



January 24, 2014

Ms. Sara Clem
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

RE: Biomonitoring for NPDES Permit No. AR0020605

Dear Ms. Clem:

Enclosed please find a copy of the results from the most recent Chronic Biomonitoring performed on wastewater samples from our system. The samples were submitted to Sorrels Research Associates in October 2014. Our DMR's for the biomonitoring are included as well.

If there are questions, please contact me.

Sincerely,

Brenda Gills
Utilities Manager

Enclosure



**SORRELLS RESEARCH
LABORATORY AND FIELD SERVICES**

WEF



CHEMISTS
ECOLOGISTS
CONSULTANTS
PLANNERS

8100 National Drive
Little Rock, Arkansas 72209

Phone 501-562-8139
Fax 501-562-7025
Toll Free 1-800-331-8139

LABORATORY ANALYSIS

Date of Report: October 29, 2014
Date Received: October 6, 2014

Date of Report: October 29, 2014
Date Received: October 6, 2014

For: ARKADELPHIA, CITY OF
P.O. BOX 495
700 CLAY STREET
ARKADELPHIA, AR 71923-

Job: NPDES BIO-MONITORING PERMIT NO: AR0020605

Sample From: OUTFALL 001 / BIO-MONITORING

ANALYTE	REFERENCE METHOD	RESULT	UNITS	METHOD
Bioassay, Ceriodaphnia dubia, chronic	=	8.000	Rp_NOEC, %	1002.0
Bioassay, Fathead minnow, chronic	=	8.000	Gr_NOEC, %	1000.0
Bioassay, Ceriodaphnia dubia, chronic	=	8.000	Sv_NOEC, %	1002.0
Bioassay, Fathead minnow, chronic	=	8.000	Sv_NOEC, %	1000.0

STANDARD METHODS, 20TH ED.; EPA METHODS, 3RD ED.

Collected by:

DAVID THOMASON on 10/06/14 at 8:00

Analysis by:

SEE ATTACHED QUALITY ASSURANCE PAGE.

Sample preservation and Laboratory Analysis conducted according to EPA 40 CFR Part 136. Test/Analyst/Time/Coeff./Var./ QA plan filed with ADPC&E.

Includes 10% replication and 10% recovery studies by random selection.

Instruments maintained and calibrated and records kept.

See Attached.

Copies to:

MS. KRISTY DANIEL

700 CLAY STREET
ARKADELPHIA, AR 71923-

Laboratory Number: 17522.0001B TKR Reviewed By: K. E. Sorrells, M.S. []



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QUALITY ASSURANCE

October 6, 2014

The following QA represents SRA's Quality Assurance values for this report.

ANALYTE	DATE	ANALYST	BEG. DATE	BEG. TIME	FIN. DATE	FIN. TIME	S.D. %	SPK. REC.	#IN BAT
Bioassay, Ceriodaphnia du	AA	AA	10/07/14	1145	10/14/14	1000	0.00	0.0	1
Bioassay, Fathead minnow,	AA	AA	10/07/14	1400	10/14/14	1030	0.00	0.0	1

Field PH/TEMP/D.O. Sampler or Courier/ at time of sampling or pick up
Sample preservation and laboratory analysis conducted according to EPA
40 CFR Part 136 -- TEST/ANALYST/TIME/COEF. VAR.* QA PLAN filed with
ADPC&E. Include replication.

KES = K. E. Sorrells
JBS = James B. Sorrells
CAS = Cecil A. Sorrells
MKM = Mark Kyle McKenzie

KESII = K. E. Sorrells, II
TJS = Todd J. Sanders
JHD = J. Henry Dodson

Laboratory Number: 17522.0001B TKR

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

D. Thomason @ City of Arkadelphia, Co

TURN AROUND TIME

RUSH 24HR. 48 HR.

5 DAY REG

OTHER _____

FOR LAB/OFFICE USE ONLY

LAB # 17522-0001B

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

PROJECT NO:

SAMPLER(S) NAME: (PRINT)

110913K2

Arkadelphia Water

David Thomason

SAMPLE NO:	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP.	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O(P)	PRESERVATIVE	
<i>0001</i>	<i>04t fall 001</i>	<i>10-5-14 0800</i>	<i>10-6-14 0800</i>	<i>comp</i>						<i>Plastic/None</i>	<i>Chronic RIO</i>

METHOD OF SHIPMENT (CIRCLE)

FED EX WALK IN SRA UPS OTHER

FIELD CALIBRATION RECORD

pH 7
pH 4
pH 10
D.O

NOTES/COMMENTS/OBSERVATIONS

*Temp SRA
3.6°C*

TYPE OF SAMPLE(S): (CIRCLE)

WATER SOIL W/W SLUDGE OTHER

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

RELINQUISHED BY: *David Thomason*

DATE/TIME: *10-6-14 1030*

RECEIVED BY(LAB): *[Signature]*

DATE/TIME: *10-6-14 1030*

SURRELLS 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 # 17522.0002B

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

110913K2

NAME OF COMPANY, CITY, OR PROJECT

PROJECT NO:

SAMPLER(S) NAME: (PRINT)

Arkadelphia Water

David Thomason

SAMPLE NO:	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O(P)	PRESERVATIVE	
	<u>06T Fall 001</u>	<u>10-8-14 0800</u>	<u>10-8-14 0800</u>	<u>Comp</u>						<u>plastic/None</u>	<u>Chronic B10</u>

METHOD OF SHIPMENT (CIRCLE)

FED EX WALK IN SRA UPS OTHER

FIELD CALIBRATION RECORD

pH 7
pH 4
pH 10
D.O

NOTES/COMMENTS/OBSERVATIONS

Temp @ Lab 6°C

TYPE OF SAMPLE(S): (CIRCLE)

WATER SOIL W/W SLUDGE OTHER

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

RELINQUISHED BY: David Thomason

DATE/TIME: 10-8-14/9:30

RECEIVED BY LAB:

Sammy Riddle

DATE/TIME: 10-8-14/9:3

JORNELLS 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 # 17522.0003B
 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: _____ PROJECT NO: _____ SAMPLER(S) NAME: (PRINT): _____

Arkadelphia Water

David Thomason

SAMPLE NO:	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O(P)	PRESERVATIVE	
	<u>outfall 001</u>	<u>10-9-14 0800</u>	<u>10-10-14 0800</u>	<u>comp</u>						<u>Plastic/None</u>	<u>Chronic BTO</u>

METHOD OF SHIPMENT (CIRCLE) FED EX <u>WALK IN</u> SRA UPS OTHER	FIELD CALIBRATION RECORD pH 7 pH 4 pH 10 D.O	NOTES/COMMENTS/OBSERVATIONS <u>Temp @ Lab 4°C</u>
TYPE OF SAMPLE(S): (CIRCLE) WATER SOIL <u>W/W</u> SLUDGE OTHER		FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY: David Thomason DATE/TIME: 10-10-14 10:02 RECEIVED BY: Jammy Riddle DATE/TIME: 10:02 10-10-14

Arkansas Analytical, Inc.

