



700 Clay Street  
P. O. Box 495  
Arkadelphia, AR 71923  
Phone (870) 246-5863  
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June 22, 2015

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 April 2015. Our DMR's for the biomonitoring are included as well.

If there are questions, please contact me.

Sincerely,

Brenda Gills  
Utilities Manager

Enclosure

# Arkansas Analytical, Inc.

## Toxicity Test Results

**City of Arkadelphia**  
**Permit Number: AR0020605**  
**AFIN # 10-00463**  
**Second Quarter 2015**

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 K1504004**

Thursday, April 23, 2015

## **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. 3<sup>rd</sup> St. approximately 2.6 miles south of intersection of 3<sup>rd</sup> 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 first half of 2015.

## **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:	4-12-15, 0800	4-13-15, 0800
Sample #2:	4-14-15, 0800	4-15-15, 0800
Sample #3:	4-16-15, 0800	4-17-15, 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:	4-13-15, 1640	1
Sample #2:	4-16-15, 0810	1
Sample #3:	4-17-15, 1607	1

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	16.0	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	32.5%	X	

#### TEST ACCEPTANCE CRITERIA for *Pimephales promelas*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	94%	X	
The percent coefficient of variation between replicates must be 40% or less for survival	9.52%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.704	X	
The percent coefficient of variation between replicates must be 40% or less for growth	11.9%	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> 3/26/15 – 4/2/15		<i>Pimephales promelas</i> 3/26/15 – 4/2/15	
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

<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)	18.7%
%CV Reproduction (critical dilution)	19.1%	Mean dry weight (critical dilution) in milligrams	0.699
		%CV growth (critical dilution)	16.9%
PMSD Reproduction	26.1%	PMSD Growth	19.3%

### 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 / Kenneth Pigue / Hallie Freyaldenhoven

Reviewed by:

  
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:	4-12-15, 0800	4-13-15, 0800
Sample #2:	4-14-15, 0800	4-15-15, 0800
Sample #3:	4-16-15, 0800	4-17-15, 0800

Test initiated (date, time): 4-14-15, 1445      Test terminated (date, time): 4-21-15, 1420

Dilution water used:      Moderately Hard Synthetic

**DATA TABLE FOR FATHEAD MINNOW SURVIVAL**

Effluent Conc %	Percent Survival in Replicate Chambers						Mean Percent Survival			CV %
	A	B	C	D	E		24 hours	48 hours	7 days	
0%	100	100	90	80	100		98	98	94	9.52
2.5%	90	100	100	100	100		100	100	98	
3.4%	70	100	100	100	90		100	98	92	
4.5%	100	90	90	90	100		100	98	94	
6%	60	100	100	90	90		98	98	88	18.7
8%	90	50	100	100	90		98	98	86	

**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%	0.777	0.728	0.736	0.560	0.718		0.704	11.9%
2.5%	0.748	0.668	0.680	0.656	0.589		0.668	
3.4%	0.573	0.768	0.690	0.619	0.515		0.633	
4.5%	0.681	0.710	0.682	0.773	0.668		0.703	
6%	0.551	0.865	0.743	0.701	0.634		0.699	16.9%
8%	0.686	0.495	0.777	0.788	0.699		0.689	

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)= 16.9 %
  
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:	4-12-15, 0800	4-13-15, 0800
Sample #2:	4-14-15, 0800	4-15-15, 0800
Sample #3:	4-16-15, 0800	4-17-15, 0800

Test initiated (date, time): 4-14-15, 1415      Test terminated (date, time): 4-21-15, 1010

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	19	14	19	15	16	16
B	14	18	20	18	17	9
C	11	19	7	11	14	15
D	19	17	11	13	16	14
E	20	16	16	21	16	22
F	20	8	14	11	14	14
G	7	20	14	20	9	17
H	12	13	13	18	16	14
I	24	13	19	9	20	12
J	14	17	10	9	13	15
Mean	16.0	15.5	14.3	14.5	15.1	14.8
Mean/surviving female	16.0	15.5	14.3	14.5	15.1	14.8
CV%*	32.5				19.1	

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)= 32.5 %

6. Enter Whole Effluent Toxicity: 8 %

APPENDIX A

Chain of Custody Forms

# 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 # 18060.0001B

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

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>04-12-15</u> <u>0800</u>	<u>04-13-15</u> <u>0800</u>	<u>Comp</u>						<u>plastic/npnc</u>	<u>K1504004</u> <u>Chronic BIO A</u>
METHOD OF SHIPMENT (CIRCLE)		FIELD CALIBRATION RECORD			NOTES/COMMENTS/OBSERVATIONS						
FED EX <u>WALK IN</u> SRA UPS OTHER		pH 7			<u>Temp in Lab 9.0</u>						
		pH 4									
		pH 10									
		D.O									
TYPE OF SAMPLE(S): (CIRCLE)					FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT						
WATER SOIL <u>W/W</u> SLUDGE OTHER											

Samples Received at Arkansas Analytical  
Relinquished By: Sorrells  
Date/Time: 4-13-15, 1640  
Received By: Sydney James

	Yes	No
Custody Seals:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Containers Correct:	<input type="checkbox"/>	<input type="checkbox"/>
COC/Labels Agree:	<input type="checkbox"/>	<input type="checkbox"/>
- Received on Ice:	<input type="checkbox"/>	<input type="checkbox"/>
Temperature on Receipt:	<u>1°C</u>	
Temperature Gun ID:	<u>HHT # 2</u>	

RELINQUISHED BY: David Thomason DATE/TIME: 4/13/15 1315

RECEIVED BY: Sydney James DATE/TIME: \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE/TIME: \_\_\_\_\_

