

Arkansas Analytical, Inc.

Toxicity Test Results

CITY of SHERIDAN
NPDES PERMIT NUMBER: AR0034347
Second Quarter 2016
AFIN # 27-00022

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

Ceriodaphnia dubia, Survival and Reproduction Test
Test 1002.0

Prepared for: **Mr. David Fitzgerald**
City of Sheridan
P.O.Box 486
Sheridan, Arkansas 72150

Prepared by: Arkansas Analytical, Inc.
8100 National Drive
Little Rock, Arkansas 72209
Lab Number K1604005

Thursday, April 21, 2016

Introduction

This report contains test results for toxicity testing for the City of Sheridan, NPDES permit number AR0034347. The plant is located in the Southeast ¼ of the Northwest ¼ of Section 11, Township 5 South, Range 13 West, in Grant County, Arkansas. The discharge is to receiving waters named Big Creek to Hurricane Creek, then to the Saline River in Segment 2C of the Ouachita River Basin.

The permit requires chronic biomonitoring testing quarterly for *Ceriodaphnia dubia* and *Pimephales promelas*. The test results in this report represent the testing of the second quarter of 2016.

Plant Operations

To be provided by permittee.

Source of Effluent and Dilution Water

Effluent sample was collected as follows:

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	4-4-16, 1300	4-5-16, 1200
Sample #2	4-5-16, 1357	4-6-16, 1257

Due to cessation of flow, the effluent samples were two composite samples collected at the final discharge from the City of Sheridan Waterworks. This is specifically allowed in the permit.

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

Sample Receiving Information:	Date, Time Sample(s) Received	Temperature Upon Receipt (°C)
Sample #1:	4-5-16, 1620	4
Sample #2	4-6-16, 1545	8 (received on ice)

Chain of custody documentation is located in Appendix A.

The permit designates the receiving water to be used as dilution water for the toxicity tests. Synthetic dilution water was substituted because of either zero flow conditions or due to an earlier characterization of the receiving water as being toxic.

The dilution water used in the toxicity tests was synthetic moderately hard. 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 10%, 13%, 17%, 23%, and 31%. The low-flow effluent concentration (**critical dilution**) was defined as **23% 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. The alternate method suggested in the method (11.3.4.5) for combating pathogen interference was run in place of the original fathead minnow test. The test chambers were 30 ml plastic cups with 20 ml of test solution. Each chamber contained 2 organisms. The total number of fish was 40 per test solution. The fish were then combined to perform growth analysis. 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 also 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 ml 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 < 24 hour old Fathead Minnows, *Pimephales promelas*, which were purchased from Aquatox; a copy of the organism history is provided in Appendix D.

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 *Pimephales promelas*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
The percent coefficient of variation between replicates must be 40% or less for survival	0%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.399	X	
The percent coefficient of variation between replicates must be 40% or less for growth	16.7%	X	

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	90%	X	
Average of 15 or more young per surviving female	26.3	X	
At least 60% of surviving females should have produced 3 broods	78%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	27.4%	X	

Reference Toxicant

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

REFERENCE TOXICANT

<i>Ceriodaphnia dubia</i> 3/2/16 – 3/9/16		<i>Pimephales promelas</i> 3/2/16 – 3/9/16	
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 E.

Summary of Results

<i>Ceriodaphnia dubia</i>		<i>Pimephales promelas</i>	
NOEC / LOEC Survival	31% / NA	NOEC / LOEC survival	31% / NA
NOEC / LOEC Reproduction	31% / NA	NOEC / LOEC growth	31% / NA
Mean number of neonates (critical dilution)	31.2	%CV survival (critical dilution)	0.00%
%CV Reproduction (critical dilution)	31.3%	Mean dry weight (critical dilution) in milligrams	0.384
		%CV growth (critical dilution)	8.54%
PMSD Reproduction	40.0%	PMSD Growth	18.0%

Conclusion

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

The permit issued to the City of Sheridan, AR0034347, specifies that the **critical dilution is 23% effluent**. The effluent samples **did not** exhibit lethal or sublethal effects at the critical dilution, and, as such, **passed** the test.

