/TIME	END DATE/TIME	COMP GRAB	FIELD ANALYSIS pH	TEMP	FLOW	CL2	D,O (W) D.O(P)	CONTAINER TYPE PRESERVATIVE	ANALYSIS REQUIRED
	04Fg11001	5/18/14 0800	5/19/14 0800	comp						Plastic/None	Chronic BIO

METHOD OF SHIPMENT (CIRCLE)
FED EX/ WALK IN SRA UPS OTHER

TYPE OF SAMPLE(S): (CIRCLE)
WATER SOIL W/W SLUDGE OTHER

FIELD CALIBRATION RECORD

pH 7			
pH 4			
pH 10			
D.O			

NOTES/COMMENTS/OBSERVATIONS
Temp D Lab 4°C

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

AR Analytical - 5-19-14

	Yes	No
Custody Seals:	X	
Containers Correct:	X	
COC/Labels Agree:	X	
~~Preservation Confirmed:~~	X	
Received on Ice:	X	
Temperature on Receipt:	4°C. HHTH2	

relinquished by: 5-19-14 14:23

received by AR Analytical: Sydney James 5/19/14.1423

RELINQUISHED BY: DATE/TIME: RECEIVED BY: DATE/TIME:

RELINQUISHED BY: David Thomason DATE/TIME: 5-19-14 10:15 RECEIVED BY(LAB): Dawn Riddle DATE/TIME: 10:15 5-19-14

SORRELLS RESEARCH ASSOCIATES, INC
8100 NATIONAL DRIVE, LITTLE ROCK, AR 72209
501-562-8139 800-331-8139
FAX 501-562-7025

COC rec'd w/ white out on it - ajf 5/22/14

CHAIN OF CUSTODY RECORD

TURN AROUND TIME
RUSH 24HR. 48 HR.
5 DAY REG
OTHER____

FOR LAB/OFFICE USE ONLY
LAB # 171621.0002B
CLIENT # 1144
P.O.#

STANDARD METHODS PRESERVATION PER EPA 40 CFR
C 4= COOL TO 4.C
S<2= SULFURIC ACID TO pH<2
N<2= NITRIC ACID TO pH<2
T= THIOSULFATE FOR DECHLORINATION
W= WINKLER AZIDE MODIFICATION
P= MEMBRANE ELECTRODE
NaOH= pH >12

NAME OF COMPANY, CITY, OR PROJECT: Arkadelphia Water Dept
PROJECT NO: 110913k2
SAMPLER(S) NAME: (PRINT): David Thomason

SAMPLE NO:	SAMPLE ID AND/ OR COLLECTION LOCATION	START DATE/TIME	END DATE/TIME	COMP GRAB	FIELD ANALYSIS pH	TEMP	FLOW	CL2	D.O (W) D.O(P)	CONTAINER TYPE PRESERVATIVE	ANALYSIS REQUIRED
	Outfall 001	5/20/14 0800	5/21/14 0800	comp						Plastic/None	K140500S-B Chronic BIO

METHOD OF SHIPMENT (CIRCLE)
FED EX WALK IN SRA UPS OTHER

TYPE OF SAMPLE(S): (CIRCLE)
WATER SOIL W/W SLUDGE OTHER

FIELD CALIBRATION RECORD
pH 7
pH 4
pH 10
D.O

NOTES/COMMENTS/OBSERVATIONS: Temp @ lab 5°C

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

	Yes	No
Custody Seals:	X	
Containers Correct:	X	
COC/Labels Agree:	X	
~~Preservation Confirmed:~~	X	
Received on Ice:	X	
Temperature on Receipt:	4°C	

ajf

RELINQUISHED BY: [signature] DATE/TIME: 5-22-14 0955
RECEIVED BY: Jamey Riddle DATE/TIME: 5-21-14 9.30

RELINQUISHED BY: David Thomason DATE/TIME: 5-21-14 0930
RECEIVED BY(LAB): Amadda Tabish DATE/TIME: 5/22/14 nacht

SORRELLS RESEARCH ASSOCIATES, INC
8100 NATIONAL DRIVE, LITTLE ROCK, AR 72209
501-562-8139 800-331-8139
FAX 501-562-7025

CHAIN OF CUSTODY RECORD

TURN AROUND TIME
RUSH 24HR. 48 HR.
5 DAY REG
OTHER_____

FOR LAB/OFFICE USE ONLY
LAB # 17062.0003B - K1405005C
CLIENT # 1144
P.O.#_____

STANDARD METHODS PRESERVATION PER EPA 40 CFR
C 4= COOL TO 4.C
S<2= SULFURIC ACID TO pH<2
N<2= NITRIC ACID TO pH<2
T= THIOSULFATE FOR DECHLORINATION
W= WINKLER AZIDE MODIFICATION
P= MEMBRANE ELECTRODE
NaOH= pH >12

NAME OF COMPANY, CITY, OR PROJECT: Philadelphia Water
PROJECT NO: 110913k2
SAMPLER(S) NAME: (PRINT) David Thomason

SAMPLE NO:	SAMPLE ID AND/ OR COLLECTION LOCATION	START DATE/TIME	END DATE/TIME	COMP GRAB	FIELD ANALYSIS pH	TEMP	FLOW	CL2	D,O (W) D.O(P)	CONTAINER TYPE PRESERVATIVE	ANALYSIS REQUIRED
		5-22-14 0800	5-23-14 0800	Comp						Plastic None	Chronic 7 d IC