RECEIVED BY LAB: Sydney James DATE/TIME: 4/13/15 1315

# 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 # 18060.0002B

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>OUT Fall 201</u>	<u>4-14-15</u> <u>0800</u>	<u>4-15-15</u> <u>0800</u>	<u>Comp</u>						<u>plastic/none</u>	<u>K1504004-B</u> <u>Chronic BIO</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											

Samples Received at Arkansas Analytical Sorrells

Relinquished By: \_\_\_\_\_

Date/Time: 4-10-15 0810

Received By: Amanda Foster

Received at Arkansas Analytical

Custody Seals:	Yes	No
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:	<u>1°C</u>	
Temperature Gun ID:	HHT # <u>2</u>	

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

RELINQUISHED BY: David Thomason DATE/TIME: 4/15/15 1153

RECEIVED BY (LAB):

Sammy Riddle

DATE/TIME: 4/15/15 11.53

# 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 # 18060.0003B

CLIENT # \_\_\_\_\_

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 Dept

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>DWT Fall 001</u>	<u>4-16-15 0800</u>	<u>4-17-15 0800</u>	<u>COMP</u>						<u>Plastic/None</u>	<u>K1504004- Chronic BIO C</u>	
METHOD OF SHIPMENT (CIRCLE)					FIELD CALIBRATION RECORD				NOTES/COMMENTS/OBSERVATIONS			
FED EX <u>WALK IN</u> SRA UPS OTHER					pH 7				<u>temp lab 3.9°</u>			
					pH 4							
					pH 10							
					D.O							
TYPE OF SAMPLE(S): (CIRCLE)									FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT			
WATER SOIL <u>W/W</u> SLUDGE OTHER												

Samples Received at Arkansas Analytical Sorrells		Yes	No
Relinquished By:		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date/Time:	<u>4-17-15 1607</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Received By:	<u>Sigamy James</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Temperature on Receipt:	<u>17°</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Temperature Gun ID:	<u>HHT # 2</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

4-17-15 1103

DATE/TIME:

RELINQUISHED BY:

Daniel Thomas

DATE/TIME:

4-17-15 1103

RECEIVED BY(LAB):

*[Signature]*

4-17-15 1103

DATE/TIME:

APPENDIX B

Effluent and Dilution Water Data



**Biomonitoring Quality Control Benchsheet**

Analyst	RH	RH	RH	RH	RP	TF	RH	RH
Date	4-14-15	4-15-15	4-16-15	4-17-15	4-18-15	4-19-15	4-20-15	4-21-15
pH Meter ID	AR60							
LIN pH 4 Buffer	1401107							
LIN pH 7 Buffer	1401173							
LIN pH 10 Buffer	1401168							
Slope (>90%)	95.6%	93.8%	92.9%	96.0%	95.9	93.0	97.1%	94.0%

Dissolved O <sub>2</sub> Meter								
Meter Reading	8.47	8.30	8.56	8.57	8.45	8.70	8.64	8.92
Temp.	23	24	22	22	23.0	20.9	22	23
Chart Value at Temp.	8.578	8.418	8.743	8.743	8.578	8.743	8.743	8.578
Difference	0.108	0.118	0.183	0.173		0.043	0.103	0.158
Acceptance Criteria	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L

Temp. Meter ID								
Meter Reading	23	24	23	22	22.8	21	22	24
Thermometer Reading	22.5	23	22.5	21	22	22	22	23
Thermometer ID	PB	PB	PB	PB	PB	PB	PB	PB
Acceptance Criteria	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C

Alkalinity								
Blank (<5mg/L)								
STD Result								
T.V. / %REC								
Acceptance Criteria	93.5-108.5% Recovery							

Hardness								
Blank (<2mg/L)								
STD. Result								
T.V. / %REC								
Acceptance Criteria	90.0-105.5% Recovery							

Conductivity Meter ID								
Blank (<1)								
STD Result								
T.V. / %REC								
Acceptance Criteria	99.2-104.0% Recovery							

Chlorine Meter ID								
Blank (<0.05mg/L)								
STD Result								
T.V. / % REC								
Acceptance Criteria	100.0-120% Recovery							

Revision 0  
Effective Date 01APR15

**Biomonitoring Quality Control Benchsheet**

Analyst	RH	RH	RH		KP		RH	
Date	4-22-15	4-23-15	4-24-15		4/25/15		4-27-15	
pH Meter ID	AR60							
LIN pH 4 Buffer	1401107							
LIN pH 7 Buffer	1401173							
LIN pH 10 Buffer	1401168							
Slope (>90%)	94.7%	94.5%	92.3%		90.4			

<b>Dissolved O<sub>2</sub> Meter</b>								
Meter Reading	8.33	8.45	8.43		8.46			
Temp.	24	23	23		23			
Chart Value at Temp.	8.418	8.578	8.578		8.578			
Difference	0.088	0.128	0.148		0.14			
Acceptance Criteria	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L	<0.2mg/L

<b>Temp. Meter ID</b>								
Meter Reading	23	23	23		23			
Thermometer Reading	23	22	22		23			
Thermometer ID	PB							
Acceptance Criteria	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C

<b>Alkalinity</b>								
Blank (<5mg/L)		0					0	
STD Result		98					104	
T.V. / %REC		100/98%					100/104%	
Acceptance Criteria	93.5-108.5% Recovery							

<b>Hardness</b>								
Blank (<2mg/L)		0					0	
STD. Result		92					98	
T.V. / %REC		100/92%					100/98%	
Acceptance Criteria	90.0-105.5% Recovery							

<b>Conductivity Meter ID</b>								
Blank (<1)		0					0	
STD Result		1440					1444	
T.V. / %REC		1412/1027%					1412/1444 RH	
Acceptance Criteria	99.2-104.0% Recovery 102%							

<b>Chlorine Meter ID</b>								
Blank (<0.05mg/L)		0					0	
STD Result		0.21					0.21	
T.V. / % REC		0.20/105%					0.20/105%	
Acceptance Criteria	100.0-120% Recovery							