Toxicity Test Results

City of Arkadelphia
Permit Number: AR0020605
AFIN # 10-00463
Second Half 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 K1410001

Wednesday, October 15, 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. However, in a waiver issued on August 21, 2013, the testing was reduced to semi annual for both organisms. The permit issued to the City of Arkadelphia expires May 31, 2017. These results represent the second 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:	10-5-14, 0800	10-6-14, 0800
Sample #2:	10-7-14, 0800	10-8-14, 0800
Sample #3:	10-9-14, 0800	10-10-14, 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:	10-6-14, 1549	1
Sample #2:	10-8-14, 1253	4
Sample #3:	10-10-14, 1546	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	16.3	X	
At least 60% of surviving females should have produced 3 broods	80%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	25.6%	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	0.573	X	
The percent coefficient of variation between replicates must be 40% or less for growth	7.51%	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

<i>Ceriodaphnia dubia</i> 9/30/14 – 10/7/14		<i>Pimephales promelas</i> 9/30/14 – 10/7/14	
NOEC Survival:	500 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	1000 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

<i>Ceriodaphnia dubia</i>		<i>Pimephales promelas</i>	
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)	15.1	%CV survival (critical dilution)	0%
%CV Reproduction (critical dilution)	25.8%	Mean dry weight (critical dilution) in milligrams	0.584
		%CV growth (critical dilution)	6.19%
PMSD Reproduction	24.3%	PMSD Growth	14.4%

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 / Chris Turney

Reviewed by:

Tracy Bounds (signature)

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:	10-5-14, 0800	10-6-14, 0800
Sample #2:	10-7-14, 0800	10-8-14, 0800
Sample #3:	10-9-14, 0800	10-10-14, 0800

Test initiated (date, time): 10-7-14, 1400 Test terminated (date, time): 10-14-14, 1030

Dilution water used: Moderately Hard Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

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

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Effluent Conc %	Average Dry Weight in milligrams in replicate chambers						Mean Dry Weight	CV%
	A	B	C	D	E			
0%	0.617	0.616	0.525	0.569	0.537		0.573	7.51%
2.5%	0.664	0.568	0.527	0.482	0.617		0.572	
3.4%	0.646	0.557	0.558	0.602	0.519		0.576	
4.5%	0.579	0.541	0.648	0.567	0.583		0.584	
6%	0.586	0.542	0.562	0.592	0.638		0.584	6.19%
8%	0.501	0.542	0.651	0.615	0.462		0.554	

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)= 7.51 %

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: 10-6-14, 0800	10-5-14, 0800	10-6-14, 0800
Sample #2: 10-8-14, 0800	10-7-14, 0800	10-8-14, 0800
Sample #3: 10-10-14, 0800	10-9-14, 0800	10-10-14, 0800

Test initiated (date, time): 10-7-14, 1145 Test terminated (date, time): 10-14-14, 1000

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	24	18	14	15	13	20
B	20	16	11	7	20	17
C	15	7	10	16	18	19
D	15	17	20	10	10	15
E	11	14	14	20	9	16
F	15	14	12	18	17	10
G	18	16	15	13	12	12
H	19	10	17	13	19	10
I	10	9	8	11	18	20
J	16	15	10	13	15	14
Mean	16.3	13.6	13.1	13.6	15.1	15.3
Mean/surviving female	16.3	13.6	13.1	13.6	15.1	15.3
CV%*	25.6				25.8	

X=Dead Adult; M= Male (Not considered in statistics)

*Coefficient of Variation = standard deviation/ mean * 100; CV% calculation based on young per surviving female

PERMITTEE SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
 AND EFFECTS OF *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:

YES 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:

YES 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)= 25.8 %

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

David Thomason City of Arkadelphia, Co

TURN AROUND TIME
 RUSH 24HR. 48 HR.
 5 DAY REG
 OTHER _____

FOR LAB/OFFICE USE ONLY

LAB # 17522-0001

CLIENT # _____

P.O.# _____

STANDARD METHODS PRESERVATION PER EPA 40 CFR
 C4= 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

PROJECT NO:

SAMPLER(S) NAME: (PRINT)

Arkadelphia water

David Thomason

SAMPLE NO.	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O (P)	PRESERVATIVE	
001	OUT Fall 001	10-5-14 0800	10-6-14 0800	COMP						Plastic/None	K14 10001-A Chronic BIO

Samples Received at Arkansas Analytical
 Relinquished By: C. Sowers
 Date/Time: 10-10-14 1549
 Received By: Amanda Bush

Custody Seals:	Yes	No
Containers Correct:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
COC/Labels Agree:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Preservation Confirmed:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> exit
Received on Ice:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Temperature on Receipt:	<u>1°C</u>	<u>H17H2</u>

METHOD OF SHIPMENT (CIRCLE)	FIELD CALIBRATION RECORD	NOTES/COMMENTS/OBSERVATIONS
FED EX <u>WALK IN</u> SRA UPS OTHER	pH 7 pH 4 pH 10 D.O	<u>Temp @ SRA 3.6°C</u>
TYPE OF SAMPLE(S): (CIRCLE)		
WATER SOIL <u>W/W</u> SLUDGE OTHER		FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY: David Thomason DATE/TIME: 10-6-14 1030 RECEIVED BY: [Signature] DATE/TIME: 10-6-14 1030

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 # 17522.0002B
 CLIENT # 1144
 P.O.# _____

