ARKADELPHIA
WATER UTILITIES

700 Clay Street
P. O. Box 495
Arkadelphia, AR 71923
Phone (870) 246-5863
Fax (870) 246-9546

November 19, 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 September 2015. Our DMR's for the biomonitoring are included as well.

If there are questions, please contact me.

Sincerely,

Brenda Gills

Brenda Gills
Utilities Manager

Enclosure

Arkansas Analytical, Inc.

Toxicity Test Results

City of Arkadelphia
Permit Number: AR0020605
AFIN # 10-00463
Third 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 K1509006

Wednesday, September 30, 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. 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 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:	9-20-15, 0800	9-21-15, 0800
Sample #2:	9-22-15, 0800	9-23-15, 0800
Sample #3:	9-24-15, 0800	9-25-15, 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:	9-21-15, 1520	1
Sample #2:	9-23-15, 1330	4
Sample #3:	9-25-15, 1059	4

Chain of custody documentation is located in Appendix A.

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

Dilution Series

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

Test Methods

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

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

Test Organisms

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

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

Quality Assurance

Test Acceptability

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	15.7	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	24.8%	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	0.672	X	
The percent coefficient of variation between replicates must be 40% or less for growth	10.3%	X	

Reference Toxicant

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

REFERENCE TOXICANT

Ceriodaphnia dubia 9/9/15 – 9/16/15		*Pimephales promelas* 9/9/15 – 9/16/15	
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

Ceriodaphnia dubia		*Pimephales promelas*	
NOEC / LOEC Survival	8% / NA	NOEC / LOEC survival	8% / NA
NOEC / LOEC Reproduction	8% / NA	NOEC / LOEC growth	8% / NA
Mean number of neonates (critical dilution)	15.5	%CV survival (critical dilution)	9.52%
%CV Reproduction (critical dilution)	27.1%	Mean dry weight (critical dilution) in milligrams	0.641
		%CV growth (critical dilution)	11.1%
PMSD Reproduction	29.6%	PMSD Growth	20.7%

Conclusion

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

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

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

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

Biomonitoring Analyst:

Ryan Hudgin / Jason Bird

Reviewed by:

Tracy Bounds by (RJ)

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:	9-20-15, 0800	9-21-15, 0800
Sample #2:	9-22-15, 0800	9-23-15, 0800
Sample #3:	9-24-15, 0800	9-25-15, 0800

Test initiated (date, time): 9-22-15, 1350 Test terminated (date, time): 9-29-15, 1500

Dilution water used: Moderately Hard Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

	Percent Survival in Replicate Chambers						**Mean Percent Survival**			
Effluent Conc %	A	B	C	D	E		24 hours	48 hours	7 days	CV %
0%	100	90	90	100	100		100	100	96	5.71
2.5%	100	90	100	90	90		100	100	94	
3.4%	90	100	60	100	100		98	98	90	
4.5%	100	70	90	100	90		100	100	90	
6%	100	90	100	80	100		100	100	94	9.52
8%	100	90	90	100	90		100	98	94	

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Average Dry Weight in milligrams in replicate chambers

Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.729	0.555	0.672	0.714	0.689		0.672	10.3%
2.5%	0.710	0.794	0.765	0.577	0.737		0.717	
3.4%	0.616	0.937	0.590	0.842	0.685		0.734	
4.5%	0.832	0.565	0.709	0.636	0.642		0.677	
6%	0.605	0.622	0.763	0.580	0.634		0.641	11.1%
8%	0.634	0.639	0.733	0.603	0.674		0.657	

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)= _____**11.1**_____%

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:	9-20-15, 0800	9-21-15, 0800
Sample #2:	9-22-15, 0800	9-23-15, 0800
Sample #3:	9-24-15, 0800	9-25-15, 0800

Test initiated (date, time): 9-22-15, 0935 Test terminated (date, time): 9-29-15, 1115
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	17	18	12	16	11	16
B	16	13	X0	15	17	13
C	13	13	12	11	16	15
D	20	9	15	9	8	23
E	14	8	10	8	15	16
F	17	19	23	10	21	9
G	21	10	12	13	16	7
H	10	7	10	18	12	12
I	10	16	10	13	21	19
J	19	20	8	15	18	11
Mean	15.7	13.3	11.2	12.8	15.5	14.1
Mean/surviving female	15.7	13.3	12.4	12.8	15.5	14.1
CV%*	24.8				27.1	

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	90	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)= _____**27.1**_____%

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 # 18440.0001B
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: Arkadelphia Water
PROJECT NO:
SAMPLER(S) NAME: (PRINT): David Thomason

SAMPLE NO:	SAMPLE ID AND/ OR COLLECTION LOCATION	START DATE/TIME	END DATE/TIME	COMP GRAB	FIELD ANALYSIS pH	TEMP	FLOW	CL2	D,O (W) D.O(P)	CONTAINER TYPE PRESERVATIVE	ANALYSIS REQUIRED
											K1509006A
	Out Fall 001	9-20-15 0800	9-21-15 0800	comp						Plastic/None	Chronic BIO

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

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

FIELD CALIBRATION RECORD

pH 7			
pH 4			
pH 10			
D.O			

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

	Yes	No
Custody Seals:		
Containers Correct:	✓	
COC/Labels Agree:	✓	
Received on Ice:	✓	

Temperature on Receipt: 1 °C
Temperature Gun ID: HHT # 2

Samples Received at Arkansas Analytical
Relinquished By: NJ ~~Sorrells~~
Date/Time: 9-21-15 1520
Received By: Amanda Fowler

RELINQUISHED BY: David Thomason X DATE/TIME: 9-21-15 10:15
RECEIVED BY: Jimmy Riddle
RECEIVED BY(LAB): DATE/TIME: 9/21/15 10:15