Revision 0  
Effective Date 01APR15

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Fathead Minnow

Lab # / Sample ID K1504004

Test Start (Date/Time) 4-14-15 1445

Client: Arkadelphia

Test End (Date/Time) 4-21-15 1920

Day of Test

		1	2	3	4	5	6	7	notes
<b>Control</b>	MDS	4-14	4-15	4-16	4-17	4-18	4-19	4-20	
D.O. (mg/L)	INITIAL	8.3	8.2	8.6	8.6	8.6	8.5	8.8	
	FINAL	7.3	8.0	7.7	8.0	8.5	8.4	7.1	
pH (s.u.)	INITIAL	8.1	7.8	8.0	8.4	7.9	8.3	8.5	
	FINAL	7.7	7.7	8.2	7.5	8.0	8.1	7.8	
temp (C)	INITIAL	23	22	23	23	26.0	21	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		6.0	---	6.4	---	---	---	---	
HARDNESS (mg/L)		80	---	82	---	---	---	---	
CONDUCTIVITY (umhd)		421	---	455	---	---	---	---	
CHLORINE (mg/L)		<0.05	---	---	---	---	---	---	
<b>CONC:</b>	2.5								
D.O. (mg/L)	INITIAL	7.9	8.0	8.6	8.6	8.8	8.4	8.7	
	FINAL	6.3	8.1	7.9	8.0	8.2	6.5	6.4	
pH (s.u.)	INITIAL	7.7	7.8	8.0	8.3	7.9	8.1	8.5	
	FINAL	7.5	7.6	8.0	7.6	8.1	7.7	7.8	
temp (C)	INITIAL	23	22	23	23	22	21	22	
	FINAL	25	25	25	25.0	25	25	25	
<b>CONC:</b>	3.4								
D.O. (mg/L)	INITIAL	8.5	8.2	8.5	8.5	8.7	8.9	8.8	
	FINAL	7.4	8.0	7.6	8.0	8.0	7.6	7.3	
pH (mg/L)	INITIAL	7.8	7.7	7.8	8.2	7.9	8.1	8.3	
	FINAL	7.6	7.7	7.9	7.6	8.0	7.7	7.8	
temp (C)	INITIAL	23	22	23	22	22	21	21	
	FINAL	25	25	25	25.0	25	25	25	
<b>CONC:</b>	4.5								
D.O. (mg/L)	INITIAL	8.7	8.2	8.7	8.6	8.7	8.9	8.8	
	FINAL	7.5	7.8	7.7	8.0	8.0	7.6	7.4	
pH (s.u.)	INITIAL	7.6	7.8	7.8	8.3	7.9	8.1	8.3	
	FINAL	7.6	7.6	7.9	7.6	8.0	7.7	7.8	
temp (C)	INITIAL	23	22	23	22	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	6								
D.O. (mg/L)	INITIAL	8.8	8.0	8.6	8.6	8.6	8.5	8.8	
	FINAL	6.7	7.9	7.5	7.9	7.9	7.8	7.3	
pH (s.u.)	INITIAL	7.5	7.6	7.5	8.1	7.9	8.1	8.3	
	FINAL	7.7	7.5	7.8	7.6	8.0	7.7	7.8	
temp (C)	INITIAL	23	22	23	23	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	8								
D.O. (mg/L)	INITIAL	8.5	8.0	8.7	8.6	8.7	8.5	8.8	
	FINAL	7.1	7.7	7.6	7.8	8.1	7.9	7.3	
pH (s.u.)	INITIAL	7.4	7.6	7.5	8.1	7.9	8.1	8.2	
	FINAL	7.7	7.7	7.9	7.6	8.0	7.7	7.8	
temp (C)	INITIAL	22	22	23	22	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	100 %	A	A	A	B	B	C	C	
ALKALINITY (mg/L)		44	---	---	44	---	46	---	
HARDNESS (mg/L)		46	---	---	28	---	42	---	
CONDUCTIVITY (umhd)		208	---	---	208	---	210	---	
CHLORINE (mg/L)		0.08	---	---	<0.05	---	0.14	---	