METHOD OF SHIPMENT (CIRCLE)
FED EX (WALK IN) SRA UPS OTHER

TYPE OF SAMPLE(S): (CIRCLE)
WATER SOIL (W/W) SLUDGE OTHER

FIELD CALIBRATION RECORD

pH 7				
pH 4				
pH 10				
D.O				

NOTES/COMMENTS/OBSERVATIONS
Temp @ Lab 5°C

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

AR Analytical - 5-23-14

	Yes	No
Custody Seals:	✓	
Containers Correct:	✓	
COC/Labels Agree:	✓	
~~Preservation Confirmed:~~		
Received on Ice:	✓	
Temperature on Receipt:	4°C-IHHT#2	

RELINQUISHED BY: David Thomason DATE/TIME: 5-23-14 0935
RECEIVED BY: Jammy Riddle DATE/TIME: 5-23-14 9:35
RELINQUISHED BY: [signature] DATE/TIME: 5-23-14 1310
RECEIVED BY(LAB): Sudhin Thomas AR Analytical DATE/TIME: 5-23-14 12:1?

APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Fathead Minnow

Lab # / Sample ID: K140 5005 — Test Start (Date/Time): 5-20-14 1140

Client: Arkadelphia — Test End (Date/Time): 5-27-14 1145

		Day of Test 1	2	3	4	5	6	7	notes
Control	mHS	5-20	5-21	5-22	5-23	5-24	5-25	5-26	
D.O. (mg/L)	INITIAL	8.4	8.6	8.5	8.7	8.5 8.5	8.5	8.6	
	FINAL	7.6	7.6	7.4	8.0	8.1	7.5	7.2	
pH (s.u.)	INITIAL	7.8	8.0	8.0	7.9	7.7 7.7	7.9	7.8	
	FINAL	7.8	8.0	7.9	7.7	7.8	7.8	8.1	
temp (C)	INITIAL	22	23	24	24	22 22	22	23	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		58							
HARDNESS (mg/L)		88							
CONDUCTIVITY (umhc		339							
CHLORINE (mg/L)		<0.05							
CONC: 2.5									
D.O. (mg/L)	INITIAL	8.4	8.5	8.6	8.5	8.5 8.4	8.2	8.7	
	FINAL	7.2	7.4	7.2	7.7	7.9	7.4	7.3	
pH (s.u)	INITIAL	7.9	8.0	7.9	7.8	7.4 7.8	7.9	7.8	
	FINAL	7.7	8.0	8.0	7.7	7.8	8.1	8.0	
temp (C)	INITIAL	22	23	24	24	24 23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 3.4									
D.O. (mg/L)	INITIAL	8.5	8.6	8.5	8.5	8.2 8.5	8.4	8.6	
	FINAL	6.5	7.6	7.3	7.5	7.9	7.2	7.2	
pH (mg/L)	INITIAL	7.8	7.9	8.0	7.9	7.5 7.6	7.9	7.6	
	FINAL	7.6	7.8	8.0	7.6	7.8	8.2	7.7	
temp (C)	INITIAL	23	23	24	24	25 23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 4.5									
D.O. (mg/L)	INITIAL	8.5	8.5	8.4	8.6	8.2 8.5	8.5	8.6	
	FINAL	7.0	7.5	7.4	7.6	7.8	7.3	7.2	
pH (s.u.)	INITIAL	7.9	7.9	7.8	8.0	7.6 7.7	8.0	7.9	
	FINAL	7.9	7.8	7.9	7.7	7.8	8.0	7.8	
temp (C)	INITIAL	23	23	24	24	25 23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 6									
D.O. (mg/L)	INITIAL	8.5	8.6	8.5	8.6	8.5 8.0 8.1	8.5	8.5	
	FINAL	6.8	7.7	7.4	8.0	7.8	7.7	7.2	
pH (s.u.)	INITIAL	7.8	8.0	8.0	8.0	7.4 7.9	7.9	7.9	
	FINAL	8.0	8.2	7.7	7.7	7.8	7.8	7.9	
temp (C)	INITIAL	23	23	23	24	23 25 27	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 8									
D.O. (mg/L)	INITIAL	8.3	8.5	8.4	8.7	8.5 8.0 7.7	8.6	8.4	
	FINAL	6.8	7.5	7.1	8.0	7.9	7.5	7.2	
pH (s.u.)	INITIAL	8.0	7.8	7.9	7.9	7.8 7.8	8.0	7.8	
	FINAL	7.6	7.9	7.9	7.8	7.8	8.1	7.9	
temp (C)	INITIAL	23	24	23	24	23 25	22	24	
	FINAL	25	25	25	25	25	25	25	
CONC: 100 %		A	A	A	B	B	C	C	
ALKALINITY (mg/L)		50			48		54		
HARDNESS (mg/L)		48			44		38		
CONDUCTIVITY (umhc		253			262		256		
CHLORINE (mg/L)		0.14			<0.05				