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 # 18440-0002B
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: Arkadelphia Water Dept.
PROJECT NO:
SAMPLER(S) NAME: (PRINT): Jessica Richburg

SAMPLE NO:	SAMPLE ID AND/ OR COLLECTION LOCATION	START DATE/TIME	END DATE/TIME	COMP GRAB	FIELD ANALYSIS pH	TEMP	FLOW	CL2	D,O (W) D.O(P)	CONTAINER TYPE PRESERVATIVE	ANALYSIS REQUIRED K150900GB
	Outfall 001	9-22-15 0800	9-23-15 0800	COMP						Plastic/none	Chronic Bio

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

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

FIELD CALIBRATION RECORD

pH 7				
pH 4				
pH 10				
D.O				

NOTI

TR

	Yes	No
Custody Seals:		
Containers Correct:		
COC/Labels Agree:		
Received on Ice:	✓	

Temperature on Receipt: 4°C
Temperature Gun ID: HHT # 2

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA (CLIENT)

X RELINQUISHED BY: _____ X DATE/TIME: 23 SEP 15 RECEIVED BY: Danny Riddle DATE/TIME: 9/23/15 1005

RELINQUISHED BY: Danny Riddle DATE/TIME: 9/23/15 1330 RECEIVED BY(LAB): Sydney James DATE/TIME: 9/23/15, 1330

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 #_____
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: Arkadelphia Water Dept.
PROJECT NO:
SAMPLER(S) NAME: (PRINT) Jessica Richburg

SAMPLE NO:	SAMPLE ID AND/ OR COLLECTION LOCATION	START DATE/TIME	END DATE/TIME	COMP GRAB	FIELD ANALYSIS pH	TEMP	FLOW	CL2	D,O (W) D.O(P)	CONTAINER TYPE PRESERVATIVE	ANALYSIS REQUIRED K150900C
	Outfall 001	9-24-15 0800	9-25-15 0800	COMP						Plastic/none	Chronic Bio

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

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

FIELD CALIBRATION RECORD

pH 7			
pH 4			
pH 10			
D.O			

	Yes	No
Custody Seals:	X	
Containers Correct:	X	
COC/Labels Agree:	X	
Received on Ice:	X	
Temperature on Receipt:	4°C	
Temperature Gun ID:	HHT #2	

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY: _____ DATE/TIME: 9-25-15 10:25AM RECEIVED BY: _____ DATE/TIME: 9-25-15 10:25

RELINQUISHED BY: _____ DATE/TIME: _____ RECEIVED BY(LAB): Amanda Folmsh DATE/TIME: 9/25/15 1059

APPENDIX B

Effluent and Dilution Water Data

Biomonitoring Quality Control Benchsheet

Analyst	RH	HH	SA	RH	RH	RH	RH	RH
Date	9-18-15	9-19-15	9-20-15	9-21-15	9-22-15	9-23-15	9-24-15	9-25-15
pH Meter ID	AR60							
LIN pH 4 Buffer	1501243			1501243				
LIN pH 7 Buffer	1501244			1501244				
LIN pH 10 Buffer	1501245			1501245				
Slope (>90%)	97.7%	97.2	97.4	97.2%	97.8%	97.9%	96.5%	96.9%

Dissolved O_2 Meter	DO 1305							
Meter Reading	8.61	8.99	8:530	8.49	8.43	8.70	8.64	8.63
Temp.	22	21	23.2	24	24	22	22	22
Chart Value at Temp.	8.743	8.715	8.578	8.418	8.418	8.743	8.743	8.743
Difference	0.133	0.125	0.048	0.088	0.028	0.043	0.103	0.103
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	AR60							
Meter Reading	22	21	24	24	24	23	22	22
Thermometer Reading	21	21	24	23	23	22	21	21
Thermometer ID	PB		PB					
Acceptance Criteria	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C

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

Hardness								
Blank(<2mg/L)					<2mg/L			
STD. Result					104			
T.V. /%REC					100/104%			
Acceptance Criteria	90.0-105.5% Recovery							

Conductivity Meter ID	Con02							
Blank (<1)					<1			
STD Result					1435			
T.V. / %REC					1412/102%			
Acceptance Criteria	99.2-104.0% Recovery							

Chlorine Meter ID	PR820							
Blank (<0.05mg/L)					<0.05mg/L			
STD Result					0.21			
T.V. / % REC					0.21/100%			
Acceptance Criteria	100.0-120% Recovery							

Biomonitoring Quality Control Benchsheet

Analyst	RH	JB	RH	RH	RH			
Date	9-26-15	27SEP15	9-28-15	9-29-15	9-30-15			
pH Meter ID	AR60	~~XL60~~						
LIN pH 4 Buffer	1501243	1500708	1501243					
LIN pH 7 Buffer	1501244	1500707	1501244					
LIN pH 10 Buffer	1501245	1500706	1501245					
Slope (>90%)	97.2%	102.6%	96%	98%	97.1%			

Dissolved O_2 Meter	DO 1305							
Meter Reading	8.59	8.59	8.55	8.58	8.58			
Temp.	22	22	23	22	22			
Chart Value at Temp.	8.743	8.743	8.578	8.743	8.743			
Difference	0.153	0.153	0.028	0.163	0.163			
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	AR60	XL60						
Meter Reading	22	22	23	22	22			
Thermometer Reading	22	22	22	23	22			
Thermometer ID	PB	PB						
Acceptance Criteria	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C	±1°C

Alkalinity								
Blank (<5mg/L)			<5mg/L					
STD Result			102					
T.V. / %REC			100/102%					
Acceptance Criteria	93.5-108.5% Recovery							