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Ceriodaphnia Dubia

Lab # / Sample ID K1504004

Test Start (Date/Time) 4-14-15 1415

Client: Arkadelphia

Test End (Date/Time) 4-21-15 1010

Day of Test

		1	2	3	4	5	6	7	notes
<b>Control</b>	mHS	4-14	4-15	4-16	4-17	4-18	4-19	4-20	
D.O. (mg/L)	INITIAL	8.3	8.2	8.6	8.6	8.6	8.5	8.8	
	FINAL	8.4	8.4	8.6	8.9	9.0	8.5	8.4	
pH (s.u.)	INITIAL	8.1	7.8	8.0	8.4	7.9	8.3	8.5	
	FINAL	7.8	8.1	7.5	7.8	8.1	8.1	8.1	
temp (C)	INITIAL	23	22	23	23	22	21	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		60	—	64	—	—	—	—	
HARDNESS (mg/L)		80	—	82	—	—	—	—	
CONDUCTIVITY (umhc)		421	—	455	—	—	—	—	
CHLORINE (mg/L)		<0.05	—	—	—	—	—	—	
<b>CONC:</b>	2.5								
D.O. (mg/L)	INITIAL	7.9	8.0	8.6	8.6	8.8	8.4	8.7	
	FINAL	8.3	8.5	8.6	8.8	8.9	8.6	8.4	
pH (s.u.)	INITIAL	7.7	7.8	8.0	8.3	7.9	8.1	8.5	
	FINAL	8.0	8.0	7.6	8.1	8.1	8.2	8.2	
temp (C)	INITIAL	23	22	23	23	22	21	22	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	3.4								
D.O. (mg/L)	INITIAL	8.5	8.2	8.5	8.5	8.7	8.5	8.8	
	FINAL	8.2	8.3	8.6	8.6	9.1	8.7	8.5	
pH (mg/L)	INITIAL	7.8	7.7	7.8	8.2	7.9	8.1	8.3	
	FINAL	7.7	7.7	7.9	8.1	8.1	8.2	8.1	
temp (C)	INITIAL	23	22	23	22	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	4.5								
D.O. (mg/L)	INITIAL	8.7	8.2	8.7	8.6	8.7	8.5	8.8	
	FINAL	8.4	8.5	8.6	8.7	9.1	8.6	8.6	
pH (s.u.)	INITIAL	7.6	7.8	7.8	8.3	7.9	8.1	8.3	
	FINAL	7.6	7.9	7.8	8.1	8.2	8.3	8.1	
temp (C)	INITIAL	23	22	23	22	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	6								
D.O. (mg/L)	INITIAL	8.8	8.0	8.6	8.6	8.6	8.5	8.8	
	FINAL	8.2	8.1	8.5	8.5	9.1	8.4	8.6	
pH (s.u.)	INITIAL	7.5	7.6	7.5	8.1	7.9	8.1	8.3	
	FINAL	7.5	8.0	7.9	8.1	8.1	8.2	8.0	
temp (C)	INITIAL	23	22	23	22	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	8								
D.O. (mg/L)	INITIAL	8.5	8.0	8.7	8.6	8.7	8.5	8.8	
	FINAL	8.2	8.1	8.6	8.5	9.0	8.2	8.5	
pH (s.u.)	INITIAL	7.4	7.6	7.5	8.1	7.9	8.1	8.2	
	FINAL	7.5	7.8	7.9	8.1	8.1	8.0	8.0	
temp (C)	INITIAL	22	22	23	22	22	21	21	
	FINAL	25	25	25	25	25	25	25	
<b>CONC:</b>	100 %								
ALKALINITY (mg/L)		44	—	—	44	—	46	—	
HARDNESS (mg/L)		46	—	—	28	—	42	—	
CONDUCTIVITY (umhc)		208	—	—	208	—	210	—	
CHLORINE (mg/L)		0.08	—	—	<0.05	—	0.14	—	

APPENDIX C

Fathead minnow raw data and statistics

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

LAB #: K1504004			TEST START		DATE	4/14/15	TIME	1445				
CLIENT: Arkadelphia			TEST END		DATE	4/21/15	TIME	1420				
ANALYST: RH / KP / HF			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	10	100%	94.0%	9.52
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	9	9	9	9	90%		
	D	10	9	9	9	9	9	8	8	80%		
	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	9	9	9	9	90%	98.0%	
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%		
	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	9	7	7	7	70%	92.0%	
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%		
	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	9	9	9	9	9	9	90%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%	94.0%	
	B	10	10	9	9	9	9	9	9	90%		
	C	10	10	10	10	9	9	9	9	90%		
	D	10	10	10	10	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	9	6	6	6	60%	88.0%	18.7
	B	10	10	10	10	10	10	10	10	100%		
	C	10	10	10	10	10	10	10	10	100%		
	D	10	9	9	9	9	9	9	9	90%		
	E	10	10	10	10	9	9	9	9	90%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	9	9	9	9	9	9	9	90%	86.0%	
	B	10	10	10	10	6	5	5	5	50%		
	C	10	10	10	10	10	10	10	10	100%		
	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	9	9	9	9	90%		
ANALYST:		RH	RH	RH	RH	KP	HF	RH	RH			
DATE:		4/14/15	4/15/15	4/16/15	1/17/15	4/18/15	4/19/15	4/20/15	4/21/15			
TIME:		1445	1100	1330	1000	1215	1400	1445	1420			

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

REMARKS:

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AA# K1504004, FATHEAD MINNOW SURV., CHRONIC, 4-14-15  
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.713

W = 0.874

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# K1504004, FATHEAD MINNOW SURV., CHRONIC, 4-14-15  
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 7.72

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# K1504004, FATHEAD MINNOW SURV., CHRONIC, 4-14-15  
 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	1.0000	1.4120
1	CONTROL	3	0.9000	1.2490
1	CONTROL	4	0.8000	1.1071
1	CONTROL	5	1.0000	1.4120
2	2.5 % EFFLUENT	1	0.9000	1.2490
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	0.7000	0.9912
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	0.9000	1.2490
4	4.5 % EFFLUENT	1	1.0000	1.4120
4	4.5 % EFFLUENT	2	0.9000	1.2490
4	4.5 % EFFLUENT	3	0.9000	1.2490
4	4.5 % EFFLUENT	4	0.9000	1.2490
4	4.5 % EFFLUENT	5	1.0000	1.4120
5	6 % EFFLUENT	1	0.6000	0.8861
5	6 % EFFLUENT	2	1.0000	1.4120
5	6 % EFFLUENT	3	1.0000	1.4120
5	6 % EFFLUENT	4	0.9000	1.2490
5	6 % EFFLUENT	5	0.9000	1.2490
6	8 % EFFLUENT	1	0.9000	1.2490
6	8 % EFFLUENT	2	0.5000	0.7854
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# K1504004, FATHEAD MINNOW SURV., CHRONIC, 4-14-15  
 File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.081	0.016	0.548
Within (Error)	24	0.713	0.030	
Total	29	0.795		

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



AA# K1504004, FATHEAD MINNOW SURV., CHRONIC, 4-14-15  
 File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	1.318	0.940		
2	2.5 % EFFLUENT	1.379	0.980	-0.559	
3	3.4 % EFFLUENT	1.295	0.920	0.213	
4	4.5 % EFFLUENT	1.314	0.940	0.039	
5	6 % EFFLUENT	1.242	0.880	0.704	
6	8 % EFFLUENT	1.222	0.860	0.889	