STANDARD METHODS PRESERVATION PER EPA 40 CFR
 C4= 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

11091312

NAME OF COMPANY, CITY, OR PROJECT PROJECT NO: SAMPLER(S) NAME: (PRINT)

Arkadelphia Water

David Thomason

SAMPLE NO.	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O (P)	PRESERVATIVE	
	<u>Out Fall 001</u>	<u>10-7-14 5800</u>	<u>10-8-14 0800</u>	<u>Comp</u>						<u>Plastic/None</u>	<u>K1410001-B</u> <u>Chronio Bio</u>

Samples Received at Arkansas Analytical
 Relinquished By: Cecil Sorrells
 Date/Time: 10-8-14, 1253
 Received By: Sydney James

Yes	No
Custody Seals: <input checked="" type="checkbox"/>	<input type="checkbox"/>
Containers Correct: <input checked="" type="checkbox"/>	<input type="checkbox"/>
COC/Labels Agree: <input checked="" type="checkbox"/>	<input type="checkbox"/>
Received on Ice: <input checked="" type="checkbox"/>	<input type="checkbox"/>
Temperature on Receipt: <input checked="" type="checkbox"/>	4°C
Temperature Gun ID: HHT # 2	

METHOD OF SHIPMENT (CIRCLE)	FIELD CALIBRATION RECORD	NOTES/COMMENTS/OBSERVATIONS
FED EX <u>WALK IN</u> SRA UPS OTHER	pH 7 pH 4 pH 10 D.O	<u>Temp @ Lab 6°C</u>
TYPE OF SAMPLE(S): (CIRCLE)		
WATER SOIL <u>W/W</u> SLUDGE OTHER		FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY: David Thomason DATE/TIME: 10-8-14/930 RECEIVED BY: Sammy Riddle DATE/TIME: 10-8-14/938

SORRELLO 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 # 17522-0003B
 CLIENT # 1144
 P.O.# _____

STANDARD METHODS PRESERVATION PER EPA 40 CFR
 C4= 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

110913K2

NAME OF COMPANY, CITY, OR PROJECT: _____ PROJECT NO: _____ SAMPLER(S) NAME: (PRINT) _____

Arkadelphia Water

David Thomason

SAMPLE NO.	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O(P)	PRESERVATIVE	
	<u>Outfall 001</u>	<u>10-9-14 8:00</u>	<u>10-10-14 0800</u>	<u>Comp</u>						<u>Plastic/None</u>	<u>K141000.C</u> <u>Chronic BTO</u>
METHOD OF SHIPMENT (CIRCLE)		FIELD CALIBRATION RECORD									
FED EX <u>WALK IN</u> SRA UPS OTHER		pH 7									
		pH 4									
		pH 10									
		D.O									
TYPE OF SAMPLE(S): (CIRCLE)											
WATER SOIL <u>W/W</u> SLUDGE OTHER		FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT									

Samples Received at Arkansas Analytical Relinquished By: E. Sorrells
 Date/Time: 10-10-14 1546
 Received By: Amanda Fabush

Custody Seals:	Yes	No
Containers Correct:	<input checked="" type="checkbox"/>	
COC/Labels Agree:	<input checked="" type="checkbox"/>	
Received on Ice:	<input checked="" type="checkbox"/>	
Temperature on Receipt:	4°C	
Temperature Gun ID:	HHT #2	

Temp @ Lab 4°C

RELINQUISHED BY: David Thomason DATE/TIME: 10-10-14 10:02 RECEIVED BY: Jammy Riddle DATE/TIME: 10:02 10-10-14

APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Fathead Minnow

Lab # / Sample ID K1410001

Test Start (Date/Time) 10-7-14

1400

Client Ackadelphia

Test End (Date/Time) 10-14-14

1030

Day of Test

		1	2	3	4	5	6	7	notes
Control	<u>1415</u>	10-7	10-8	10-9	10-10	10-11	10-12	10-13	
D.O. (mg/L)	INITIAL	8.7	8.8	8.8	8.8	8.8	8.7	8.7	
	FINAL	8.5	8.5	7.9	8.3	8.2	8.3	8.2	
pH (s.u.)	INITIAL	7.8	8.1	8.0	8.1	7.6	8.1	8.1	
	FINAL	7.8	8.0	7.5	7.5	7.5	8.1	8.3	
temp (C)	INITIAL	22	22	23	21	22	21.4	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		58							
HARDNESS (mg/L)		84							
CONDUCTIVITY (umho)		385							
CHLORINE (mg/L)		<0.05							
CONC:	<u>2.5</u>								
D.O. (mg/L)	INITIAL	8.7	9.0	8.8	8.8	8.8	8.7	8.7	
	FINAL	8.5	8.5	7.9	8.5	8.1	8.3	8.2	
pH (s.u.)	INITIAL	7.8	8.1	8.0	8.0	7.7	8.2	8.1	
	FINAL	7.6	8.2	7.5	7.6	7.8	8.0	8.3	
temp (C)	INITIAL	22	22	23	21	22	21.5	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	<u>3.4</u>								
D.O. (mg/L)	INITIAL	8.7	9.0	8.7	8.7	8.8	8.6	8.7	
	FINAL	8.5	8.5	7.7	8.3	8.0	8.1	8.1	
pH (mg/L)	INITIAL	7.8	8.0	7.9	7.9	7.9	8.3	8.0	
	FINAL	7.6	8.1	7.6	7.7	7.9	8.0	8.1	
temp (C)	INITIAL	22	22	23	21	22	21.5	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	<u>4.5</u>								
D.O. (mg/L)	INITIAL	8.6	8.8	8.8	8.8	8.8	8.6	8.7	
	FINAL	8.3	8.5	7.9	8.2	8.0	8.1	8.0	
pH (s.u.)	INITIAL	7.8	8.1	7.9	7.9	7.8	8.2	7.8	
	FINAL	7.6	8.0	7.6	7.7	8.1	8.0	8.1	
temp (C)	INITIAL	22	22	23	21	22	21.6	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	<u>6</u>								
D.O. (mg/L)	INITIAL	8.6	9.0	8.8	8.8	8.8	8.6	8.7	
	FINAL	8.4	8.5	7.9	8.2	8.2	8.1	8.0	
pH (s.u.)	INITIAL	7.7	8.0	7.8	7.9	7.9	8.3	7.8	
	FINAL	7.7	8.1	7.6	7.8	8.1	8.0	8.0	
temp (C)	INITIAL	22	22	22	21	22	21.8	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	<u>8</u>								
D.O. (mg/L)	INITIAL	8.6	8.9	8.8	8.8	8.8	8.6	8.7	
	FINAL	8.3	8.5	7.7	8.2	8.2	8.1	8.1	
pH (s.u.)	INITIAL	7.7	8.0	8.0	7.9	7.7	8.3	7.9	
	FINAL	7.7	8.0	7.7	7.8	8.2	8.0	7.9	
temp (C)	INITIAL	22	22	22	21	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	<u>100 %</u>								
ALKALINITY (mg/L)		70			48		52		
HARDNESS (mg/L)		46			56		52		
CONDUCTIVITY (umho)		307			292		293		
CHLORINE (mg/L)		0.10			<0.05		<0.05		