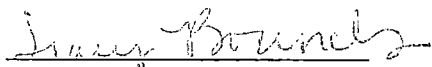
Chronic static renewal survival and reproduction test using *Ceriodaphnia dubia*, (Method 1002.0)

The permit issued to the City of Sheridan, AR0034347, specifies that the **critical dilution is 23% effluent**. The effluent samples **did not** exhibit lethal or sublethal effects at the critical dilution, and, as such, **passed** the test.

Biomonitoring Analyst:

Tracy Bounds, Zabrina Ruggles, Ken Rood, Chris Turney, Teresa Coins

Reviewed by:



Tracy Bounds, lab manager

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

PERMITTEE: City of Sheridan

NPDES #: AR0034347

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	4-4-16, 1300	4-5-16, 1200
Sample #2	4-5-16, 1357	4-6-16, 1257

Test initiated (date, time): 4-6-16, 1625 Test terminated (date, time): 4-13-16, 1605

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	100	100	100	100		100	100	100	0.0%
10%	100	100	87.5	87.5	100		87.5	87.5	95	
13%	100	100	100	75	100		75	75	95	
17%	87.5	100	100	100	87.5		100	87.5	95	
23%	100	100	100	100	100		100	100	100	0.0%
31%	100	87.5	100	100	100		100	100	97.5	

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Average Dry Weight in milligrams in replicate chambers							Mean Dry Weight	CV%
Effluent Conc %	A	B	C	D	E			
0%	0.294	0.390	0.475	0.414	0.424		0.399	16.7%
10%	0.366	0.376	0.404	0.344	0.424		0.383	
13%	0.342	0.435	0.403	0.273	0.383		0.367	
17%	0.325	0.395	0.436	0.395	0.370		0.384	
23%	0.357	0.372	0.381	0.366	0.440		0.383	8.54%
31%	0.359	0.336	0.399	0.433	0.331		0.372	

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, (23%) 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, (23%) 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)= 31 % effluent
b) NOEC growth (parameter TPP6C)= 31 % effluent
c) Coefficient of variation (parameter TQP6C)= 16.7 %

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
Ceriodaphnia dubia SURVIVAL AND REPRODUCTION

Permittee: City of Sheridan

NPDES #: AR0034347

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	4-4-16, 1300	4-5-16, 1200
Sample #2	4-5-16, 1357	4-6-16, 1257

Test initiated (date, time): 4-6-16, 0935 Test terminated (date, time): 4-12-16, 1440

Dilution water used: Moderately Hard Synthetic

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

PERCENT EFFLUENT

Replicate	0%	10%	13%	17%	23%	31%
A	31	32	39	34	41	35
B	X0	13	20	29	14	36
C	33	40	42	39	38	32
D	29	36	38	40	35	35
E	15	19	19	18	37	35
F	28	36	27	30	32	30
G	36	40	39	34	39	35
H	23	18	25	26	20	21
I	26	32	36	36	37	33
J	16	18	19	22	19	15
Mean	23.7	28.4	30.4	30.8	31.2	30.7
Mean/surviving female	26.3	28.4	30.4	30.8	31.2	30.7
CV%*	27.4				31.3	

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 Sheridan

NPDES #: AR0034347

PERCENT SURVIVAL

PERCENT EFFLUENT	0%	10%	13%	17%	23%	31%
Time of Reading: 24 HOURS	100	100	100	100	100	100
48 HOURS	100	100	100	100	100	100
Test termination	90	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, (23%): 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, (23%): 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:

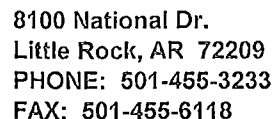
a) NOEC survival (parameter TOP3B)= 31 % effluent

b) NOEC reproduction (parameter TPP3B)= 31 % effluent

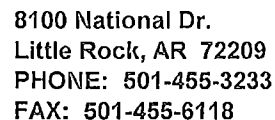
c) Coefficient of variation (parameter TQP3B)= 31.3 %

APPENDIX A

Chain of Custody Forms



CLIENT INFORMATION		BILLING INFORMATION		Project Description		Turnaround Time		Preservation Codes:								
Sheridan Waterworks 104 W High St. Sheridan, AR 72150	Sheridan Waterworks P.O. Box 486 Sheridan, AR 72150			Chronic Toxicity		1 Day (100%) 2 Day (50%) 3 Day (25%)		1. Cool, 4 Degrees Centigrade 2. Sulfuric Acid (H_2SO_4), pH < 2 3. Nitric Acid (HNO_3), pH < 2				4. Thiosulfate for Dechlorination 5. Hydrochloric Acid(HCl) 6. Sodium Hydroxide (NaOH), pH > 12				
				Reporting Information		Routine	TEST PARAMETERS								Bottle Type Code	
Attn: David Fitzgerald				Telephone: 870-942-2722		Fax: 870-942-1937	Email: sheridanwater@windstream.net	Preservative Code: 	P							G = Glass; P = Plastic V = Septum; A = Amber
Sampler(s) Signature		Sampler(s) Printed														Arkansas Analytical Work Order Number:
Field Number	SAMPLE COLLECTION Date/s Time/s		Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION		Chronic Toxicity							
	4/4-5/16	1300-1200	X			Water	Final Discharge	X								K16040051
1. Relinquished by: (Signature)		Date/Time	2. Received by: (Signature)		SAMPLE CONDITION UPON RECEIPT IN LAB				REMARKS / SAMPLE COMMENTS							
Cellen Parker		1620 4-5-16			1. CUSTODY SEALS: Yes No 2. CONTAINERS CORRECT: Yes No 3. COC/LABELS AGREE: Yes No 4. RECEIVED ON ICE: Yes No 5. TEMPERATURE ON RECEIPT: 4 °C 6. TEMPERATURE GUN ID: HHT# 2											
3. Relinquished by: (Signature)		Date/Time	4. Received by lab: (Signature)		FOR COMPLETION BY LAB ONLY											
			Luanada Parker													

[illegible]

APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									
Lab # / Sample ID K1604005					Fathead Minnow				
Client: Sheridan					Test Start (Date/Time) 4-6-16 1625				
					Test End (Date/Time) 4-13-16 1605				
		MHS 816 Day of Test							
		1	2	3	4	5	6	7	notes
Control	MHS 815	4/6	4/7	4/8	4/9	4/10	4/11	4/12	
D.O. (mg/L)	INITIAL	8.2	8.0	8.6	8.1	8.3	8.2	8.3	
	FINAL	6.9	7.0	8.1	8.1	7.3	7.9	7.3	
pH (s.u.)	INITIAL	8.2	7.8	8.0	8.5	8.1	8.1	8.1	
	FINAL	7.3	7.9	8.1	8.0	7.8	7.9	7.8	
temp (C)	INITIAL	24	23	20	23	24	24	24	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)		58		48					
HARDNESS (mg/L)		80		66					
CONDUCTIVITY (umho)		272		273					
CHLORINE (mg/L)		0.05		0.05					
CONC:	10%								
D.O. (mg/L)	INITIAL	8.4	8.2	7.7	8.1	8.1	8.2	8.3	
	FINAL	6.0	6.9	8.1	8.2	7.4	7.5	7.3 7.5	
pH (s.u.)	INITIAL	8.2	8.1	8.4	8.4	8.0	8.2	8.1	
	FINAL	7.9	7.8	8.1	8.0	7.7	7.8	7.7 7.9	
temp (C)	INITIAL	25	23	22	23	24	24	24	
	FINAL	25	25	25	25	25	25	25	
CONC:	13%								
D.O. (mg/L)	INITIAL	8.4	8.7	7.7	8.1	8.1	8.1	8.4	
	FINAL	6.4	7.1	8.1	8.2	7.5	7.4	7.3 7.7	
pH (mg/L)	INITIAL	8.2	8.1	8.3	8.3	8.0	8.1	8.1	
	FINAL	7.5	7.9	8.1	8.0	7.5 7.7	7.8	7.7 7.9	
temp (C)	INITIAL	24	21	22	24	24	24	24	
	FINAL	25	25	25	25	25	25	25	
CONC:	17%								
D.O. (mg/L)	INITIAL	8.5	9.0	7.6	8.1	8.1	8.1	8.7	
	FINAL	6.5	7.3	8.2	8.2	7.5	7.4	6.9 7.7	
pH (s.u.)	INITIAL	8.2	8.1	8.2	8.3	8.0	8.0	8.0	
	FINAL	7.5	7.8	8.0	8.0	7.7	7.8	7.7 7.9	
temp (C)	INITIAL	24	20	22	24	24	25	24	
	FINAL	25	25	25	25	25	25	25	
CONC:	23%								
D.O. (mg/L)	INITIAL	8.7	9.0	7.5	8.0	8.1	8.0	8.4	
	FINAL	6.7	7.3	8.2	8.2	7.5	7.4	6.8 7.7	
pH (s.u.)	INITIAL	8.1	8.0	8.1	8.2	7.9	8.0	7.9	
	FINAL	7.5	7.8	8.0	8.0	7.7	7.7	7.8 7.9	
temp (C)	INITIAL	23	20	22	24	24	25	24	
	FINAL	25	25	25	25	25	25	25	
CONC:	31%								
D.O. (mg/L)	INITIAL	8.7	9.0	7.7	8.0	8.0	8.0	8.5	
	FINAL	6.9	7.6	8.3	8.2	7.6	7.4	7.6	
pH (s.u.)	INITIAL	8.1	7.9	7.7	8.1	7.8	7.9	7.8	
	FINAL	7.9	7.8	7.9	8.0	7.8	7.8	7.9	
temp (C)	INITIAL	23	20	22	24	24	25	24	
	FINAL	25	25	25	25	25	25	25	
CONC:	100 %	A	A	A	B	B	B	B	
ALKALINITY (mg/L)		40			34				
HARDNESS (mg/L)		52			44				
CONDUCTIVITY (umho)		229			232				
CHLORINE (mg/L)		0.12			0.07				