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

AA# K1504004, FATHEAD MINNOW SURV., CHRONIC, 4-14-15  
 File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

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	0.176	18.7	-0.040
3	3.4 % EFFLUENT	5	0.176	18.7	0.020
4	4.5 % EFFLUENT	5	0.176	18.7	0.000
5	6 % EFFLUENT	5	0.176	18.7	0.060
6	8 % EFFLUENT	5	0.176	18.7	0.080

**WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST**

LAB # / #s:		K1504004				TEST DATES (BEGIN / END):		4/14/15 - 4/21/15	
CLIENT:		Arkadelphia				WEIGHING DATE / TIME:		4/22/2015 1600	
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	1.01031	1.00254	0.00777	10	0.777	AVG DRY		
	B	1.00479	0.99751	0.00728	10	0.728	WEIGHT (mg)		
	C	1.01637	1.00901	0.00736	10	0.736	0.704		
	D	1.00293	0.99733	0.00560	10	0.560	CV		
	E	1.01165	1.00447	0.00718	10	0.718	11.9		
2.5%	A	1.00450	0.99702	0.00748	10	0.748	AVG DRY		
	B	1.02580	1.01912	0.00668	10	0.668	WEIGHT (mg)		
	C	1.00531	0.99851	0.00680	10	0.680	0.668		
	D	1.01122	1.00466	0.00656	10	0.656	CV		
	E	1.00854	1.00265	0.00589	10	0.589			
3.4%	A	1.01454	1.00881	0.00573	10	0.573	AVG DRY		
	B	0.98998	0.98230	0.00768	10	0.768	WEIGHT (mg)		
	C	1.03021	1.02331	0.00690	10	0.690	0.633		
	D	1.01853	1.01234	0.00619	10	0.619	CV		
	E	1.00672	1.00157	0.00515	10	0.515			
4.5%	A	1.02793	1.02112	0.00681	10	0.681	AVG DRY		
	B	0.98228	0.97518	0.00710	10	0.710	WEIGHT (mg)		
	C	1.03196	1.02514	0.00682	10	0.682	0.703		
	D	1.00487	0.99714	0.00773	10	0.773	CV		
	E	0.97164	0.96496	0.00668	10	0.668			
6%	A	0.99632	0.99081	0.00551	10	0.551	AVG DRY		
	B	1.00383	0.99518	0.00865	10	0.865	WEIGHT (mg)		
	C	0.99841	0.99098	0.00743	10	0.743	0.699		
	D	1.02092	1.01391	0.00701	10	0.701	CV		
	E	0.99754	0.99120	0.00634	10	0.634	16.9		
8%	A	1.01880	1.01194	0.00686	10	0.686	AVG DRY		
	B	0.98561	0.98066	0.00495	10	0.495	WEIGHT (mg)		
	C	0.98689	0.97912	0.00777	10	0.777	0.689		
	D	1.00737	0.99949	0.00788	10	0.788	CV		
	E	1.01475	1.00776	0.00699	10	0.699			

CV = (STANDARD DEVIATION/MEAN)\*100

**REMARKS:**

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AA# K1504004, FATHEAD MINNOW GROWTH CHRONIC, 4-14-15

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

Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

---

D = 0.198

W = 0.975

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# K1504004, FATHEAD MINNOW GROWTH CHRONIC, 4-14-15

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

Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 5.22

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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# K1504004, FATHEAD MINNOW GROWTH CHRONIC, 4-14-15  
 FILE: C:\COPYTO~1\TOXSTAT\FHGWGROWTH.  
 TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.7770	0.7770
1	CONTROL	2	0.7280	0.7280
1	CONTROL	3	0.7360	0.7360
1	CONTROL	4	0.5600	0.5600
1	CONTROL	5	0.7180	0.7180
2	2.5 % EFFLUENT	1	0.7480	0.7480
2	2.5 % EFFLUENT	2	0.6680	0.6680
2	2.5 % EFFLUENT	3	0.6800	0.6800
2	2.5 % EFFLUENT	4	0.6560	0.6560
2	2.5 % EFFLUENT	5	0.5890	0.5890
3	3.4 % EFFLUENT	1	0.5730	0.5730
3	3.4 % EFFLUENT	2	0.7680	0.7680
3	3.4 % EFFLUENT	3	0.6900	0.6900
3	3.4 % EFFLUENT	4	0.6190	0.6190
3	3.4 % EFFLUENT	5	0.5150	0.5150
4	4.5 % EFFLUENT	1	0.6810	0.6810
4	4.5 % EFFLUENT	2	0.7100	0.7100
4	4.5 % EFFLUENT	3	0.6820	0.6820
4	4.5 % EFFLUENT	4	0.7730	0.7730
4	4.5 % EFFLUENT	5	0.6680	0.6680
5	6 % EFFLUENT	1	0.5510	0.5510
5	6 % EFFLUENT	2	0.8650	0.8650
5	6 % EFFLUENT	3	0.7430	0.7430
5	6 % EFFLUENT	4	0.7010	0.7010
5	6 % EFFLUENT	5	0.6340	0.6340
6	8 % EFFLUENT	1	0.6860	0.6860
6	8 % EFFLUENT	2	0.4950	0.4950
6	8 % EFFLUENT	3	0.7770	0.7770
6	8 % EFFLUENT	4	0.7880	0.7880
6	8 % EFFLUENT	5	0.6990	0.6990

AA# K1504004, FATHEAD MINNOW GROWTH CHRONIC, 4-14-15  
 File: C:\COPYTO~1\TOXSTAT\FHGWGROWTH. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.019	0.004	0.464
Within (Error)	24	0.198	0.008	
Total	29	0.217		