Hardness								
Blank(<2mg/L)			<2mg/L					
STD. Result			96					
T.V. /%REC			102/96%					
Acceptance Criteria	90.0-105.5% Recovery							

Conductivity Meter ID	Cond 02							
Blank (<1)			<1					
STD Result			1438					
T.V. / %REC			1412	102%				
Acceptance Criteria	99.2-104.0% Recovery							

Chlorine Meter ID	DR820							
Blank (<0.05mg/L)			<0.05mg/L					
STD Result			0.2					
T.V. / % REC			0.2/100%					
Acceptance Criteria	100.0-120% Recovery							

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Ceriodaphnia Dubia

Lab # / Sample ID: K150900 6 — Test Start (Date/Time): 9-22-15 0935 ~~0950~~ RH

Client: Arkadelphia — Test End (Date/Time): 9-29-15 1115

		Day of Test							
		1	2	3	4	5	6	7	notes
Control	lg 45	9-22	9-23	9-24	9-25	9-26	9-27	9-28	
D.O. (mg/L)	INITIAL	8.4	8.7	8.8	8.7	8.5	8.7	8.7	
	FINAL	8.3	8.4	8.1	8.6	8.5	8.5	8.1	
pH (s.u.)	INITIAL	7.7	8.3	7.8	7.9	7.8	8.3	8.0	
	FINAL	7.1	7.7	7.8	7.3	7.3	7.8	7.5	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		62	—	—	—	58	—	—	
HARDNESS (mg/L)		98	—	—	—	84	—	—	
CONDUCTIVITY (umhc		446	—	—	—	463	—	—	
CHLORINE (mg/L)		<0.05	—	—	—	—	—	—	
CONC:	2.5								
D.O. (mg/L)	INITIAL	7.5	8.5	8.8	8.7	8.5	8.5	8.7	
	FINAL	8.4	8.3	8.2	8.1	8.4	8.5	8.2	
pH (s.u)	INITIAL	7.8	8.3	7.6	7.9	7.8	8.3	7.8	
	FINAL	7.0	7.5	7.7	7.4	7.3	7.8	7.6	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	3.4								
D.O. (mg/L)	INITIAL	8.6	8.6	8.7	8.7	8.6	8.6	8.8	
	FINAL	8.4	8.3	8.2	8.3	8.5	8.5	8.2	
pH (mg/L)	INITIAL	7.8	8.3	7.6	7.8	7.8	8.3	7.8	
	FINAL	7.2	7.5	7.7	7.6	7.4	7.9	7.6	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	4.5								
D.O. (mg/L)	INITIAL	8.4	8.5	8.8	8.5	8.5	8.3	8.7	
	FINAL	8.4	8.4	8.3	8.4	8.5	8.4	8.2	
pH (s.u.)	INITIAL	7.8	8.3	7.5	7.8	7.8	8.3	7.7	
	FINAL	7.2	7.6	7.6	7.7	7.4	8.0	7.6	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	6								
D.O. (mg/L)	INITIAL	8.6	8.4	8.8	8.6	8.4	8.4	8.8	
	FINAL		8.4	8.3	8.4	8.5	8.4	8.1	
pH (s.u.)	INITIAL	7.9	8.1	7.5	7.8	7.8	8.1	7.6	
	FINAL	7.3	7.6	7.6	7.7	7.4	8.0	7.7	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	8								
D.O. (mg/L)	INITIAL	8.6	8.2	8.8	8.5	8.6	8.8	8.8	
	FINAL	8.5	8.5	8.3	8.5	8.4	8.4	8.1	
pH (s.u.)	INITIAL	7.8	7.7	7.5	7.8	7.9	7.8	7.6	
	FINAL	7.3	7.7	7.7	7.8	7.4	7.9	7.7	
temp (C)	INITIAL	23	22	23	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	**100 %**	A	A	A	B	B	C	C	
ALKALINITY (mg/L)		108	—	—	108	—	102	—	
HARDNESS (mg/L)		48	—	—	50	—	54	—	
CONDUCTIVITY (umhc		368	—	—	356	—	363	—	
CHLORINE (mg/L)		<0.05	—	—	—	—	—	—	