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING						Ceriodaphnia Dubia			
Lab # / Sample ID K1604005				Test Start (Date/Time) 4-6-16 / 0935					
Client: Shendan				Test End (Date/Time) 4-12-16 / 1440					
		MHS 816		Day of Test					
		1	2	3	4	5	6	7	notes
Control	MHS 815	4/6	4/7	4/8	4/9	4/10	4/11		
D.O. (mg/L)	INITIAL	8.2	8.0	8.6	8.1	8.3	8.2		
	FINAL	8.0	8.8	8.4	8.4	8.4	9.1		
pH (s.u.)	INITIAL	8.2	7.8	8.0	8.5	8.1	8.1		
	FINAL	8.2	8.1	8.1	8.2	8.3	8.4		
temp (C)	INITIAL	24	23	20	23	24	24		
	FINAL	25	25	25	25	25	25		
ALKALINITY (mg/L)		58		48					
HARDNESS (mg/L)		80		166					
CONDUCTIVITY (umhc)		272		273					
CHLORINE (mg/L)		0.05		0.05					
CONC: 10%									
D.O. (mg/L)	INITIAL	8.4	8.2	7.7	8.1	8.1	8.2		
	FINAL	8.3	8.7	8.3	8.3	8.6	8.7		
pH (s.u.)	INITIAL	8.2	8.1	8.4	8.4	8.0	8.2		
	FINAL	8.2	8.2	8.1	8.1	8.2	8.2		
temp (C)	INITIAL	25	23	22	23	24	84		
	FINAL	25	25	25	25	25	25		
CONC: 13%									
D.O. (mg/L)	INITIAL	8.4	8.7	7.7	8.1	8.1	8.1		
	FINAL	8.4	8.4	8.3	8.3	8.6	8.6		
pH (mg/L)	INITIAL	8.2	8.1	8.3	8.3	8.0	8.1		
	FINAL	8.2	8.2	8.1	8.0	8.2	8.1		
temp (C)	INITIAL	24	21	22	24	24	24		
	FINAL	25	25	25	25	25	25		
CONC: 17%									
D.O. (mg/L)	INITIAL	8.5	9.0	7.6	8.1	8.1	8.1		
	FINAL	8.5	8.4	8.3	8.2	8.6	8.6		
pH (s.u.)	INITIAL	8.2	8.1	8.2	8.3	8.0	8.0		
	FINAL	8.2	8.3	8.0	8.0	8.1	8.1		
temp (C)	INITIAL	24	20	22	24	24	25		
	FINAL	25	25	25	25	25	25		
CONC: 23%									
D.O. (mg/L)	INITIAL	8.7	9.0	7.5	8.0	8.1	8.0		
	FINAL	8.5	8.5	8.2	8.1	8.6	8.5		
pH (s.u.)	INITIAL	8.1	8.0	8.1	8.2	7.9	8.0		
	FINAL	8.1	8.2	8.1	8.0	8.1	8.1		
temp (C)	INITIAL	23	20	22	24	24	25		
	FINAL	25	25	25	25	25	25		
CONC: 31%									
D.O. (mg/L)	INITIAL	8.7	9.0	7.7	8.0	8.0	8.0		
	FINAL	8.5	8.6	8.2	8.1	8.6	8.5		
pH (s.u.)	INITIAL	8.1	7.9	7.7	8.1	7.8	7.9		
	FINAL	8.2	8.2	8.0	7.9	8.1	8.0		
temp (C)	INITIAL	23	20	22	24	24	25		
	FINAL	25	25	25	25	25	25		
CONC: 100 %		A	A	A	B	B	B		
ALKALINITY (mg/L)		40			34				
HARDNESS (mg/L)		52			44				
CONDUCTIVITY (umhc)		229			232				
CHLORINE (mg/L)		0.12			0.07				

APPENDIX C

Fathead minnow raw data and statistics

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/SAMPLE ID K11004005 TEST START DATE 4-1-16 TIME 1625
 CLIENT Sheridan TEST END DATE 4-13-16 TIME 1605
 AGE AND SOURCE OF MINNOWS Aquatox, <24 hrs

DAY (NUMBER SURVIVING)											SURVIVAL	
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
Control	CONC:	A	8	8	8	8	8	8	8	100	100	0%
		B	8	8	8	8	8	8	8	100		
		C	8	8	8	8	8	8	8	100		
		D	8	8	8	8	8	8	8	100		
		E	8	8	8	8	8	8	8	100		
10%	CONC:	A	8	8	8	8	8	8	8	100	95	
		B	8	8	8	8	8	8	8	100		
		C	8	8	8	7	7	7	7	87.5		
		D	7	7	7	7	7	7	7	87.5		
		E	8	8	8	8	8	8	8	100		
13%	CONC:	A	8	8	8	8	8	8	8	100	95	
		B	8	8	8	8	8	8	8	100		
		C	8	8	8	8	8	8	8	100		
		D	6	6	6	6	6	6	6	75		
		E	8	8	8	8	8	8	8	100		
17%	CONC:	A	8	8	8	8	7	7	7	87.5	95	
		B	8	8	8	8	8	8	8	100		
		C	8	8	8	8	8	8	8	100		
		D	8	8	8	8	8	8	8	100		
		E	8	7	7	7	7	7	7	87.5		
23%	CONC:	A	8	8	8	8	8	8	8	100	100	0%
		B	8	8	8	8	8	8	8	100		
		C	8	8	8	8	8	8	8	100		
		D	8	8	8	8	8	8	8	100		
		E	8	8	8	8	8	8	8	100		
31%	CONC:	A	8	8	8	8	8	8	8	100	97.5	
		B	8	8	8	7	7	7	7	87.5		
		C	8	8	8	8	8	8	8	100		
		D	8	8	8	8	8	8	8	100		
		E	8	8	8	8	8	8	8	100		
ANALYST		ZR	KR	CT	TC	TC	CT	tb	tb			
DATE:		6 APR 16	4-7-16	4-8-16	4-9-16	4-10-16	4-11-16	4-12-16	4-13-16			
TIME:		1625	1215	1425	1830	1635	1245	1500	1605			