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

AA# K1504004, FATHEAD MINNOW GROWTH CHRONIC, 4-14-15  
 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	0.704	0.704		
2	2.5 % EFFLUENT	0.668	0.668	0.620	
3	3.4 % EFFLUENT	0.633	0.633	1.232	
4	4.5 % EFFLUENT	0.703	0.703	0.017	
5	6 % EFFLUENT	0.699	0.699	0.087	
6	8 % EFFLUENT	0.689	0.689	0.258	

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

AA# K1504004, FATHEAD MINNOW GROWTH CHRONIC, 4-14-15  
 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	0.136	19.3	0.036
3	3.4 % EFFLUENT	5	0.136	19.3	0.071
4	4.5 % EFFLUENT	5	0.136	19.3	0.001
5	6 % EFFLUENT	5	0.136	19.3	0.005
6	8 % EFFLUENT	5	0.136	19.3	0.015

APPENDIX D

*Ceriodaphnia dubia* Raw Data and Statistics



AA # K1504004, C.DUBIA CHRONIC, REPRODUCTION, 4-14-15  
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 # K1504004, C.DUBIA CHRONIC, REPRODUCTION, 4-14-15  
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORMATION

---

Bartlett's test for homogeneity of variance  
Calculated B1 statistic = 3.97

---

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

=====			
NUMBER OF			
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

=====			
NUMBER OF			
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

=====			
NUMBER OF			
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 # K1504004, C.DUBIA CHRONIC, REPRODUCCION, 4-14-15  
FILE: C:\COPYTO~1\TOXSTAT\C.DUB  
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	19.0000	19.0000
1	CONTROL	2	14.0000	14.0000
1	CONTROL	3	11.0000	11.0000
1	CONTROL	4	19.0000	19.0000
1	CONTROL	5	20.0000	20.0000
1	CONTROL	6	20.0000	20.0000
1	CONTROL	7	7.0000	7.0000
1	CONTROL	8	12.0000	12.0000
1	CONTROL	9	24.0000	24.0000
1	CONTROL	10	14.0000	14.0000
2	2.5 % EFFLUENT	1	14.0000	14.0000
2	2.5 % EFFLUENT	2	18.0000	18.0000
2	2.5 % EFFLUENT	3	19.0000	19.0000
2	2.5 % EFFLUENT	4	17.0000	17.0000
2	2.5 % EFFLUENT	5	16.0000	16.0000
2	2.5 % EFFLUENT	6	8.0000	8.0000
2	2.5 % EFFLUENT	7	20.0000	20.0000
2	2.5 % EFFLUENT	8	13.0000	13.0000
2	2.5 % EFFLUENT	9	13.0000	13.0000
2	2.5 % EFFLUENT	10	17.0000	17.0000
3	3.4 % EFFLUENT	1	19.0000	19.0000
3	3.4 % EFFLUENT	2	20.0000	20.0000
3	3.4 % EFFLUENT	3	7.0000	7.0000
3	3.4 % EFFLUENT	4	11.0000	11.0000
3	3.4 % EFFLUENT	5	16.0000	16.0000
3	3.4 % EFFLUENT	6	14.0000	14.0000
3	3.4 % EFFLUENT	7	14.0000	14.0000
3	3.4 % EFFLUENT	8	13.0000	13.0000
3	3.4 % EFFLUENT	9	19.0000	19.0000
3	3.4 % EFFLUENT	10	10.0000	10.0000
4	4.5 % EFFLUENT	1	15.0000	15.0000
4	4.5 % EFFLUENT	2	18.0000	18.0000
4	4.5 % EFFLUENT	3	11.0000	11.0000
4	4.5 % EFFLUENT	4	13.0000	13.0000
4	4.5 % EFFLUENT	5	21.0000	21.0000
4	4.5 % EFFLUENT	6	11.0000	11.0000
4	4.5 % EFFLUENT	7	20.0000	20.0000
4	4.5 % EFFLUENT	8	18.0000	18.0000

4	4.5	% EFFLUENT	9	9.0000	9.0000
4	4.5	% EFFLUENT	10	9.0000	9.0000
5	6	% EFFLUENT	1	16.0000	16.0000
5	6	% EFFLUENT	2	17.0000	17.0000
5	6	% EFFLUENT	3	14.0000	14.0000
5	6	% EFFLUENT	4	16.0000	16.0000
5	6	% EFFLUENT	5	16.0000	16.0000
5	6	% EFFLUENT	6	14.0000	14.0000
5	6	% EFFLUENT	7	9.0000	9.0000
5	6	% EFFLUENT	8	16.0000	16.0000
5	6	% EFFLUENT	9	20.0000	20.0000
5	6	% EFFLUENT	10	13.0000	13.0000
6	8	% EFFLUENT	1	16.0000	16.0000
6	8	% EFFLUENT	2	9.0000	9.0000
6	8	% EFFLUENT	3	15.0000	15.0000
6	8	% EFFLUENT	4	14.0000	14.0000
6	8	% EFFLUENT	5	22.0000	22.0000
6	8	% EFFLUENT	6	14.0000	14.0000
6	8	% EFFLUENT	7	17.0000	17.0000
6	8	% EFFLUENT	8	14.0000	14.0000
6	8	% EFFLUENT	9	12.0000	12.0000
6	8	% EFFLUENT	10	15.0000	15.0000

AA # K1504004, C.DUBIA CHRONIC, REPRODUCCION, 4-14-15

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

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	20.333	4.067	0.249
Within (Error)	54	883.600	16.363	
Total	59	903.933		

Critical F value = 2.45 (0.05,5,40)

Since F < Critical F FAIL TO REJECT Ho: All equal

AA # K1504004, C.DUBIA CHRONIC, REPRODUCCION, 4-14-15

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	16.000	16.000		
2	2.5 % EFFLUENT	15.500	15.500	0.276	
3	3.4 % EFFLUENT	14.300	14.300	0.940	
4	4.5 % EFFLUENT	14.500	14.500	0.829	
5	6 % EFFLUENT	15.100	15.100	0.498	
6	8 % EFFLUENT	14.800	14.800	0.663	