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Fathead Minnow
Lab # / Sample ID: K1509006					Test Start (Date/Time):	9-22-15	1350		
Client: Arkadelphia					Test End (Date/Time):	9-29-15	1500		
		Day of Test							
		1	2	3	4	5	6	7	notes
Control	My HS	9-22	9-23	9-24	9-25	9-26	9-27	9-28	
D.O. (mg/L)	INITIAL	8.4	8.7	8.8	8.7	8.5	8.6	8.7	
	FINAL	6.0	7.1	7.7	8.2	7.2	7.3	7.6	
pH (s.u.)	INITIAL	7.7	8.3	7.8	7.9	7.8	8.2	8.0	
	FINAL	7.8	8.1	7.5	7.8	7.4	7.6	7.8	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		62				58			
HARDNESS (mg/L)		98				84			
CONDUCTIVITY (umhc		446				463			
CHLORINE (mg/L)		<0.05							
CONC:	2.5								
D.O. (mg/L)	INITIAL	7.5	8.5	8.8	8.7	8.5	8.4	8.7	
	FINAL	5.7	7.0	7.8	8.1	7.7	7.5	7.6	
pH (s.u)	INITIAL	7.8	8.3	7.6	7.9	7.8	8.0	7.8	
	FINAL	7.8	8.1	7.5	7.8	7.6	7.6	7.9	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	3.4								
D.O. (mg/L)	INITIAL	8.6	8.6	8.7	8.7	8.6	8.6	8.8	
	FINAL	6.5	7.3	7.9	8.3	7.8	7.4	7.5	
pH (mg/L)	INITIAL	7.8	8.3	7.6	7.8	7.8	7.5	7.8	
	FINAL	7.5	8.0	7.5	7.7	7.9	7.7	7.8	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	4.5								
D.O. (mg/L)	INITIAL	8.4	8.5	8.8	8.5	8.5	8.4	8.7	
	FINAL	6.5	7.2	7.9	8.3	7.3	7.5	7.5	
pH (s.u.)	INITIAL	7.8	8.3	7.5	7.8	7.8	8.4	7.7	
	FINAL	7.4	8.0	7.5	7.5	7.9	7.6	7.8	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	6								
D.O. (mg/L)	INITIAL	8.6	8.4	8.8	8.6	8.4	8.6	8.8	
	FINAL	6.4	7.5	7.9	8.3	7.6	7.3	7.4	
pH (s.u.)	INITIAL	7.9	8.1	7.5	7.8	7.8	8.3	7.6	
	FINAL	7.4	8.0	7.5	7.3	7.9	7.4	7.7	
temp (C)	INITIAL	23	22	22	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	8								
D.O. (mg/L)	INITIAL	8.6	8.2	8.8	8.5	8.6	8.3	8.8	
	FINAL	6.3	7.3	7.9	8.3	7.4	7.3	7.4	
pH (s.u.)	INITIAL	7.8	7.7	7.5	7.8	7.9	7.6	7.6	
	FINAL	7.4	7.8	7.4	7.2	7.7	7.4	7.6	
temp (C)	INITIAL	23	22	23	22	22	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	100 %	A	A	A	B	B	C	C	
ALKALINITY (mg/L)		108			108		102		
HARDNESS (mg/L)		48			50		54		
CONDUCTIVITY (umhc		368			356		363		
CHLORINE (mg/L)		<0.05							

APPENDIX C

Fathead minnow raw data and statistics

Pimephales promelas **FATHEAD MINNOW**

SURVIVAL DATA FOR LARVAL SURVIVAL AND GROWTH TEST (CHRONIC)

LAB #: K1509006			TEST START		DATE	9/22/15	TIME	1350				
CLIENT: Arkadelphia			TEST END		DATE	9/29/15	TIME	1500				
ANALYST: RH / JB			AGE AND SOURCE OF MINNOWS			< 48 hrs old, Aquatox						
			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%		
	B	10	10	10	10	10	10	9	9	90%		
	C	10	10	10	10	9	9	9	9	90%	*96.0%*	*5.71*
MHS	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	9	9	9	90%		
	C	10	10	10	10	10	10	10	10	100%	*94.0%*	
2.5%	D	10	10	10	10	9	9	9	9	90%		
	E	10	10	10	9	9	9	9	9	90%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	9	9	9	90%		
	B	10	10	10	10	10	10	10	10	100%		
	C	10	9	9	9	8	6	6	6	60%	*90.0%*	
3.4%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	10	10	10	100%		
	REP #	START	1	2	3	4	5	6	7	%	MEAN %	CV
CONC:	A	10	10	10	10	10	10	10	10	100%		
	B	10	10	10	10	10	7	7	7	70%		
	C	10	10	10	9	9	9	9	9	90%	*90.0%*	
4.5%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	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%		
	B	10	10	10	10	10	9	9	9	90%		
	C	10	10	10	10	10	10	10	10	100%	*94.0%*	*9.52*
6%	D	10	10	10	10	9	8	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	10	10	10	10	100%		
	B	10	10	9	9	9	9	9	9	90%		
	C	10	10	10	9	9	9	9	9	90%	*94.0%*	
8%	D	10	10	10	10	10	10	10	10	100%		
	E	10	10	10	10	10	9	9	9	90%		
ANALYST:		RH	RH	RH	RH	RH	JB	RH	RH			
DATE:		9/22/15	9/23/15	9/24/15	9/25/15	9/26/15	9/27/15	9/28/15	9/29/15			
TIME:		1350	1645	1405	1140	1335	0935	1340	1500			

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

REMARKS:

AA# K1509006, FATHEAD MINNOW SURV.,CHRONIC, 9-22-15
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.498

W = 0.875

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# K1509006, FATHEAD MINNOW SURV.,CHRONIC, 9-22-15
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 6.16

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# K1509006, FATHEAD MINNOW SURV.,CHRONIC, 9-22-15
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	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	0.9000	1.2490
2	2.5 % EFFLUENT	3	1.0000	1.4120
2	2.5 % EFFLUENT	4	0.9000	1.2490
2	2.5 % EFFLUENT	5	0.9000	1.2490
3	3.4 % EFFLUENT	1	0.9000	1.2490
3	3.4 % EFFLUENT	2	1.0000	1.4120
3	3.4 % EFFLUENT	3	0.6000	0.8861
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	0.7000	0.9912
4	4.5 % EFFLUENT	3	0.9000	1.2490
4	4.5 % EFFLUENT	4	1.0000	1.4120
4	4.5 % EFFLUENT	5	0.9000	1.2490
5	6.0 % EFFLUENT	1	1.0000	1.4120
5	6.0 % EFFLUENT	2	0.9000	1.2490
5	6.0 % EFFLUENT	3	1.0000	1.4120
5	6.0 % EFFLUENT	4	0.8000	1.1071
5	6.0 % EFFLUENT	5	1.0000	1.4120
6	8.0 % EFFLUENT	1	1.0000	1.4120
6	8.0 % EFFLUENT	2	0.9000	1.2490
6	8.0 % EFFLUENT	3	0.9000	1.2490
6	8.0 % EFFLUENT	4	1.0000	1.4120
6	8.0 % EFFLUENT	5	0.9000	1.2490