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Ceriodaphnia Dubia

Lab # / Sample ID: K14D5005 — Test Start (Date/Time): 5-20-14 1115

Client: Arkadelphia — Test End (Date/Time): 5-27-14 1045

		Day of Test							
		1	2	3	4	5	6	7	notes
Control	MHS	5-20	5-21	5-22	5-23	5-24	5-25	5-26	
D.O. (mg/L)	INITIAL	8.4	8.6	8.5	8.7	8.5	8.5	8.6	
	FINAL	8.5	8.1	8.0	8.3	7.9	7.7	8.2	
pH (s.u.)	INITIAL	7.8	8.0	8.0	7.9	7.7	7.9	7.8	
	FINAL	7.8	8.1	7.9	7.8	7.7	8.1	7.7	
temp (C)	INITIAL	22	23	24	24	22	22	23	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		58							
HARDNESS (mg/L)		88							
CONDUCTIVITY (umhc		339							
CHLORINE (mg/L)		<0.05							
CONC: 2.5									
D.O. (mg/L)	INITIAL	8.4	8.5	8.6	8.5	8.4	8.2	8.7	
	FINAL	8.3	8.0	8.1	8.2	7.9	7.5	8.1	
pH (s.u)	INITIAL	7.9	8.0	7.9	7.8	7.8	7.9	7.8	
	FINAL	8.1	8.1	8.0	7.8	7.7	7.9	7.8	
temp (C)	INITIAL	22	23	24	24	23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 3.4									
D.O. (mg/L)	INITIAL	8.5	8.6	8.5	8.5	8.5	8.4	8.6	
	FINAL	8.4	8.1	8.0	8.0	8.1	7.8	8.0	
pH (mg/L)	INITIAL	7.8	7.9	8.0	7.9	7.6	7.9	7.6	
	FINAL	7.9	7.9	7.9	8.1	7.7	8.0	7.8	
temp (C)	INITIAL	23	23	24	24	23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 4.5									
D.O. (mg/L)	INITIAL	8.5	8.5	8.4	8.6	8.5	8.5	8.6	
	FINAL	8.3	8.1	8.0	8.1	8.3	7.9	7.8	
pH (s.u.)	INITIAL	7.9	7.9	7.8	8.0	7.7	8.0	7.9	
	FINAL	8.0	7.9	7.8	7.8	7.8	7.9	8.1	
temp (C)	INITIAL	23	23	24	24	23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 6									
D.O. (mg/L)	INITIAL	8.5	8.6	8.5	8.6	8.5	8.5	8.5	
	FINAL	8.1	8.0	8.0	8.3	8.3	7.7	8.1	
pH (s.u.)	INITIAL	7.8	8.0	8.0	8.0	7.9	7.9	7.9	
	FINAL	7.8	7.9	7.7	7.9	7.8	7.8	8.2	
temp (C)	INITIAL	23	23	23	24	23	22	23	
	FINAL	25	25	25	25	25	25	25	
CONC: 8									
D.O. (mg/L)	INITIAL	8.3	8.5	8.4	8.7	8.5	8.6	8.4	
	FINAL	8.2	8.1	8.1	8.2	8.3	7.7	8.0	
pH (s.u.)	INITIAL	8.0	7.8	7.9	7.9	7.8	8.0	7.8	
	FINAL	7.9	8.0	7.6	7.6	7.7	7.6	7.9	
temp (C)	INITIAL	23	24	23	24	23	22	24	
	FINAL	25	25	25	25	25	25	25	
CONC: 100 %		A	A	A	B	B	C	C	
ALKALINITY (mg/L)		50			48		54		
HARDNESS (mg/L)		48			44		38		
CONDUCTIVITY (umhc		253			262		256		
CHLORINE (mg/L)		0.14			<0.05				

APPENDIX C

Fathead minnow raw data and statistics

Pimephales promelas

FATHEAD MINNOW

SURVIVAL DATA FOR LARVAL SURVIVAL AND GROWTH TEST (CHRONIC)

LAB #: K1405005	TEST START	DATE 5/20/14	TIME 1140
CLIENT: Arkadelphia	TEST END	DATE 5/27/14	TIME 1145
ANALYST: RH	AGE AND SOURCE OF MINNOWS		

		DAY(NUMBER SURVIVING)								SURVIVAL		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONTROL	A	10	10	10	10	10	10	10	9	90%		
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%	*96.0%*	*5.71*
MHS	D	10	10	9	9	9	9	9	9	90%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%	*100.0%*	
2.5%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%	*98.0%*	
3.4%	D	10	10	10	9	9	9	9	9	90%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	9	9	9	90%		
	C	10	10	10	10	10	10	10	10	100%	*98.0%*	
4.5%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%	*100.0%*	*0.00*
6%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%	*100.0%*	
8%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	10	10	10	100%		
ANALYST:		RH	RH	RH	RH	KR	KR	RH	RH			
DATE:		5/20/14	5/21/14	5/22/14	5/23/14	5/24/14	5/25/14	5/26/14	5/27/14			
TIME:		1140	1445	1100	1100	900	1100	850	1145			

CV= PERCENT COEFFICIENT OF VARIATION: STANDARD DEVIATION/MEAN * 100

REMARKS:

AA# K1405005, FATHEAD MINNOW SURVIVAL,CHRONIC,5-20-14
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.074

W = 0.760

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.

AA# K1405005, FATHEAD MINNOW SURVIVAL,CHRONIC,5-20-14
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. 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.

TITLE: AA# K1405005, FATHEAD MINNOW SURVIVAL,CHRONIC,5-20-14
FILE: C:\COPYTO~1\TOXSTAT\FHSURV~1.
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.9000	1.2490
1	CONTROL	2	1.0000	1.4120
1	CONTROL	3	1.0000	1.4120
1	CONTROL	4	0.9000	1.2490
1	CONTROL	5	1.0000	1.4120
2	2.5 % EFFLUENT	1	1.0000	1.4120
2	2.5 % EFFLUENT	2	1.0000	1.4120
2	2.5 % EFFLUENT	3	1.0000	1.4120
2	2.5 % EFFLUENT	4	1.0000	1.4120
2	2.5 % EFFLUENT	5	1.0000	1.4120
3	3.4 % EFFLUENT	1	1.0000	1.4120
3	3.4 % EFFLUENT	2	1.0000	1.4120
3	3.4 % EFFLUENT	3	1.0000	1.4120
3	3.4 % EFFLUENT	4	0.9000	1.2490
3	3.4 % EFFLUENT	5	1.0000	1.4120
4	4.5 % EFFLUENT	1	1.0000	1.4120
4	4.5 % EFFLUENT	2	0.9000	1.2490
4	4.5 % EFFLUENT	3	1.0000	1.4120
4	4.5 % EFFLUENT	4	1.0000	1.4120
4	4.5 % EFFLUENT	5	1.0000	1.4120
5	6 % EFFLUENT	1	1.0000	1.4120
5	6 % EFFLUENT	2	1.0000	1.4120
5	6 % EFFLUENT	3	1.0000	1.4120
5	6 % EFFLUENT	4	1.0000	1.4120
5	6 % EFFLUENT	5	1.0000	1.4120
6	8 % EFFLUENT	1	1.0000	1.4120
6	8 % EFFLUENT	2	1.0000	1.4120
6	8 % EFFLUENT	3	1.0000	1.4120
6	8 % EFFLUENT	4	1.0000	1.4120
6	8 % EFFLUENT	5	1.0000	1.4120