U.S. ENVIRONMENTAL CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING						Ceriodaphnia Dubia			
Lab # / Sample ID		K1410001		Test Start (Date/Time)		10-7-14		1145	
Client:		Arkadelphia		Test End (Date/Time)		10-14-14		1000	
		Day of Test							
		1	2	3	4	5	6	7	notes
Control		10-7	10-8	10-9	10-10	10-11	10-12	10-13	
D.O. (mg/L)	INITIAL	8.7	8.8	8.8	8.8	8.8	8.7	8.7	
	FINAL	8.6	8.3	8.3	8.3	8.5	8.3	8.2	
pH (s.u.)	INITIAL	7.8	8.1	8.0	8.1	7.6	8.1	8.1	
	FINAL	7.7	7.8	7.7	8.0	7.9	8.2	8.0	
temp (C)	INITIAL	22	22	23	21	22	21.4	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		58							
HARDNESS (mg/L)		84							
CONDUCTIVITY (umho)		385							
CHLORINE (mg/L)		0.05							
CONC: 2.5									
D.O. (mg/L)	INITIAL	8.7	9.0	8.8	8.8	8.8	8.7	8.7	
	FINAL	8.4	8.4	8.5	8.3	8.4	8.3	8.2	
pH (s.u.)	INITIAL	7.8	8.1	8.0	8.0	7.7	8.2	8.1	
	FINAL	7.8	7.8	7.7	8.1	7.8	8.2	8.0	
temp (C)	INITIAL	22	22	23	21	22	21.5	22	
	FINAL	25	25	25	25	25	25	25	
CONC: 3.4									
D.O. (mg/L)	INITIAL	8.7	9.0	8.7	8.7	8.8	8.6	8.7	
	FINAL	8.4	8.3	8.3	8.2	8.4	8.3	8.3	
pH (mg/L)	INITIAL	7.8	8.0	7.9	7.9	7.9	8.3	8.0	
	FINAL	7.8	7.9	7.9	8.0	7.9	8.2	8.0	
temp (C)	INITIAL	22	22	23	21	22	21.5	22	
	FINAL	25	25	25	25	25	25	25	
CONC: 4.5									
D.O. (mg/L)	INITIAL	8.6	8.8	8.8	8.8	8.8	8.6	8.7	
	FINAL	8.5	8.3	8.4	8.3	8.4	8.2	8.3	
pH (s.u.)	INITIAL	7.8	8.1	7.9	7.9	7.8	8.2	7.8	
	FINAL	7.9	7.9	7.9	7.8	7.8	8.1	7.9	
temp (C)	INITIAL	22	22	23	21	22	21.6	22	
	FINAL	25	25	25	25	25	25	25	
CONC: 6									
D.O. (mg/L)	INITIAL	8.6	9.0	8.8	8.8	8.8	8.6	8.7	
	FINAL	8.4	8.3	8.4	8.3	8.4	8.2	8.3	
pH (s.u.)	INITIAL	7.7	8.0	7.8	7.9	7.8	8.3	7.8	
	FINAL	7.9	8.0	8.0	7.9	7.9	8.1	7.9	
temp (C)	INITIAL	22	22	22	21	22	21.8	22	
	FINAL	25	25	25	25	25	25	25	
CONC: 8									
D.O. (mg/L)	INITIAL	8.6	8.9	8.8	8.8	8.8	8.6	8.7	
	FINAL	8.5	8.3	8.3	8.4	8.4	8.2	8.2	
pH (s.u.)	INITIAL	7.7	8.0	8.0	7.9	7.9	8.3	7.9	
	FINAL	8.0	7.9	8.1	7.8	7.8	8.2	7.9	
temp (C)	INITIAL	22	22	22	21	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC: 100 %									
ALKALINITY (mg/L)		70			48		52		
HARDNESS (mg/L)		46			56		52		
CONDUCTIVITY (umho)		302			292		293		
CHLORINE (mg/L)		0.10			0.05		0.05		

SL 10-12-14

APPENDIX C

Fathead minnow raw data and statistics

ADP# Pimephales promelas

FATHEAD MINNOW

SRV SURVIVAL DATA FOR LARVAL SURVIVAL AND GROWTH TEST (CHRONIC)

TEST #	LAB #	TEST START	DATE	TIME							
1	K1410001	10/7/14	10/7/14	1400							
CLIENT:	Arkadelphia	TEST END	DATE	TIME							
			10/14/14	1030							
ANALYST:	RH / CT										
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	100%	96.0%	5.71
MHS	B	10	9	9	9	9	9	9	90%		
	C	10	10	10	9	9	9	9	90%		
	D	10	10	10	10	10	10	10	100%		
	E	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	100%	100.0%	
2.5%	B	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	100%		
	D	10	10	10	10	10	10	10	100%		
	E	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	100%	100.0%	
3.4%	B	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	100%		
	D	10	10	10	10	10	10	10	100%		
	E	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	100%	98.0%	
4.5%	B	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	100%		
	D	10	9	9	9	9	9	9	90%		
	E	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	100%	100.0%	0.00
6%	B	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	100%		
	D	10	10	10	10	10	10	10	100%		
	E	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	100%	98.0%	
8%	B	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	100%		
	D	10	10	10	10	10	10	10	100%		
	E	10	9	9	9	9	9	9	90%		
ANALYST:		RH	RH	RH	RH	CT	CT	RH	RH		
DATE:		10/7/14	10/8/14	10/9/14	10/10/14	10/11/14	10/12/14	10/13/14	10/14/14		
TIME:		1400	1000	1015	1030	1150	845	1130	1030		