AA# K1509006, FATHEAD MINNOW SURV.,CHRONIC, 9-22-15
File: C:\COPYTO~1\TOXSTAT\FHSURV~1. Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.024	0.005	0.233
Within (Error)	24	0.498	0.021	
Total	29	0.523		

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

AA# K1509006, FATHEAD MINNOW SURV.,CHRONIC, 9-22-15
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	1.347	0.960		
2	2.5 % EFFLUENT	1.314	0.940	0.358	
3	3.4 % EFFLUENT	1.274	0.900	0.797	
4	4.5 % EFFLUENT	1.263	0.900	0.924	
5	6.0 % EFFLUENT	1.318	0.940	0.311	
6	8.0 % EFFLUENT	1.314	0.940	0.358	

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

AA# K1509006, FATHEAD MINNOW SURV.,CHRONIC, 9-22-15
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	0.131	13.7	0.020
3	3.4 % EFFLUENT	5	0.131	13.7	0.060
4	4.5 % EFFLUENT	5	0.131	13.7	0.060
5	6.0 % EFFLUENT	5	0.131	13.7	0.020
6	8.0 % EFFLUENT	5	0.131	13.7	0.020

Pimephales promelas **FATHEAD MINNOW** TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K1509006					TEST DATES (BEGIN / END):	9/22/15 - 9/29/15	
CLIENT:	Arkadelphia					WEIGHING DATE / TIME:	9/30/2015	
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	1.00323	0.99594	0.00729	10	0.729	AVG DRY	
	B	1.03527	1.02972	0.00555	10	0.555	WEIGHT (mg)	
MHS	C	1.02220	1.01548	0.00672	10	0.672		0.672
	D	0.99340	0.98626	0.00714	10	0.714	CV	
	E	1.00821	1.00132	0.00689	10	0.689		10.3
CONC:	A	0.99809	0.99099	0.00710	10	0.710	AVG DRY	
	B	1.03224	1.02430	0.00794	10	0.794	WEIGHT (mg)	
2.5%	C	0.99266	0.98501	0.00765	10	0.765		0.717
	D	1.00398	0.99821	0.00577	10	0.577	CV	
	E	1.01556	1.00819	0.00737	10	0.737		
CONC:	A	1.00821	1.00205	0.00616	10	0.616	AVG DRY	
	B	1.01278	1.00341	0.00937	10	0.937	WEIGHT (mg)	
3.4%	C	0.98884	0.98294	0.00590	10	0.590		0.734
	D	1.00956	1.00114	0.00842	10	0.842	CV	
	E	1.00947	1.00262	0.00685	10	0.685		
CONC:	A	0.98843	0.98011	0.00832	10	0.832	AVG DRY	
	B	0.99885	0.99320	0.00565	10	0.565	WEIGHT (mg)	
4.5%	C	0.99690	0.98981	0.00709	10	0.709		0.677
	D	1.02020	1.01384	0.00636	10	0.636	CV	
	E	1.01502	1.00860	0.00642	10	0.642		
CONC:	A	1.00247	0.99642	0.00605	10	0.605	AVG DRY	
	B	1.01306	1.00684	0.00622	10	0.622	WEIGHT (mg)	
6%	C	1.00880	1.00117	0.00763	10	0.763		0.641
	D	1.01925	1.01345	0.00580	10	0.580	CV	
	E	1.01991	1.01357	0.00634	10	0.634		11.1
CONC:	A	0.99911	0.99277	0.00634	10	0.634	AVG DRY	
	B	0.98482	0.97843	0.00639	10	0.639	WEIGHT (mg)	
8%	C	1.02525	1.01792	0.00733	10	0.733		0.657
	D	1.01070	1.00467	0.00603	10	0.603	CV	
	E	1.01382	1.00708	0.00674	10	0.674		

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

AA# K1509005, FATHEAD MINNOW GROWTH CHRONIC, 9-22-15
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.208

W = 0.974

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# K1509005, FATHEAD MINNOW GROWTH CHRONIC, 9-22-15
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.42

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# K1509005, FATHEAD MINNOW GROWTH CHRONIC, 9-22-15
FILE: C:\COPYTO~1\TOXSTAT\FHGROWTH.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.7290	0.7290
1	CONTROL	2	0.5550	0.5550
1	CONTROL	3	0.6720	0.6720
1	CONTROL	4	0.7140	0.7140
1	CONTROL	5	0.6890	0.6890
2	2.5 % EFFLUENT	1	0.7100	0.7100
2	2.5 % EFFLUENT	2	0.7940	0.7940
2	2.5 % EFFLUENT	3	0.7650	0.7650
2	2.5 % EFFLUENT	4	0.5770	0.5770
2	2.5 % EFFLUENT	5	0.7370	0.7370
3	3.4 % EFFLUENT	1	0.6160	0.6160
3	3.4 % EFFLUENT	2	0.9370	0.9370
3	3.4 % EFFLUENT	3	0.5900	0.5900
3	3.4 % EFFLUENT	4	0.8420	0.8420
3	3.4 % EFFLUENT	5	0.6850	0.6850
4	4.5 % EFFLUENT	1	0.8320	0.8320
4	4.5 % EFFLUENT	2	0.5650	0.5650
4	4.5 % EFFLUENT	3	0.7090	0.7090
4	4.5 % EFFLUENT	4	0.6360	0.6360
4	4.5 % EFFLUENT	5	0.6420	0.6420
5	6.0 % EFFLUENT	1	0.6050	0.6050
5	6.0 % EFFLUENT	2	0.6220	0.6220
5	6.0 % EFFLUENT	3	0.7630	0.7630
5	6.0 % EFFLUENT	4	0.5800	0.5800
5	6.0 % EFFLUENT	5	0.6340	0.6340
6	8.0 % EFFLUENT	1	0.6340	0.6340
6	8.0 % EFFLUENT	2	0.6390	0.6390
6	8.0 % EFFLUENT	3	0.7330	0.7330
6	8.0 % EFFLUENT	4	0.6030	0.6030
6	8.0 % EFFLUENT	5	0.6740	0.6740