AA# K1405005, FATHEAD MINNOW SURVIVAL,CHRONIC,5-20-14
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. 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	1.347				
2	2.5 % EFFLUENT	1.412	32.50	16.00	5.00	
3	3.4 % EFFLUENT	1.379	30.00	16.00	5.00	
4	4.5 % EFFLUENT	1.379	30.00	16.00	5.00	
5	6 % EFFLUENT	1.412	32.50	16.00	5.00	
6	8 % EFFLUENT	1.412	32.50	16.00	5.00	

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

Pimephales promelas **FATHEAD MINNOW** TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K1405005
CLIENT:	Arkadelphia
ANALYSTS:	RH
SAMPLE ID:	

TEST DATES (BEGIN / END):	5/20/ - 27/14
WEIGHING DATE / TIME:	5/28/2014 1315
DRYING TEMP (DEGREES C):	60
DRYING TIME (HOURS):	24

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVAE (mg)	
CONTROL	A	1.02470	1.01872	0.00598	10	0.598	AVG DRY
	B	1.02166	1.01553	0.00613	10	0.613	WEIGHT (mg)
MHS	C	1.00867	1.00046	0.00821	10	0.821	0.679
	D	1.02183	1.01577	0.00606	10	0.606	CV
	E	1.01547	1.00789	0.00758	10	0.758	15.20
CONC:	A	1.01439	1.00673	0.00766	10	0.766	AVG DRY
	B	1.01844	1.01228	0.00616	10	0.616	WEIGHT (mg)
2.5%	C	1.01221	1.00610	0.00611	10	0.611	0.665
	D	1.01897	1.01213	0.00684	10	0.684	CV
	E	1.00704	1.00058	0.00646	10	0.646	
CONC:	A	1.00404	0.99827	0.00577	10	0.577	AVG DRY
	B	1.02206	1.01464	0.00742	10	0.742	WEIGHT (mg)
3.4%	C	1.02001	1.01258	0.00743	10	0.743	0.659
	D	1.01035	1.00472	0.00563	10	0.563	CV
	E	1.02184	1.01512	0.00672	10	0.672	
CONC:	A	1.01464	1.00947	0.00517	10	0.517	AVG DRY
	B	1.01288	1.00538	0.00750	10	0.750	WEIGHT (mg)
4.5%	C	1.02420	1.01800	0.00620	10	0.620	0.659
	D	1.02747	1.02094	0.00653	10	0.653	CV
	E	1.01750	1.00993	0.00757	10	0.757	
CONC:	A	1.00531	0.99941	0.00590	10	0.590	AVG DRY
	B	1.00655	0.99979	0.00676	10	0.676	WEIGHT (mg)
6%	C	1.01553	1.00999	0.00554	10	0.554	0.625
	D	1.00840	1.00110	0.00730	10	0.730	CV
	E	1.01976	1.01403	0.00573	10	0.573	12.03
CONC:	A	0.99452	0.98703	0.00749	10	0.749	AVG DRY
	B	1.01396	1.00911	0.00485	10	0.485	WEIGHT (mg)
8%	C	1.02321	1.01610	0.00711	10	0.711	0.656
	D	1.07151	1.06459	0.00692	10	0.692	CV
	E	1.00037	0.99392	0.00645	10	0.645	

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

AA# K1405005, FATHEAD MINNOW GROWTH CHRONIC, 5-20-14
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.193

W = 0.955

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.

AA# K1405005, FATHEAD MINNOW GROWTH CHRONIC, 5-20-14
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 1.29

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.

TITLE: AA# K1405005, FATHEAD MINNOW GROWTH CHRONIC, 5-20-14
FILE: C:\COPYTO~1\TOXSTAT\FHGROWTH.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.5980	0.5980
1	CONTROL	2	0.6130	0.6130
1	CONTROL	3	0.8210	0.8210
1	CONTROL	4	0.6060	0.6060
1	CONTROL	5	0.7580	0.7580
2	2.5 % EFFLUENT	1	0.7660	0.7660
2	2.5 % EFFLUENT	2	0.6160	0.6160
2	2.5 % EFFLUENT	3	0.6110	0.6110
2	2.5 % EFFLUENT	4	0.6840	0.6840
2	2.5 % EFFLUENT	5	0.6460	0.6460
3	3.4 % EFFLUENT	1	0.5770	0.5770
3	3.4 % EFFLUENT	2	0.7420	0.7420
3	3.4 % EFFLUENT	3	0.7430	0.7430
3	3.4 % EFFLUENT	4	0.5630	0.5630
3	3.4 % EFFLUENT	5	0.6720	0.6720
4	4.5 % EFFLUENT	1	0.5170	0.5170
4	4.5 % EFFLUENT	2	0.7500	0.7500
4	4.5 % EFFLUENT	3	0.6200	0.6200
4	4.5 % EFFLUENT	4	0.6530	0.6530
4	4.5 % EFFLUENT	5	0.7570	0.7570
5	6 % EFFLUENT	1	0.5900	0.5900
5	6 % EFFLUENT	2	0.6760	0.6760
5	6 % EFFLUENT	3	0.5540	0.5540
5	6 % EFFLUENT	4	0.7300	0.7300
5	6 % EFFLUENT	5	0.5730	0.5730
6	8 % EFFLUENT	1	0.7490	0.7490
6	8 % EFFLUENT	2	0.4850	0.4850
6	8 % EFFLUENT	3	0.7110	0.7110
6	8 % EFFLUENT	4	0.6920	0.6920
6	8 % EFFLUENT	5	0.6450	0.6450