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

REMARKS:

AA# K1410001, FATHEAD MINNOW SURVIVAL, CHRONIC, 10-7-14

File: C:\COPYTO71\TOXSTAT\FHSURV~1 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

$D = 0.074$

$V = 0.760$

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# K1410001, FATHEAD MINNOW SURVIVAL, CHRONIC, 10-7-14

File: C:\COPYTO71\TOXSTAT\FHSURV~1 Transform: ARC SINE(SQUARE ROOT(Y))

Bartley'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 VALUE: AA# K1410001, FATHEAD MINNOW SURVIVAL, CHRONIC, 10-7-14

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	1.0000	1.4120
1	CONTROL	2	0.9000	1.2490
1	CONTROL	3	0.9000	1.2490
1	CONTROL	4	1.0000	1.4120
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	1.0000	1.4120
3	3.4 % EFFLUENT	5	1.0000	1.4120
4	4.5 % EFFLUENT	1	1.0000	1.4120
4	4.5 % EFFLUENT	2	1.0000	1.4120
4	4.5 % EFFLUENT	3	1.0000	1.4120
4	4.5 % EFFLUENT	4	0.9000	1.2490
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	0.9000	1.2490

AA# K1410001, FATHEAD MINNOW SURVIVAL, CHRONIC, 10-7-14

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	1.412	32.50	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	1.379	30.00	16.00	5.00	

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

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:		K1410001				TEST DATES (BEGIN / END):		10/7/14 - 10/14/14	
CLIENT:		Arkadelphia				WEIGHING DATE / TIME:		10/8/2014 1300	
ANALYSTS:		RH				DRYING TEMP (DEGREES C):		60	
SAMPLE ID:						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	1.03944	1.03327	0.00617	10	0.617	AVG DRY		
MHS	B	1.04001	1.03385	0.00616	10	0.616	WEIGHT (mg)		
	C	1.00456	0.99931	0.00525	10	0.525	0.573		
	D	1.02343	1.01774	0.00569	10	0.569	CV		
	E	1.00841	1.00304	0.00537	10	0.537	7.51		
CONC:	A	1.01156	1.00492	0.00664	10	0.664	AVG DRY		
2.5%	B	1.03176	1.02608	0.00568	10	0.568	WEIGHT (mg)		
	C	1.01809	1.01282	0.00527	10	0.527	0.572		
	D	1.01920	1.01438	0.00482	10	0.482	CV		
	E	0.96626	0.96009	0.00617	10	0.617			
CONC:	A	0.98381	0.97735	0.00646	10	0.646	AVG DRY		
3.4%	B	0.96044	0.95487	0.00557	10	0.557	WEIGHT (mg)		
	C	1.00030	0.99472	0.00558	10	0.558	0.576		
	D	0.98097	0.97495	0.00602	10	0.602	CV		
	E	1.02120	1.01601	0.00519	10	0.519			
CONC:	A	0.98869	0.98290	0.00579	10	0.579	AVG DRY		
4.5%	B	0.99487	0.98946	0.00541	10	0.541	WEIGHT (mg)		
	C	0.97947	0.97299	0.00648	10	0.648	0.584		
	D	0.99362	0.98795	0.00567	10	0.567	CV		
	E	1.00250	0.99667	0.00583	10	0.583			
CONC:	A	1.00417	0.99831	0.00586	10	0.586	AVG DRY		
6%	B	0.98503	0.97961	0.00542	10	0.542	WEIGHT (mg)		
	C	0.98871	0.98309	0.00562	10	0.562	0.584		
	D	1.01234	1.00642	0.00592	10	0.592	CV		
	E	0.98046	0.97408	0.00638	10	0.638	6.19		
CONC:	A	0.98127	0.97626	0.00501	10	0.501	AVG DRY		
8%	B	0.99370	0.98828	0.00542	10	0.542	WEIGHT (mg)		
	C	1.00654	1.00003	0.00651	10	0.651	0.554		
	D	0.97160	0.96545	0.00615	10	0.615	CV		
	E	1.01163	1.00701	0.00462	10	0.462			

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

A# K1410001, FATHEAD MINNOW GROWTH CHRONIC, 10-7-14

file: C:\COPYTO\1\TOXSTAT\FHGROWTH.

Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

W = 0.074

P = 0.964

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.

A# K1410001, FATHEAD MINNOW GROWTH CHRONIC, 10-7-14

file: C:\COPYTO\1\TOXSTAT\FHGROWTH.

Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 3.90

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# K1410001, FATHEAD MINNOW GROWTH CHRONIC, 10-7-14
 FILE: C:\COPYTO~1\TOXSTAT\FHGROWTH.
 TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

RP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.6170	0.6170
1	CONTROL	2	0.6160	0.6160
1	CONTROL	3	0.5250	0.5250
1	CONTROL	4	0.5690	0.5690
1	CONTROL	5	0.5370	0.5370
2	2.5 % EFFLUENT	1	0.6640	0.6640
2	2.5 % EFFLUENT	2	0.5680	0.5680
2	2.5 % EFFLUENT	3	0.5270	0.5270
2	2.5 % EFFLUENT	4	0.4820	0.4820
2	2.5 % EFFLUENT	5	0.6170	0.6170
3	3.4 % EFFLUENT	1	0.6460	0.6460
3	3.4 % EFFLUENT	2	0.5570	0.5570
3	3.4 % EFFLUENT	3	0.5580	0.5580
3	3.4 % EFFLUENT	4	0.6020	0.6020
3	3.4 % EFFLUENT	5	0.5190	0.5190
4	4.5 % EFFLUENT	1	0.5790	0.5790
4	4.5 % EFFLUENT	2	0.5410	0.5410
4	4.5 % EFFLUENT	3	0.6480	0.6480
4	4.5 % EFFLUENT	4	0.5670	0.5670
4	4.5 % EFFLUENT	5	0.5830	0.5830
5	6 % EFFLUENT	1	0.5860	0.5860
5	6 % EFFLUENT	2	0.5420	0.5420
5	6 % EFFLUENT	3	0.5620	0.5620
5	6 % EFFLUENT	4	0.5920	0.5920
5	6 % EFFLUENT	5	0.6380	0.6380
6	8 % EFFLUENT	1	0.5010	0.5010
6	8 % EFFLUENT	2	0.5420	0.5420
6	8 % EFFLUENT	3	0.6510	0.6510
6	8 % EFFLUENT	4	0.6150	0.6150
6	8 % EFFLUENT	5	0.4620	0.4620