AA# K1509005, FATHEAD MINNOW GROWTH CHRONIC, 9-22-15
File: C:\COPYTO~1\TOXSTAT\FHGROWTH. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.032	0.006	0.736
Within (Error)	24	0.208	0.009	
Total	29	0.240		

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

AA# K1509005, FATHEAD MINNOW GROWTH CHRONIC, 9-22-15
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	0.672	0.672		
2	2.5 % EFFLUENT	0.717	0.717	-0.761	
3	3.4 % EFFLUENT	0.734	0.734	-1.057	
4	4.5 % EFFLUENT	0.677	0.677	-0.085	
5	6.0 % EFFLUENT	0.641	0.641	0.527	
6	8.0 % EFFLUENT	0.657	0.657	0.258	

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

AA# K1509005, FATHEAD MINNOW GROWTH CHRONIC, 9-22-15
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	0.139	20.7	-0.045
3	3.4 % EFFLUENT	5	0.139	20.7	-0.062
4	4.5 % EFFLUENT	5	0.139	20.7	-0.005
5	6.0 % EFFLUENT	5	0.139	20.7	0.031
6	8.0 % EFFLUENT	5	0.139	20.7	0.015

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

SURVIVAL AND REPRODUCTION TEST

Ceriodaphnia dubia

Discharger: Arkadelphia AFIN # 10-00463	Lab Number/s
Location: Outfall 001	*K1509006*
Date Sample Collected: 9 - 21/23/25 - 15	

Analyst: RH	
Test Start - Date/Time: 9-22-15, 0935	
Test Stop - Date/Time: 9-29-15, 1115	

Conc	1	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
MHS	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	RH
	3	0	0	0	0	0	1	1	0	0	0	2	10	0.2	RH
	4	1	2	3	5	3	4	0	0	4	3	25	10	2.5	RH
	5	7	6	2	0	1	6	8	2	0	5	37	10	3.7	RH
	6	0	1	7	12	5	0	7	8	6	9	55	10	5.5	RH
	7	9	7	1	3	5	6	5	0	0	2	38	10	3.8	RH
	8														
	Total	17	16	13	20	14	17	21	10	10	19	157		Avg. =	15.7
														C.V. =	24.8

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	1	0	1	10	0.1	RH
	4	1	0	0	2	1	2	2	5	3	4	20	10	2.0	RH
	5	8	6	0	2	5	6	0	0	2	4	33	10	3.3	RH
	6	9	4	8	5	2	6	7	0	5	12	58	10	5.8	RH
	7	0	3	5	0	0	5	1	2	5	0	21	10	2.1	RH
	8														
	Total	18	13	13	9	8	19	10	7	16	20	133		Avg. =	13.3
														C.V. =	35.8

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	0	0	0	0	0	0	10	0.0	RH
	4	2	0	1	1	2	3	4	3	0	1	17	10	1.7	RH
	5	0	X	5	8	6	5	0	7	1	1	33	10	3.3	RH
	6	8		6	5	1	8	6	0	8	3	45	10	4.5	RH
	7	2		0	1	1	7	2	0	1	3	17	10	1.7	RH
	8														
	Total	12	0	12	15	10	23	12	10	10	8	112		Avg. =	12.4
			X											C.V. =	35.5

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	0	0	0	0	0	0	0	10	0.0	RH
	4	1	1	0	5	2	3	5	6	0	4	27	10	2.7	RH
	5	5	7	6	4	0	7	5	4	8	4	50	10	5.0	RH
	6	5	7	5	0	6	0	1	8	0	6	38	10	3.8	RH
	7	5	0	0	0	0	0	2	0	5	1	13	10	1.3	RH
	8												10	0.0	
	Total	16	15	11	9	8	10	13	18	13	15	128		Avg. =	12.8
														C.V. =	25.5

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	0	0	1	0	0	1	0	2	10	0.2	RH
	4	3	2	3	3	0	5	4	3	4	2	29	10	2.9	RH
	5	7	6	8	0	4	7	6	0	2	9	49	10	4.9	RH
	6	0	1	5	0	6	8	1	0	9	0	30	10	3.0	RH
	7	1	8	0	5	5	0	5	9	5	7	45	10	4.5	RH
	8												10	0.0	RH
	Total	11	17	16	8	15	21	16	12	21	18	155		Avg. =	15.5
														C.V. =	27.1

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	0	0	0	0	0	0	1	0	0	0	1	10	0.1	RH
	4	2	0	3	1	0	2	2	4	0	3	17	10	1.7	RH
	5	8	5	9	5	0	7	4	0	6	0	44	10	4.4	RH
	6	0	1	3	12	8	0	0	8	12	7	51	10	5.1	RH
	7	6	7	0	5	8	0	0	0	1	1	28	10	2.8	RH
	8												10	0.0	RH
	Total	16	13	15	23	16	9	7	12	19	11	141		Avg. =	14.1
														C.V. =	33.7

AA # K1509006, C.DUBIA CHRONIC, REPRODUCION, 9-22-15
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 # K1509006, C.DUBIA CHRONIC, REPRODUCION, 9-22-15
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 3.18

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

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

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
2.5	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
3.4	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 9.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
4.5	10	0	10

TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6.0	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
8.0	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	1	
3	4.5	10	0	
4	6.0	10	0	
5	8.0	10	0	