AA# K1405005, FATHEAD MINNOW GROWTH CHRONIC, 5-20-14
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.008	0.002	0.200
Within (Error)	24	0.193	0.008	
Total	29	0.202		

Critical F value = 2.62 (0.05,5,24)
Since F < Critical F FAIL TO REJECT Ho: All equal

AA# K1405005, FATHEAD MINNOW GROWTH CHRONIC, 5-20-14
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. 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	0.679	0.679		
2	2.5 % EFFLUENT	0.665	0.665	0.257	
3	3.4 % EFFLUENT	0.659	0.659	0.349	
4	4.5 % EFFLUENT	0.659	0.659	0.349	
5	6 % EFFLUENT	0.625	0.625	0.962	
6	8 % EFFLUENT	0.656	0.656	0.402	

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

AA# K1405005, FATHEAD MINNOW GROWTH CHRONIC, 5-20-14
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. 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	2.5 % EFFLUENT	5	0.134	19.7	0.015
3	3.4 % EFFLUENT	5	0.134	19.7	0.020
4	4.5 % EFFLUENT	5	0.134	19.7	0.020
5	6 % EFFLUENT	5	0.134	19.7	0.055
6	8 % EFFLUENT	5	0.134	19.7	0.023

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

SURVIVAL AND REPRODUCTION TEST

Ceriodaphnia dubia

Discharger: Arkadelphia AFIN # 10-00463	Lab Number/s
Location: Outfall 001	*K1405005*
Date Sample Collected: 5-19/21/23 -14	

Analyst: RH	
Test Start - Date/Time: 5-20-14, 1115	
Test Stop - Date/Time: 5-27-14, 1045	

Conc	1	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
MHS	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	0	0	0	2	0	0	1	0	0	1	4	10	0.4	RH
	4	4	1	0	3	6	0	3	5	0	4	26	10	2.6	RH
	5	5	2	3	7	0	2	1	0	8	5	33	10	3.3	RH
	6	0	8	9	6	6	5	7	10	7	0	58	10	5.8	RH
	7	6	4	7	0	4	0	0	3	5	2	31	10	3.1	RH
	8														
	Total	15	15	19	18	16	7	12	18	20	12	152		Avg. =	15.2
														C.V. =	26.1

Conc	2	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
2.5%	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	2	0	0	0	0	0	0	0	2	0	4	10	0.4	RH
	4	0	0	6	3	4	5	0	0	2	6	26	10	2.6	RH
	5	3	4	5	5	6	0	7	0	2	1	33	10	3.3	RH
	6	5	4	1	0	0	3	1	5	0	0	19	10	1.9	RH
	7	2	2	8	6	5	4	6	6	4	6	49	10	4.9	RH
	8														
	Total	12	10	20	14	15	12	14	11	10	13	131		Avg. =	13.1
														C.V. =	22.6

Conc	3	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
3.4%	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	1	0	0	1	1	0	0	0	0	0	3	10	0.3	RH
	4	1	6	3	1	2	0	6	3	4	3	29	10	2.9	RH
	5	8	5	4	0	5	6	7	5	1	0	41	10	4.1	RH
	6	5	7	6	9	5	6	0	9	6	11	64	10	6.4	RH
	7	0	1	2	3	8	2	2	1	0	3	22	10	2.2	RH
	8														
	Total	15	19	15	14	21	14	15	18	11	17	159		Avg. =	15.9
														C.V. =	18.1

Conc	4	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
4.5%	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	2	0	0	0	1	1	0	0	0	3	7	10	0.7	RH
	4	0	6	5	0	0	1	2	5	7	3	29	10	2.9	RH
	5	8	2	7	4	0	5	6	3	0	7	42	10	4.2	RH
	6	5	9	0	6	8	8	0	2	8	1	47	10	4.7	RH
	7	3	2	0	2	7	3	0	1	5	1	24	10	2.4	RH
	8												10	0.0	
	Total	18	19	12	12	16	18	8	11	20	15	149		Avg. =	14.9
														C.V. =	26.7

Conc	5	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
6%	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	4	0	0	0	0	1	1	0	0	0	6	10	0.6	RH
	4	0	6	2	3	5	4	0	0	1	1	22	10	2.2	RH
	5	9	0	5	8	5	1	7	3	2	6	46	10	4.6	RH
	6	8	11	0	8	0	1	0	3	9	6	46	10	4.6	RH
	7	1	3	0	2	3	3	5	3	5	0	25	10	2.5	RH
	8												10	0.0	RH
	Total	22	20	7	21	13	10	13	9	17	13	145		Avg. =	14.5
														C.V. =	36.2

Conc	6	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
8%	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	2	0	1	1	0	0	0	3	0	0	7	10	0.7	RH
	4	3	0	5	0	6	4	6	3	7	2	36	10	3.6	RH
	5	3	9	0	0	0	7	5	4	6	4	38	10	3.8	RH
	6	0	1	5	6	5	0	2	0	3	4	26	10	2.6	RH
	7	2	9	2	7	0	6	5	4	0	5	40	10	4.0	RH
	8												10	0.0	RH
	Total	10	19	13	14	11	17	18	14	16	15	147		Avg. =	14.7
														C.V. =	19.8

AA # K1405005, C. DUBIA CHRONIC, REPRODUCION, 5-20-14
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

******** Shapiro - Wilk's Test is aborted ********

This test can not be performed because total number of replicates
is greater than 50.