A# K1410001, FATHEAD MINNOW GROWTH CHRONIC, 10-7-14
 file: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.003	0.001	0.195
Within (Error)	24	0.074	0.003	
Total	29	0.077		

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

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

AA# K1410001, FATHEAD MINNOW GROWTH CHRONIC, 10-7-14

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	0.573	0.573		
2	2.5 % EFFLUENT	0.572	0.572	0.034	
3	3.4 % EFFLUENT	0.576	0.576	-0.103	
4	4.5 % EFFLUENT	0.584	0.584	-0.308	
5	6 % EFFLUENT	0.584	0.584	-0.320	
6	8 % EFFLUENT	0.554	0.554	0.531	

Dunnnett table value = 2.36

(1 Tailed Value, P=0.05, df=24,5)

AA# K1410001, FATHEAD MINNOW GROWTH CHRONIC, 10-7-14

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	0.083	14.4	0.001
3	3.4 % EFFLUENT	5	0.083	14.4	-0.004
4	4.5 % EFFLUENT	5	0.083	14.4	-0.011
5	6 % EFFLUENT	5	0.083	14.4	-0.011
6	8 % EFFLUENT	5	0.083	14.4	0.019

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

SURVIVAL AND REPRODUCTION TEST

Ceriodaphnia dubia

Discharger: Arkadelphia AFIN # 10-00463													Lab Number/s			Analyst: RH			
Location: Outfall 001													K1410001			Test Start - Date/Time: 10-7-14, 1145			
Date Sample Collected: 10 - 6/8/10 - 14																Test Stop - Date/Time: 10-14-14, 1000			
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	1	0	0	0	0	0	0	0	1	1	3	10	0.3	RH				
	4	3	5	0	0	2	0	6	1	3	4	24	10	2.4	RH				
	5	4	1	6	8	3	7	0	5	0	0	34	10	3.4	RH				
	6	9	10	9	5	1	0	1	8	6	10	59	10	5.9	RH				
	7	7	4	0	2	5	8	11	5	0	1	43	10	4.3	RH				
	8																		
Total	24	20	15	15	11	15	18	19	10	16	163		Avg. = 16.3						
													C.V. = 25.6						
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	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH				
	4	0	0	1	2	2	5	6	3	0	4	23	10	2.3	RH				
	5	6	7	0	0	8	5	4	7	4	3	44	10	4.4	RH				
	6	5	2	3	11	2	3	1	0	4	8	39	10	3.9	RH				
	7	7	7	3	4	2	1	5	0	1	0	30	10	3.0	RH				
	8																		
Total	18	16	7	17	14	14	16	10	9	15	136		Avg. = 13.6						
													C.V. = 27.1						
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	0	0	0	0	0	2	0	0	0	0	2	10	0.2	RH				
	4	2	2	3	0	1	1	0	0	5	6	20	10	2.0	RH				
	5	7	5	0	4	2	0	6	8	3	4	39	10	3.9	RH				
	6	3	2	8	11	6	7	7	8	0	0	50	10	5.0	RH				
	7	2	2	1	5	5	2	2	1	0	0	20	10	2.0	RH				
	8																		
Total	14	11	10	20	14	12	15	17	8	10	131		Avg. = 13.1						
													C.V. = 27.7						
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	0	0	0	0	1	0	0	0	0	0	1	10	0.1	RH				
	4	0	1	4	0	4	3	5	6	1	2	26	10	2.6	RH				
	5	4	3	7	0	6	5	0	3	4	5	37	10	3.7	RH				
	6	5	1	4	10	7	4	7	1	0	6	45	10	4.5	RH				
	7	6	2	1	0	2	6	1	3	6	0	27	10	2.7	RH				
	8																		
Total	15	7	16	10	20	18	13	13	11	13	136		Avg. = 13.6						
													C.V. = 28.2						
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	0	0	0	1	0	0	0	0	1	0	2	10	0.2	RH				
	4	4	3	5	0	0	0	1	3	6	5	27	10	2.7	RH				
	5	2	8	0	3	4	5	0	1	1	7	31	10	3.1	RH				
	6	3	4	5	6	0	2	6	9	8	1	44	10	4.4	RH				
	7	4	5	8	0	5	10	5	6	2	2	47	10	4.7	RH				
	8																		
Total	13	20	18	10	9	17	12	19	18	15	151		Avg. = 15.1						
													C.V. = 25.8						
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	0	1	0	0	0	0	0	0	3	10	0.3	RH				
	4	4	6	0	0	1	2	4	3	0	0	20	10	2.0	RH				
	5	0	6	3	5	0	0	7	2	8	0	31	10	3.1	RH				
	6	9	3	12	8	9	7	0	0	5	6	59	10	5.9	RH				
	7	5	2	4	1	6	1	1	5	7	0	32	10	3.2	RH				
	8																		
Total	20	17	19	15	16	10	12	10	20	14	145		Avg. = 15.3						
													C.V. = 24.8						

AA # K1410001, C.DUBIA CHRONIC, REPRODUCCION, 10-7-14

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 # K1410001, C.DUBIA CHRONIC, REPRODUCCION, 10-7-14

File: C:\COPYTO~1\TOXSTAT\C.DUB

Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 0.20

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	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	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	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	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	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.