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

AA # K1504004, C.DUBIA CHRONIC, REPRODUCCION, 4-14-15

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	4.179	26.1	0.500
3	3.4 % EFFLUENT	10	4.179	26.1	1.700
4	4.5 % EFFLUENT	10	4.179	26.1	1.500
5	6 % EFFLUENT	10	4.179	26.1	0.900
6	8 % EFFLUENT	10	4.179	26.1	1.200

---

APPENDIX E

Organism History

**AQUATOX, INC.**

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

192

**TEST ORGANISM HISTORY**

DATE SHIPPED 4/14/15 CLIENT Ar Analytical

Purchase Order #: \_\_\_\_\_ Refer

SPECIES: Pimephales promelas

Quantity Shipped: 300

Age: hatched 4/12/15 @ 15-1600  
EST

Brood Stock Source: Anderson Farms, AR

Culture Water: Groundwater

Hardness (Mg/l CaCO3): 160

Dissolved Oxygen (Mg/l): 8.5

Temperature (°C): 25.1°C

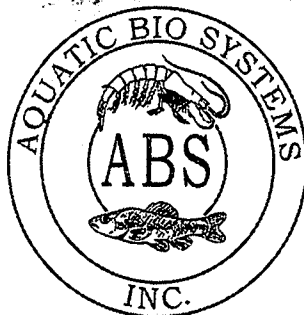
Feeding: Art

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 <sub>3</sub> ):	<u>94 mg/l</u>	<u>76-130 mg/l</u>
TOTAL ALKALINITY (as CaCO <sub>3</sub> ):	<u>65 mg/l</u>	<u>65-100 mg/l</u>
pH:	<u>7.98</u>	<u>7.50-8.20</u>

Comments:

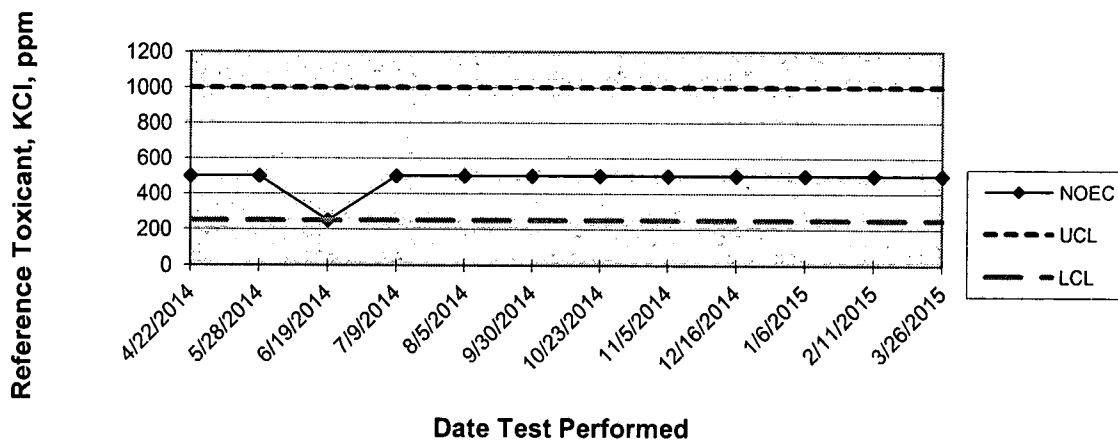
Facility Supervisor



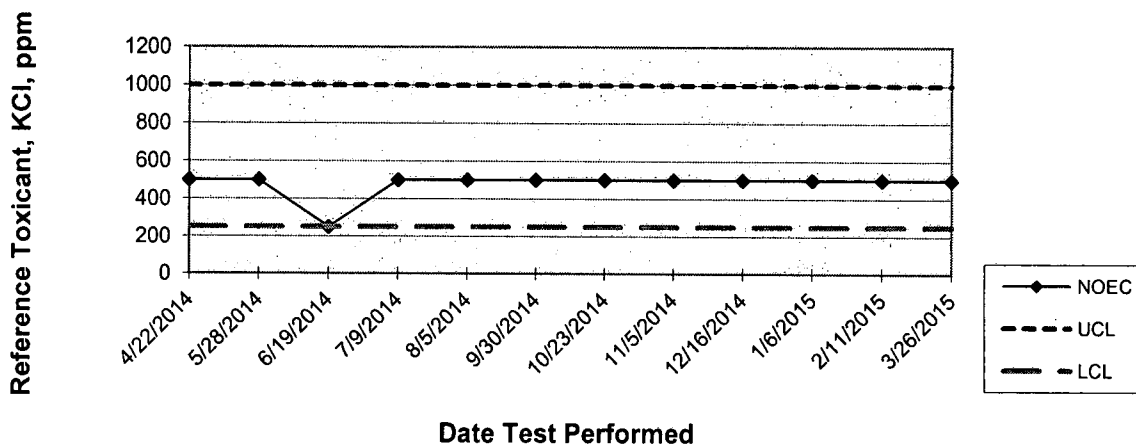
APPENDIX F

Quality Assurance Charts

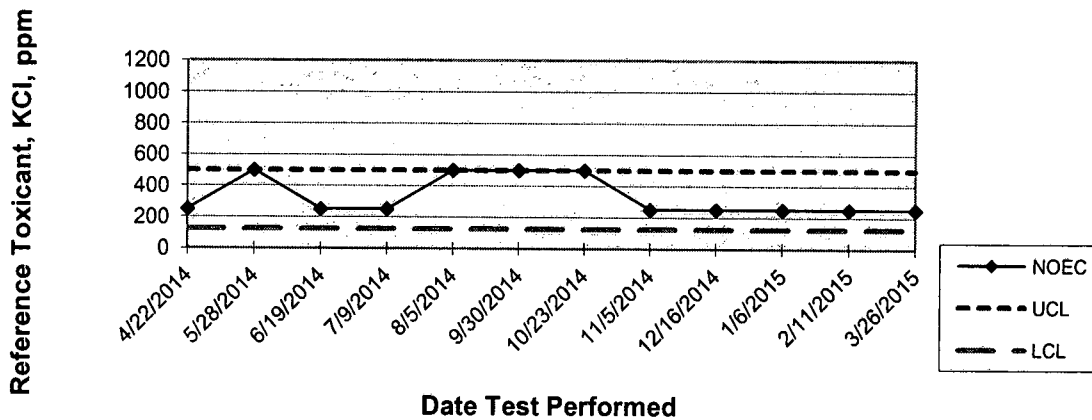
**ARKANSAS ANALYTICAL, INC.**  
**FATHEAD MINNOW SURVIVAL 7 Day**  
**QUALITY ASSURANCE**



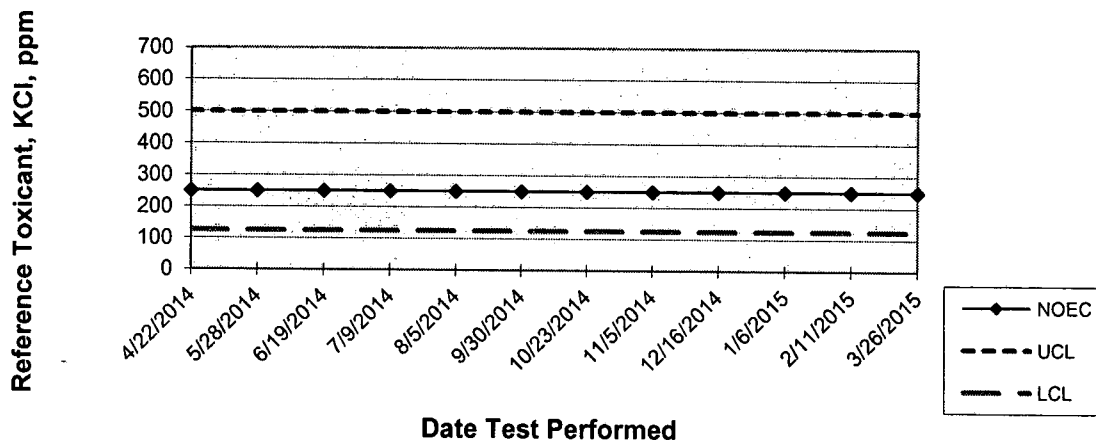
**ARKANSAS ANALYTICAL, INC.**  
**FATHEAD MINNOW GROWTH 7 Day**  
**QUALITY ASSURANCE**



**ARKANSAS ANALYTICAL, INC.**  
**CERIODAPHNIA DUBIA SURVIVAL**  
**QUALITY ASSURANCE**



**ARKANSAS ANALYTICAL, INC.**  
**CERIODAPHNIA DUBIA REPRODUCTION**  
**QUALITY ASSURANCE**





**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: May 6, 2015  
Date Received : April 13, 2015

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 / 24 HR COMP 04/12-13/15 0800-0800

ANALYTE		RESULT	UNITS	METHOD
Bioassay, Ceriodaphnia dubia, chronic	=	6.000	Rp_NOEC, %	1002.0
Bioassay, Fathead minnow, chronic	=	6.000	Gr_NOEC, %	1000.0
Bioassay, Ceriodaphnia dubia- chronic	=	6.000	Sv_NOEC, %	1002.0
Bioassay, Fathead minnow, chronic	=	6.000	Sv_NOEC, %	1000.0

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

Collected by:

DAVID THOMASON on 04/13/15 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: 18060.0001B TKR Reviewed By: K. E. Sorrells, M.S. [ ]



# SORRELLS RESEARCH LABORATORY AND FIELD SERVICES

# WEF



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Little Rock, Arkansas 72209

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

## QUALITY ASSURANCE

April 13, 2015

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

ANALYTE	ANALYST	BEG. DATE	BEG. TIME	FIN. DATE	FIN. TIME	S.D. %	SPK. REC.	#IN BAT
Bioassay, Ceriodaphnia du	ARANA	04/14/15	1415	04/21/15	1010	0.00	0.0	1
Bioassay, Fathead minnow,	ARANA	04/14/15	1445	04/21/15	1420	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: 18060.0001B 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**

TURN AROUND TIME

RUSH 24HR. 48 HR.

5 DAY REG

OTHER \_\_\_\_\_

FOR LAB/OFFICE USE ONLY

LAB # 18060.0002B

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

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>OUT Fall 201</u>	<u>4-14-15</u> <u>0800</u>	<u>4-15-15</u> <u>0800</u>	<u>Comp</u>						<u>plastic/none</u>	<u>Chronic BIO</u>

METHOD OF SHIPMENT (CIRCLE)	FIELD CALIBRATION RECORD			NOTES/COMMENTS/OBSERVATIONS
FED EX <u>WALK IN</u> SRA UPS OTHER	pH 7			<u>Temp @ lab 4°</u>
	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

RELINQUISHED BY: David Thomason DATE/TIME: 4/15/15 11:53 RECEIVED BY: Sammy Riddle DATE/TIME: 4/15/15 11:53





AFK  
700  
P.O.

Arkadelphia, AR 71923



02 1P  
0001609054 JUN 22 2015  
MAILED FROM ZIP CODE 71923

\$ 002.96<sup>0</sup>

Ms. Sara Clem  
ADEQ  
5301 Northshore Drive  
North Little Rock, AR 72118-5317