Total number of replicates = 60

AA # K1405005, C. DUBIA CHRONIC, REPRODUCION, 5-20-14
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.39

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.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
2.5	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
3.4	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
4.5	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	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6	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	NUMBER OF 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
etween 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	2.5	10	0	
2	3.4	10	0	
3	4.5	10	0	
4	6	10	0	
5	8	10	0	

TITLE: AA # K1405005, C. DUBIA CHRONIC, REPRODUCION, 5-20-14
FILE: C:\COPYTO~1\TOXSTAT\C.DUB
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	15.0000	15.0000
1	CONTROL	2	15.0000	15.0000
1	CONTROL	3	19.0000	19.0000
1	CONTROL	4	18.0000	18.0000
1	CONTROL	5	16.0000	16.0000
1	CONTROL	6	7.0000	7.0000
1	CONTROL	7	12.0000	12.0000
1	CONTROL	8	18.0000	18.0000
1	CONTROL	9	20.0000	20.0000
1	CONTROL	10	12.0000	12.0000
2	2.5 % EFFLUENT	1	12.0000	12.0000
2	2.5 % EFFLUENT	2	10.0000	10.0000
2	2.5 % EFFLUENT	3	20.0000	20.0000
2	2.5 % EFFLUENT	4	14.0000	14.0000
2	2.5 % EFFLUENT	5	15.0000	15.0000
2	2.5 % EFFLUENT	6	12.0000	12.0000
2	2.5 % EFFLUENT	7	14.0000	14.0000
2	2.5 % EFFLUENT	8	11.0000	11.0000
2	2.5 % EFFLUENT	9	10.0000	10.0000
2	2.5 % EFFLUENT	10	13.0000	13.0000
3	3.4 % EFFLUENT	1	15.0000	15.0000
3	3.4 % EFFLUENT	2	19.0000	19.0000
3	3.4 % EFFLUENT	3	15.0000	15.0000
3	3.4 % EFFLUENT	4	14.0000	14.0000
3	3.4 % EFFLUENT	5	21.0000	21.0000
3	3.4 % EFFLUENT	6	14.0000	14.0000
3	3.4 % EFFLUENT	7	15.0000	15.0000
3	3.4 % EFFLUENT	8	18.0000	18.0000
3	3.4 % EFFLUENT	9	11.0000	11.0000
3	3.4 % EFFLUENT	10	17.0000	17.0000
4	4.5 % EFFLUENT	1	18.0000	18.0000
4	4.5 % EFFLUENT	2	19.0000	19.0000
4	4.5 % EFFLUENT	3	12.0000	12.0000
4	4.5 % EFFLUENT	4	12.0000	12.0000
4	4.5 % EFFLUENT	5	16.0000	16.0000
4	4.5 % EFFLUENT	6	18.0000	18.0000
4	4.5 % EFFLUENT	7	8.0000	8.0000
4	4.5 % EFFLUENT	8	11.0000	11.0000

4	4.5 % EFFLUENT	9	20.0000	20.0000
4	4.5 % EFFLUENT	10	15.0000	15.0000
5	6 % EFFLUENT	1	22.0000	22.0000
5	6 % EFFLUENT	2	20.0000	20.0000
5	6 % EFFLUENT	3	7.0000	7.0000
5	6 % EFFLUENT	4	21.0000	21.0000
5	6 % EFFLUENT	5	13.0000	13.0000
5	6 % EFFLUENT	6	10.0000	10.0000
5	6 % EFFLUENT	7	13.0000	13.0000
5	6 % EFFLUENT	8	9.0000	9.0000
5	6 % EFFLUENT	9	17.0000	17.0000
5	6 % EFFLUENT	10	13.0000	13.0000
6	8 % EFFLUENT	1	10.0000	10.0000
6	8 % EFFLUENT	2	19.0000	19.0000
6	8 % EFFLUENT	3	13.0000	13.0000
6	8 % EFFLUENT	4	14.0000	14.0000
6	8 % EFFLUENT	5	11.0000	11.0000
6	8 % EFFLUENT	6	17.0000	17.0000
6	8 % EFFLUENT	7	18.0000	18.0000
6	8 % EFFLUENT	8	14.0000	14.0000
6	8 % EFFLUENT	9	16.0000	16.0000
6	8 % EFFLUENT	10	15.0000	15.0000

AA # K1405005, C. DUBIA CHRONIC, REPRODUCION, 5-20-14
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	43.283	8.657	0.613
Within (Error)	54	762.900	14.128	
Total	59	806.183		

Critical F value = 2.45 (0.05,5,40)
Since F < Critical F FAIL TO REJECT Ho: All equal

AA # K1405005, C. DUBIA CHRONIC, REPRODUCION, 5-20-14
File: C:\COPYTO~1\TOXSTAT\C.DUB 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	15.200	15.200		
2	2.5 % EFFLUENT	13.100	13.100	1.249	
3	3.4 % EFFLUENT	15.900	15.900	-0.416	
4	4.5 % EFFLUENT	14.900	14.900	0.178	
5	6 % EFFLUENT	14.500	14.500	0.416	
6	8 % EFFLUENT	14.700	14.700	0.297	

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

AA # K1405005, C. DUBIA CHRONIC, REPRODUCION, 5-20-14
File: C:\COPYTO~1\TOXSTAT\C.DUB 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	2.5 % EFFLUENT	10	3.883	25.5	2.100
3	3.4 % EFFLUENT	10	3.883	25.5	-0.700
4	4.5 % EFFLUENT	10	3.883	25.5	0.300
5	6 % EFFLUENT	10	3.883	25.5	0.700
6	8 % EFFLUENT	10	3.883	25.5	0.500

APPENDIX E

Organism History

AQUATOX, INC.