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 # K1410001, C.DUBIA CHRONIC, REPRODUCCION, 10-7-14

FILE: C:\COPYTO\1\TOXSTAT\C.DUB

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	24.0000	24.0000
1	CONTROL	2	20.0000	20.0000
1	CONTROL	3	15.0000	15.0000
1	CONTROL	4	15.0000	15.0000
1	CONTROL	5	11.0000	11.0000
1	CONTROL	6	15.0000	15.0000
1	CONTROL	7	18.0000	18.0000
1	CONTROL	8	19.0000	19.0000
1	CONTROL	9	10.0000	10.0000
1	CONTROL	10	16.0000	16.0000
2	2.5 % EFFLUENT	1	18.0000	18.0000
2	2.5 % EFFLUENT	2	16.0000	16.0000
2	2.5 % EFFLUENT	3	7.0000	7.0000
2	2.5 % EFFLUENT	4	17.0000	17.0000
2	2.5 % EFFLUENT	5	14.0000	14.0000
2	2.5 % EFFLUENT	6	14.0000	14.0000
2	2.5 % EFFLUENT	7	16.0000	16.0000
2	2.5 % EFFLUENT	8	10.0000	10.0000
2	2.5 % EFFLUENT	9	9.0000	9.0000
2	2.5 % EFFLUENT	10	15.0000	15.0000
3	3.4 % EFFLUENT	1	14.0000	14.0000
3	3.4 % EFFLUENT	2	11.0000	11.0000
3	3.4 % EFFLUENT	3	10.0000	10.0000
3	3.4 % EFFLUENT	4	20.0000	20.0000
3	3.4 % EFFLUENT	5	14.0000	14.0000
3	3.4 % EFFLUENT	6	12.0000	12.0000
3	3.4 % EFFLUENT	7	15.0000	15.0000
3	3.4 % EFFLUENT	8	17.0000	17.0000
3	3.4 % EFFLUENT	9	8.0000	8.0000
3	3.4 % EFFLUENT	10	10.0000	10.0000
4	4.5 % EFFLUENT	1	15.0000	15.0000
4	4.5 % EFFLUENT	2	7.0000	7.0000
4	4.5 % EFFLUENT	3	16.0000	16.0000
4	4.5 % EFFLUENT	4	10.0000	10.0000
4	4.5 % EFFLUENT	5	20.0000	20.0000
4	4.5 % EFFLUENT	6	18.0000	18.0000
4	4.5 % EFFLUENT	7	13.0000	13.0000
4	4.5 % EFFLUENT	8	13.0000	13.0000

4	4.5 %	EFFLUENT	9	11.0000	11.0000
4	4.5 %	EFFLUENT	10	13.0000	13.0000
5	6 %	EFFLUENT	1	13.0000	13.0000
5	6 %	EFFLUENT	2	20.0000	20.0000
5	6 %	EFFLUENT	3	18.0000	18.0000
5	6 %	EFFLUENT	4	10.0000	10.0000
5	6 %	EFFLUENT	5	9.0000	9.0000
5	6 %	EFFLUENT	6	17.0000	17.0000
5	6 %	EFFLUENT	7	12.0000	12.0000
5	6 %	EFFLUENT	8	19.0000	19.0000
5	6 %	EFFLUENT	9	18.0000	18.0000
5	6 %	EFFLUENT	10	15.0000	15.0000
6	8 %	EFFLUENT	1	20.0000	20.0000
6	8 %	EFFLUENT	2	17.0000	17.0000
6	8 %	EFFLUENT	3	19.0000	19.0000
6	8 %	EFFLUENT	4	15.0000	15.0000
6	8 %	EFFLUENT	5	16.0000	16.0000
6	8 %	EFFLUENT	6	10.0000	10.0000
6	8 %	EFFLUENT	7	12.0000	12.0000
6	8 %	EFFLUENT	8	10.0000	10.0000
6	8 %	EFFLUENT	9	20.0000	20.0000
6	8 %	EFFLUENT	10	14.0000	14.0000

AA # K1410001, C.DUBIA CHRONIC, REPRODUCCION, 10-7-14
 File: C:\COPYTO\1\TOXSTAT\C.DUB Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	78.200	15.640	1.060
Within (Error)	54	796.800	14.756	
Total	59	875.000		

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

AA # K1410001, C.DUBIA CHRONIC, REPRODUCCION, 10-7-14
 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	16.300	16.300		
2	2.5 % EFFLUENT	13.600	13.600	1.572	
3	3.4 % EFFLUENT	13.100	13.100	1.863	
4	4.5 % EFFLUENT	13.600	13.600	1.572	
5	6 % EFFLUENT	15.100	15.100	0.699	
6	8 % EFFLUENT	15.300	15.300	0.582	

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

AA # K1410001, C.DUBIA CHRONIC, REPRODUCTION, 10-7-14
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	3.968	24.3	2.700
3	3.4 % EFFLUENT	10	3.968	24.3	3.200
4	4.5 % EFFLUENT	10	3.968	24.3	2.700
5	6 % EFFLUENT	10	3.968	24.3	1.200
6	8 % EFFLUENT	10	3.968	24.3	1.000

APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 10/7/14 CLIENT ARK ANALYTICAL

Purchase Order #: _____

SPECIES: Pimephales promelas

Quantity Shipped: 300 300 18-1600

Age: LESS 48 50 DAYS EST

Brood Stock Source: Anderson Farms, AR

Culture Water: Groundwater

Hardness (Mg/l CaCO₃): 2160

Dissolved Oxygen (Mg/l): 8.1

Temperature (°C): 25.1°C

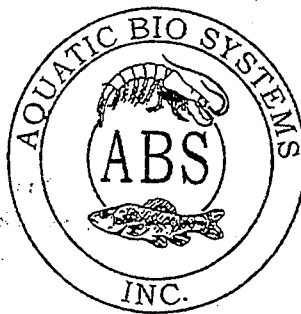
Feeding: ARTEMIA

Comments: _____

Shipped Via: Federal Express UPS Overnight Shuttle

Packaged By: _____

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:	<u>22°C</u>	<u>22-26°C</u>
SALINITY/CONDUCTIVITY:	<u>--</u>	<u>--</u>
TOTAL HARDNESS (as CaCO ₃):	<u>94 mg/l</u>	<u>76-130 mg/l</u>
TOTAL ALKALINITY (as CaCO ₃):	<u>65 mg/l</u>	<u>65-100 mg/l</u>
pH:	<u>7.98</u>	<u>7.50-8.20</u>