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/SAMPLE ID K1604005 TEST START DATE 6 April 16 TIME 1625
 CLIENT Sheridan A TEST END DATE 4-13-16 TIME 1605
 AGE AND SOURCE OF MINNOWS Aquatox <24hrs

DAY (NUMBER SURVIVING)											SURVIVAL	
CONC:	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
control	A	82*	2	2	2	2	2	2	2			
	B	1	1	1	1	1	1	1	1			
	C	1	1	1	1	1	1	1	1			
	D	1	1	1	1	1	1	1	1			
	E	1	1	1	1	1	1	1	1			
10%	A	82*	2	2	2	2	2	2	2			
	B	1	1	1	1	1	1	1	1			
	C	1	1	1	1	1	1	1	1			
	D	1	1	1	1	1	1	1	1			
	E	1	1	1	1	1	1	1	1			
13%	A	82*	2	2	2	2	2	2	2			
	B	1	1	1	1	1	1	1	1			
	C	1	1	1	1	1	1	1	1			
	D	1	1	1	1	1	1	1	1			
	E	1	1	1	1	1	1	1	1			
17%	A	82*	2	2	2	2	2	2	2			
	B	1	1	1	1	1	1	1	1			
	C	1	1	1	1	1	1	1	1			
	D	1	1	1	1	1	1	1	1			
	E	1	1	1	1	1	1	1	1			
23%	A	82*	2	2	2	2	2	2	2			
	B	1	1	1	1	1	1	1	1			
	C	1	1	1	1	1	1	1	1			
	D	1	1	1	1	1	1	1	1			
	E	1	1	1	1	1	1	1	1			
31%	A	82*	2	2	2	2	2	2	2			
	B	1	1	1	1	1	1	1	1			
	C	1	1	1	1	1	1	1	1			
	D	1	1	1	1	1	1	1	1			
	E	1	1	1	1	1	1	1	1			
ANALYST		ZK	KP	ST	SD	FO	CT	tb	tb			
DATE:		6 APR 16	8 APR 16	4 APR 16	4-10-16	4-11-16	4-12-16	4-13-16				
TIME:		1625	1215	1425	1830	1135	1245	1500	1605			

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

* tb 4-12-16

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/SAMPLE ID K1004005 TEST START DATE 6 April TIME 1625
 CLIENT Sherridan B TEST END DATE 4-13-16 TIME 1605
 AGE AND SOURCE OF MINNOWS Aquatex, <24 hrs
 DAY (NUMBER SURVIVING) SURVIVAL

CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
control	A	82*	2	2	2	2	2	2			
	B		1	1	1	1	1	1			
	C		1	1	1	1	1	1			
	D		1	1	1	1	1	1			
	E										
CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
10%	A	82*	2	2	2	2	2	2			
	B		1	1	1	1	1	1			
	C		1	1	1	1	1	1			
	D		1	1	1	1	1	1			
	E										
CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
13%	A	82*	2	2	2	2	2	2			
	B		1	1	1	1	1	1			
	C		1	1	1	1	1	1			
	D		1	1	1	1	1	1			
	E										
CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
17%	A	82*	2	2	2	2	2	2			
	B		1	1	1	1	1	1			
	C		1	1	1	1	1	1			
	D		1	1	1	1	1	1			
	E										
CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
23%	A	82*	2	2	2	2	2	2			
	B		1	1	1	1	1	1			
	C		1	1	1	1	1	1			
	D		1	1	1	1	1	1			
	E										
CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
31%	A	82*	2	2	2	2	2	2			
	B		1	1	1	1	1	1			
	C		1	1	1	1	1	1			
	D		1	1	1	1	1	1			
	E										
ANALYST	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
DATE:		6 April	6 April	4-8-16	4-9-16	4-10-16	4-11-16	4-12-16	4-13-16		
TIME:		1625	1240	1435	1830	1635	1245	1500	1605		

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

* 4b 4-12-16

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/SAMPLE ID KU04005 TEST START DATE 6/4/16 TIME 1625
 CLIENT Sheridan C TEST END DATE 4/2/16 TIME 1605
 AGE AND SOURCE OF MINNOWS Aquatox, 224hrs

DAY (NUMBER SURVIVING)											SURVIVAL	
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
control	CONC:	A	82*	2	2	2	2	2	2			
		B	1	1	1	1	1	1	1			
		C	1	1	1	1	1	1	1			
		D	1	1	1	1	1	1	1			
		E										
10%	CONC:	A	82*	2	2	2	2	2	2			
		B	1	1	1	1	1	1	1			
		C	1	1	1	2	2	2	2			
		D	1	1	1	2	2	2	2			
		E										
13%	CONC:	A	82*	2	2	2	2	2	2			
		B	1	1	1	1	1	1	1			
		C	1	1	1	1	1	1	1			
		D	1	1	1	1	1	1	1			
		E										
17%	CONC:	A	82*	2	2	2	2	2	2			
		B	1	1	1	1	1	1	1			
		C	1	1	1	1	1	1	1			
		D	1	1	1	1	1	1	1			
		E										
23%	CONC:	A	82*	2	2	2	2	2	2			
		B	1	1	1	1	1	1	1			
		C	1	1	1	1	1	1	1			
		D	1	1	1	1	1	1	1			
		E										
31%	CONC:	A	82*	2	2	2	2	2	2			
		B	1	1	1	1	1	1	1			
		C	1	1	1	1	1	1	1			
		D	1	1	1	1	1	1	1			
		E										
ANALYST		ZK	KR	JK	PD	PD	JA	Hb	Hb			
DATE:		6/4/16	6/4/16	4-8-16	4-9-16	4-10-16	4-11-16	4-12-16	4-13-16			
TIME:		1625	1300	1501	1830	1735	1300	1510	1605			

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

* Hb 4-12-16

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/SAMPLE ID K1604005 TEST START DATE 6 Apr 16 TIME 1625
 CLIENT Sheridan D TEST END DATE 4-13-16 TIME 1605
 AGE AND SOURCE OF MINNOWS Aquatox, 424 hrs