TITLE: AA # K1509006, C.DUBIA CHRONIC, REPRODUCION, 9-22-15
FILE: C:\COPYTO~1\TOXSTAT\C.DUB
TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	17.0000	17.0000
1	CONTROL	2	16.0000	16.0000
1	CONTROL	3	13.0000	13.0000
1	CONTROL	4	20.0000	20.0000
1	CONTROL	5	14.0000	14.0000
1	CONTROL	6	17.0000	17.0000
1	CONTROL	7	21.0000	21.0000
1	CONTROL	8	10.0000	10.0000
1	CONTROL	9	10.0000	10.0000
1	CONTROL	10	19.0000	19.0000
2	2.5 % EFFLUENT	1	18.0000	18.0000
2	2.5 % EFFLUENT	2	13.0000	13.0000
2	2.5 % EFFLUENT	3	13.0000	13.0000
2	2.5 % EFFLUENT	4	9.0000	9.0000
2	2.5 % EFFLUENT	5	8.0000	8.0000
2	2.5 % EFFLUENT	6	19.0000	19.0000
2	2.5 % EFFLUENT	7	10.0000	10.0000
2	2.5 % EFFLUENT	8	7.0000	7.0000
2	2.5 % EFFLUENT	9	16.0000	16.0000
2	2.5 % EFFLUENT	10	20.0000	20.0000
3	3.4 % EFFLUENT	1	12.0000	12.0000
3	3.4 % EFFLUENT	2	0.0000	0.0000
3	3.4 % EFFLUENT	3	12.0000	12.0000
3	3.4 % EFFLUENT	4	15.0000	15.0000
3	3.4 % EFFLUENT	5	10.0000	10.0000
3	3.4 % EFFLUENT	6	23.0000	23.0000
3	3.4 % EFFLUENT	7	12.0000	12.0000
3	3.4 % EFFLUENT	8	10.0000	10.0000
3	3.4 % EFFLUENT	9	10.0000	10.0000
3	3.4 % EFFLUENT	10	8.0000	8.0000
4	4.5 % EFFLUENT	1	16.0000	16.0000
4	4.5 % EFFLUENT	2	15.0000	15.0000
4	4.5 % EFFLUENT	3	11.0000	11.0000
4	4.5 % EFFLUENT	4	9.0000	9.0000
4	4.5 % EFFLUENT	5	8.0000	8.0000
4	4.5 % EFFLUENT	6	10.0000	10.0000
4	4.5 % EFFLUENT	7	13.0000	13.0000
4	4.5 % EFFLUENT	8	18.0000	18.0000

4	4.5 % EFFLUENT	9	13.0000	13.0000
4	4.5 % EFFLUENT	10	15.0000	15.0000
5	6.0 % EFFLUENT	1	11.0000	11.0000
5	6.0 % EFFLUENT	2	17.0000	17.0000
5	6.0 % EFFLUENT	3	16.0000	16.0000
5	6.0 % EFFLUENT	4	8.0000	8.0000
5	6.0 % EFFLUENT	5	15.0000	15.0000
5	6.0 % EFFLUENT	6	21.0000	21.0000
5	6.0 % EFFLUENT	7	16.0000	16.0000
5	6.0 % EFFLUENT	8	12.0000	12.0000
5	6.0 % EFFLUENT	9	21.0000	21.0000
5	6.0 % EFFLUENT	10	18.0000	18.0000
6	8.0 % EFFLUENT	1	16.0000	16.0000
6	8.0 % EFFLUENT	2	13.0000	13.0000
6	8.0 % EFFLUENT	3	15.0000	15.0000
6	8.0 % EFFLUENT	4	23.0000	23.0000
6	8.0 % EFFLUENT	5	16.0000	16.0000
6	8.0 % EFFLUENT	6	9.0000	9.0000
6	8.0 % EFFLUENT	7	7.0000	7.0000
6	8.0 % EFFLUENT	8	12.0000	12.0000
6	8.0 % EFFLUENT	9	19.0000	19.0000
6	8.0 % EFFLUENT	10	11.0000	11.0000

AA # K1509006, C.DUBIA CHRONIC, REPRODUCION, 9-22-15
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	145.933	29.187	1.442
Within (Error)	54	1092.800	20.237	
Total	59	1238.733		

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

AA # K1509006, C.DUBIA CHRONIC, REPRODUCION, 9-22-15
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	15.700	15.700		
2	2.5 % EFFLUENT	13.300	13.300	1.193	
3	3.4 % EFFLUENT	11.200	11.200	2.237	
4	4.5 % EFFLUENT	12.800	12.800	1.441	
5	6.0 % EFFLUENT	15.500	15.500	0.099	
6	8.0 % EFFLUENT	14.100	14.100	0.795	

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

AA # K1509006, C.DUBIA CHRONIC, REPRODUCION, 9-22-15
File: C:\COPYTO~1\TOXSTAT\C.DUB Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	2.5 % EFFLUENT	10	4.647	29.6	2.400
3	3.4 % EFFLUENT	10	4.647	29.6	4.500
4	4.5 % EFFLUENT	10	4.647	29.6	2.900
5	6.0 % EFFLUENT	10	4.647	29.6	0.200
6	8.0 % EFFLUENT	10	4.647	29.6	1.600

APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 9/22/15 **CLIENT** ARL ANALYTICAL

Purchase Order #: _____

SPECIES: Pimephales promelas

Quantity Shipped: 300+ 15-1600 CST

Age: HATCHED 9/20/15

Brood Stock Source: Anderson Farms, AR

Culture Water: Groundwater

Hardness (Mg/l CaCO3): =160

Dissolved Oxygen (Mg/1): 8.5

Temperature (°C): 25.1

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

Comments:

Facility Supervisor

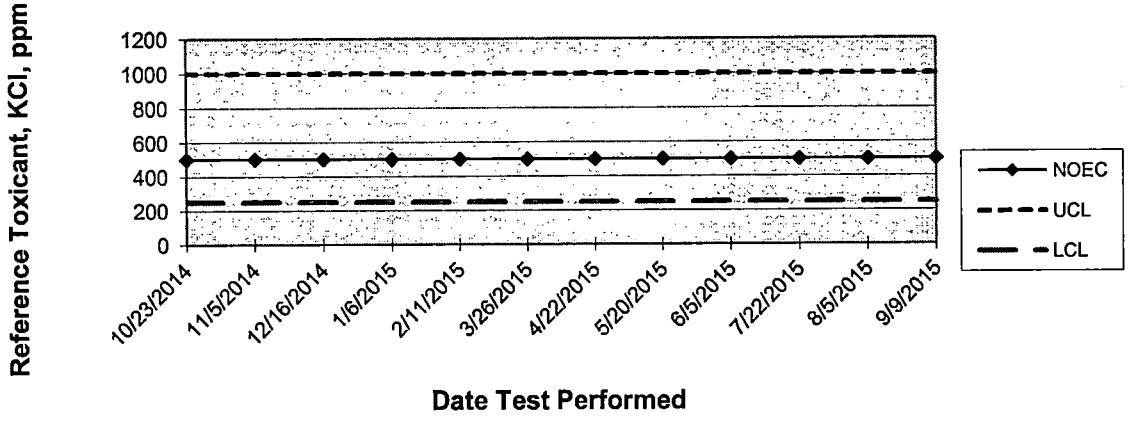
APPENDIX F

Quality Assurance Charts

ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW SURVIVAL 7 Day

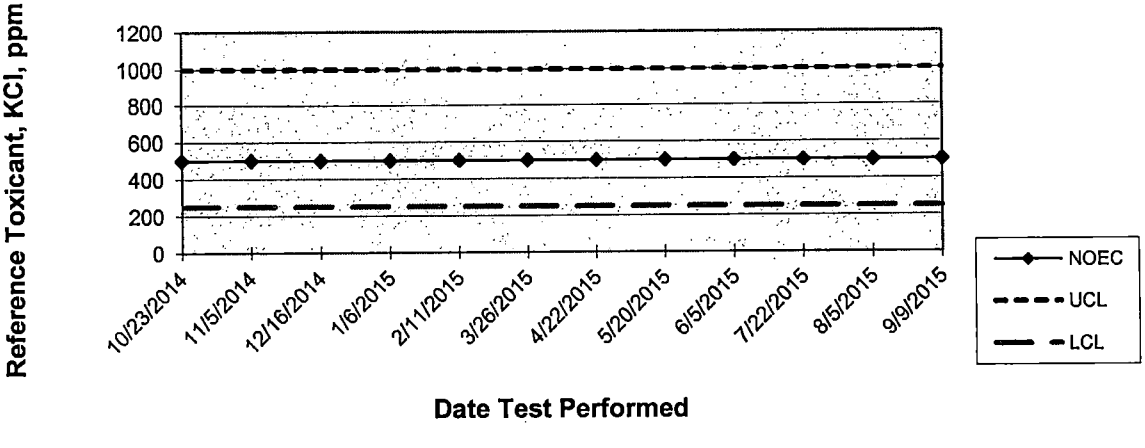
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

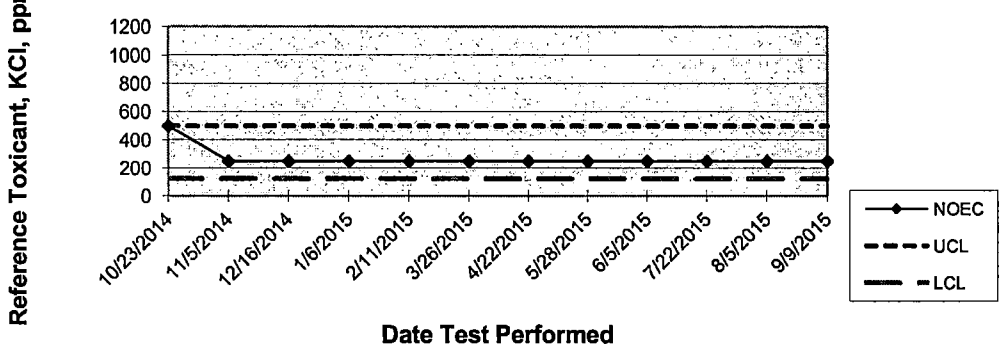
FATHEAD MINNOW GROWTH 7 Day

QUALITY ASSURANCE



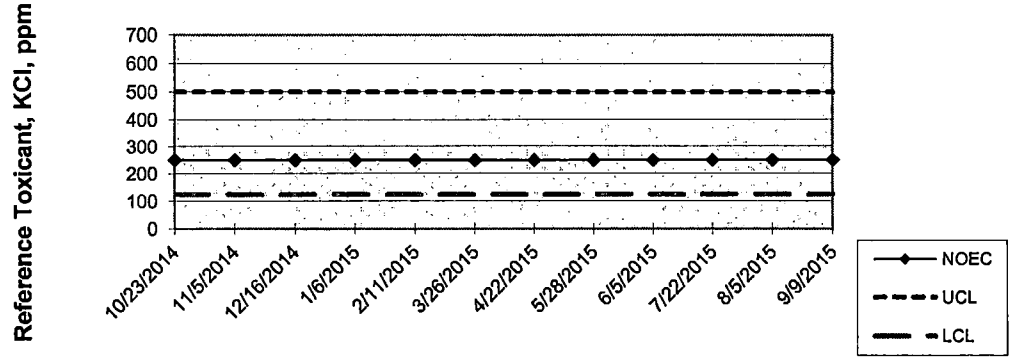
ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE



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