416 TWIN POINTS ROAD
HOT SPRINGS, ARKANSAS 71913
501-520-0560

TEST ORGANISM HISTORY

DATE SHIPPED 5/20/14 **CLIENT** AR Analytical
Regan

Purchase Order #: _____

SPECIES: **Pimephales promelas**

Quantity Shipped: 600

Age: Hatched 5/18/14 1500

Brood Stock Source: **Anderson Farms, AR**

Culture Water: **Groundwater** 160

Hardness (Mg/l CaCO3): _____

Dissolved Oxygen (Mg/1): 8.2

Temperature (°C): 25.1°C

Feeding: Artemia

Comments: _____

Shipped Via: **Federal Express** **UPS Overnight** **Shuttle**

Packaged By: _____

Bill Hall Printers 3171

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel:970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 11/25/2013

SPECIES: *Ceriodaphnia dubia*

AGE: > 3 day

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, *Selenastrum* sp.

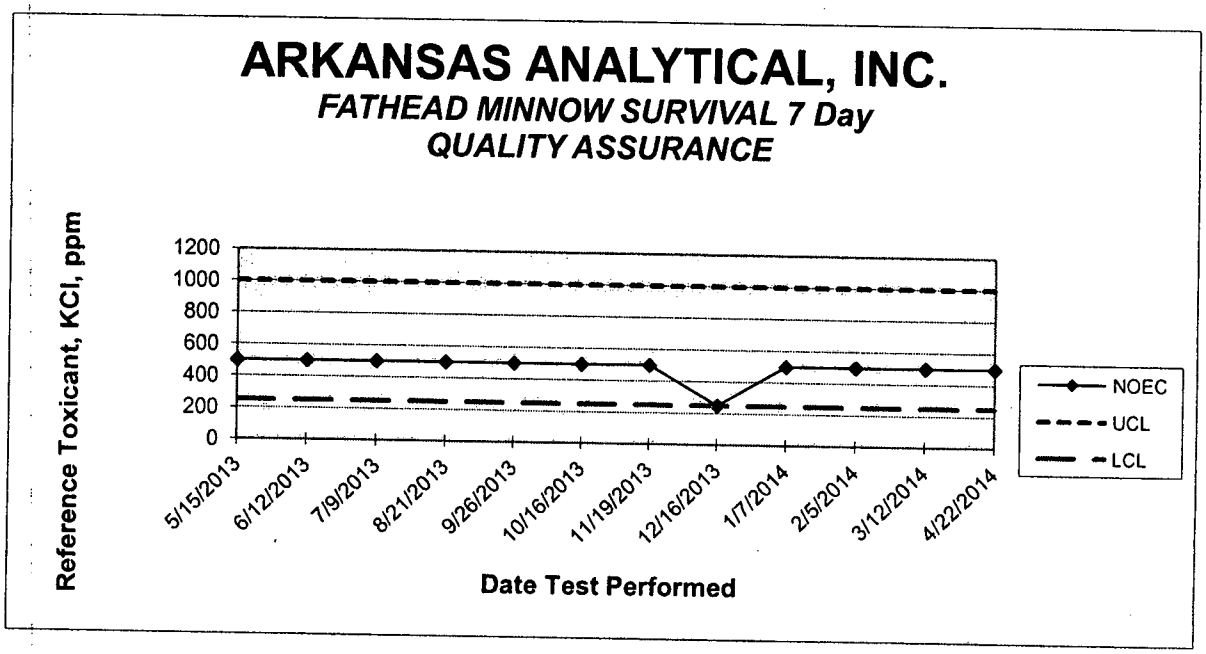
Water Chemistry Record:	Current	Range
TEMPERATURE:	22°C	22-26°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	94 mg/l	76-130 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	65 mg/l	65-100 mg/l
pH:	7.98	7.50-8.20