Comments:

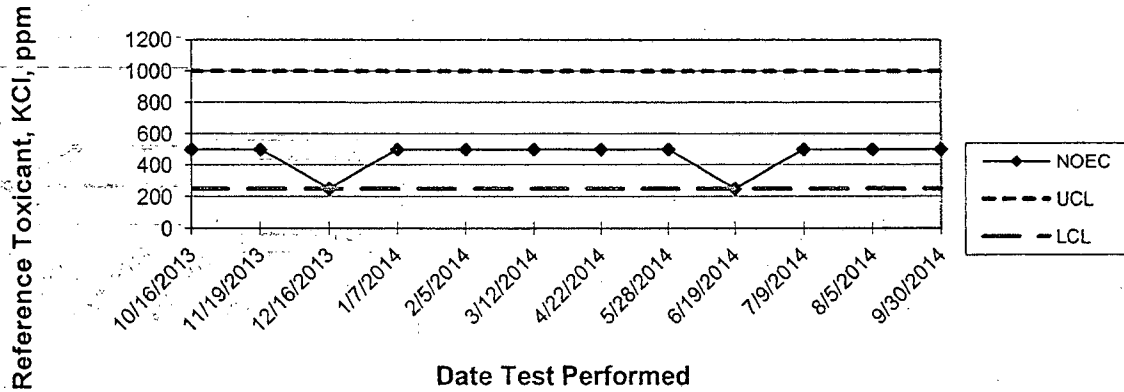


Facility Supervisor

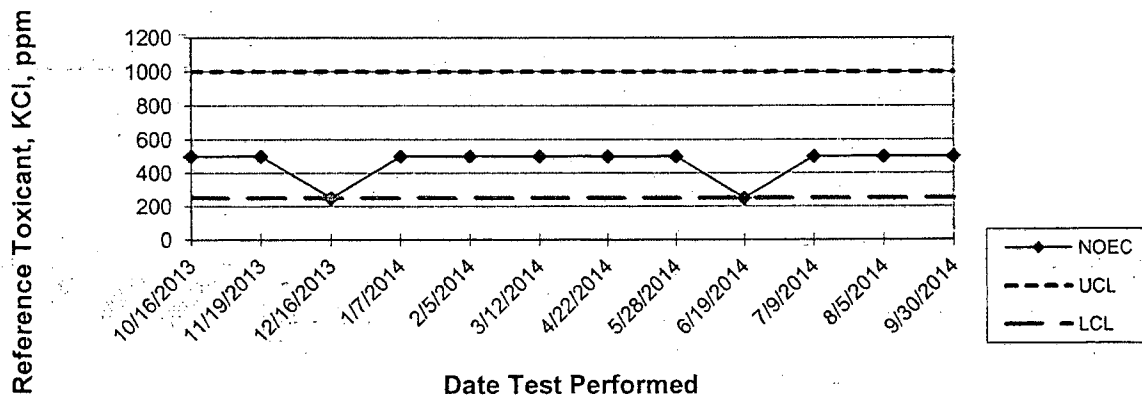
APPENDIX F

Quality Assurance Charts

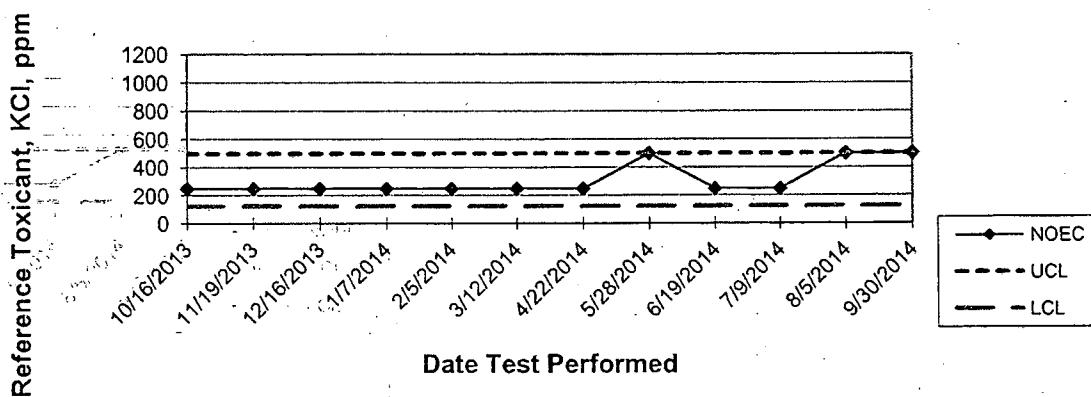
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL 7 Day
QUALITY ASSURANCE



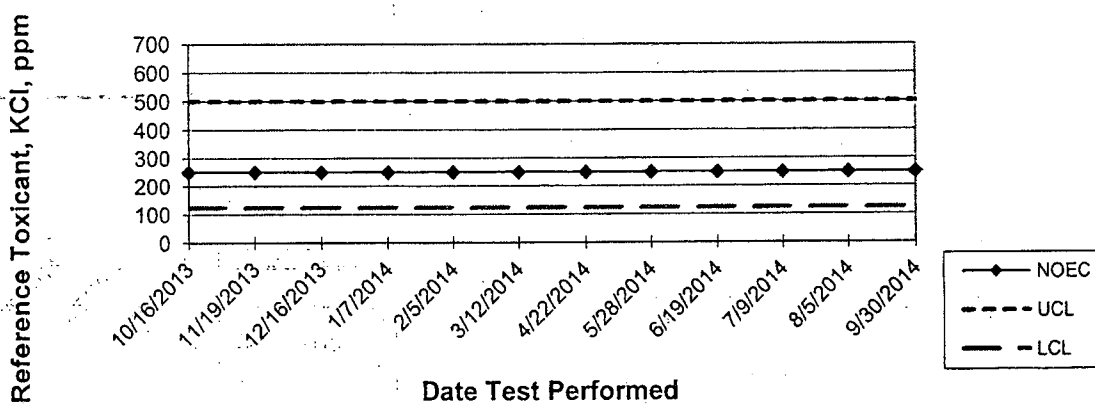
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH 7 Day
QUALITY ASSURANCE



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



Ms. Sara Clem
AR Dept. of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