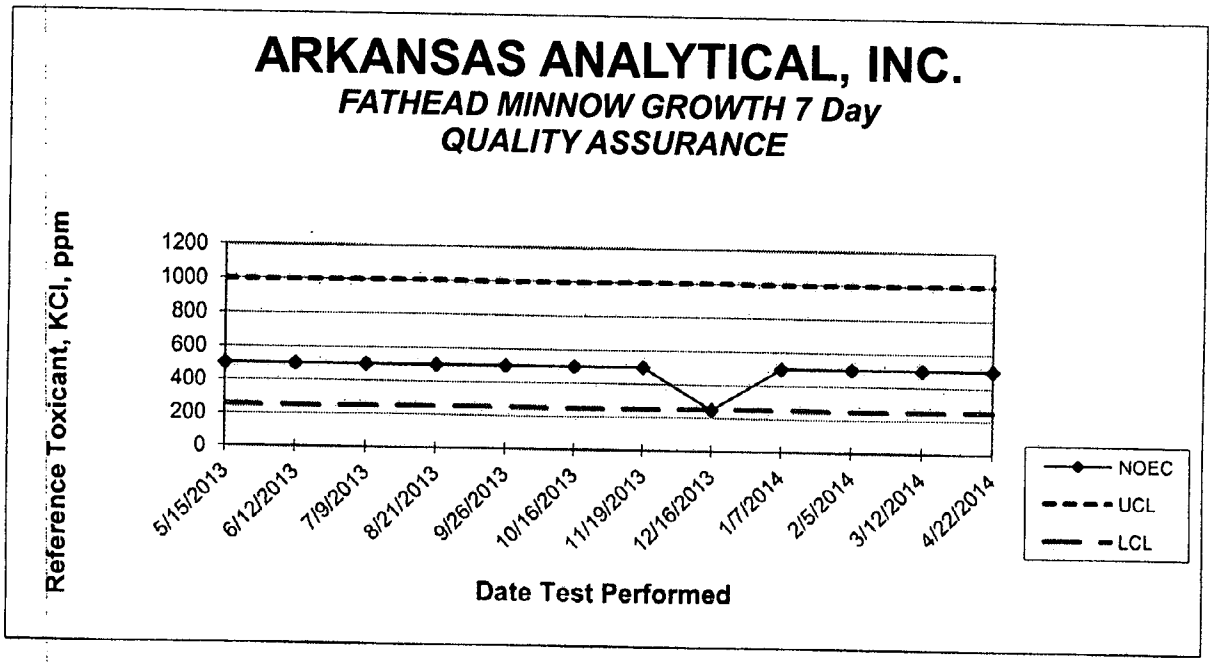
Comments:

Facility Supervisor

APPENDIX F

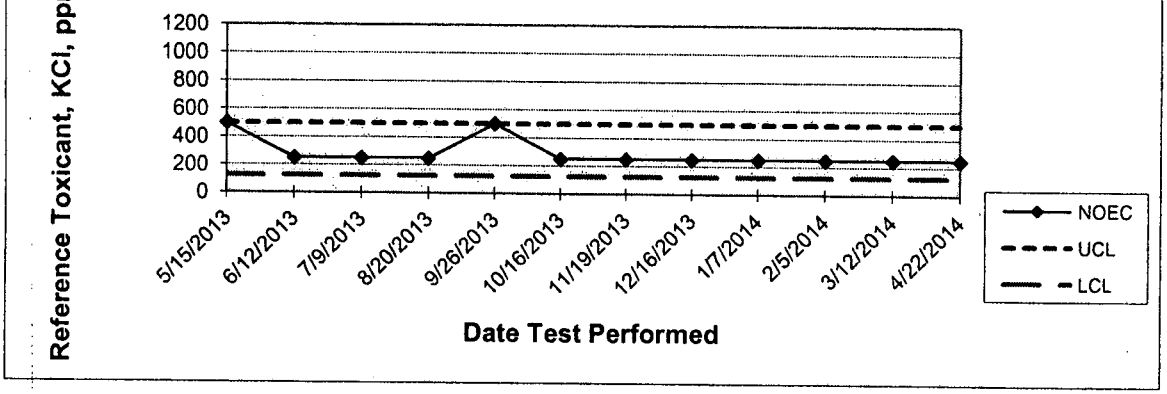
Quality Assurance Charts


ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL 7 Day
QUALITY ASSURANCE
Reference Toxicant, KCl, ppm
1200
1000
800
600
400
200
0
5/15/2013
6/12/2013
7/9/2013
8/21/2013
9/26/2013
10/16/2013
11/19/2013
12/16/2013
1/7/2014
2/5/2014
3/12/2014
4/22/2014
Date Test Performed
NOEC
UCL
LCL


ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH 7 Day
QUALITY ASSURANCE
Reference Toxicant, KCl, ppm
1200
1000
800
600
400
200
0
5/15/2013
6/12/2013
7/9/2013
8/21/2013
9/26/2013
10/16/2013
11/19/2013
12/16/2013
1/7/2014
2/5/2014
3/12/2014
4/22/2014
Date Test Performed
NOEC
UCL
LCL

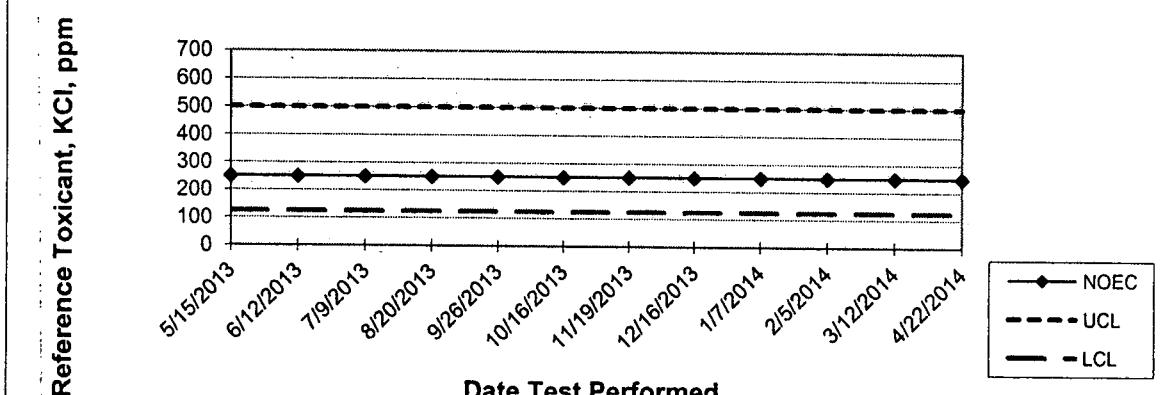
ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE



Arkadelphia Water Co.
700 Clay Street
P.O. Box 495
Arkadelphia, AR 71923

Arkansas Department of Environmental Quality
NPDES Enforcement Section
5301 NOrthshore Drive
North Little Rock, AR 72118-5317