		DAY (NUMBER SURVIVING)						SURVIVAL			
	REP #	start	1	2	3	4	5	6	7%	MEAN %	CV
control	CONC:	A	82*	2	2	2	2	2	2		
		B	1	1	1	1	1	1	1		
		C	1	1	1	1	1	1	1		
		D	1	1	1	1	1	1	1		
		E	1	1	1	1	1	1	1		
10%	CONC:	A	82*	1	1	1	1	1	1		
		B	1	2	2	2	2	2	2		
		C	1	1	1	1	1	2	2		
		D	1	1	1	1	1	2	2		
		E	1	1	1	1	1	2	2		
13%	CONC:	A	82*	2	2	2	2	2	2		
		B	1	1	1	1	1	1	2		
		C	1	1	1	1	1	1	2		
		D	1	0	0	0	0	0	0		
		E	1	0	0	0	0	0	0		
17%	CONC:	A	82*	2	2	2	2	2	2		
		B	1	1	1	1	1	1	1		
		C	1	1	1	1	1	1	1		
		D	1	1	1	1	1	1	1		
		E	1	1	1	1	1	1	1		
23%	CONC:	A	82*	2	2	2	2	2	2		
		B	1	1	1	1	1	1	1		
		C	1	1	1	1	1	1	1		
		D	1	1	1	1	1	1	1		
		E	1	1	1	1	1	1	1		
31%	CONC:	A	82*	2	2	2	2	2	2		
		B	1	1	1	1	1	1	1		
		C	1	1	1	1	1	1	1		
		D	1	1	1	1	1	1	1		
		E	1	1	1	1	1	1	1		
ANALYST		ZR	KR	J	JO	JO	CA	tb	12		
DATE:		6 Apr 16	6 Apr 16	4-9-16	4-9-16	4-10-16	4-11-16	4-12-16	4-13-16		
TIME:		11:25	1315	1501	1830	1635	1300	1510	1605		

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

* tb 4-12-16

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID K1604005 TEST START DATE 10 APR 16 TIME 1625
 CLIENT Shondan E TEST END DATE 4-13-16 TIME 16105
 AGE AND SOURCE OF MINNOWS * Aquatory, 424 hrs

		DAY (NUMBER SURVIVING)							SURVIVAL	
CONC:	REP #	start	1	2	3	4	5	6	7%	MEAN % CV
control	A	82*	2	2	2	2	2	2	2	
	B									
	C									
	D									
	E									
10%	A	82*	2	2	2	2	2	2	2	
	B									
	C									
	D									
	E									
13%	A	82*	2	2	2	2	2	2	2	
	B									
	C									
	D									
	E									
17%	A	82*	2	2	2	2	2	2	2	
	B									
	C									
	D									
	E									
23%	A	82*	2	2	2	2	2	2	2	
	B									
	C									
	D									
	E									
31%	A	82*	2	2	2	2	2	2	2	
	B									
	C									
	D									
	E									
ANALYST		FR	KR	CA	FO	FO	CA	tb	tb	
DATE:		10 APR 16	07 APR 16	4-8-16	4-9-16	4-10-16	4-11-16	4-12-16	4-13-16	
TIME:		1625	1330	1535	1830	1635	1310	1515	16105	

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

* tb 4-12-16

Pimephales promelas

FATHEAD MINNOW

TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:		K1604005		TEST DATES (BEGIN / END):		4/6/16 - 4/13/16	
CLIENT:		Sheridan		WEIGHING DATE / TIME:		4/15/16, 1345	
ANALYSTS:		CT, TB		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	0.97314	0.97079	0.00235	8	0.294	AVG DRY
MHS	B	0.96747	0.96435	0.00312	8	0.390	WEIGHT (mg)
	C	0.99662	0.99282	0.00380	8	0.475	0.399
	D	0.98073	0.97742	0.00331	8	0.414	CV
	E	0.95924	0.95585	0.00339	8	0.424	16.7
CONC:	A	0.95966	0.95673	0.00293	8	0.366	AVG DRY
10%	B	1.03177	1.02876	0.00301	8	0.376	WEIGHT (mg)
	C	1.03971	1.03648	0.00323	8	0.404	0.383
	D	1.00913	1.00638	0.00275	8	0.344	CV
	E	1.00854	1.00515	0.00339	8	0.424	
CONC:	A	0.99995	0.99721	0.00274	8	0.342	AVG DRY
13%	B	1.00730	1.00382	0.00348	8	0.435	WEIGHT (mg)
	C	1.01016	1.00694	0.00322	8	0.403	0.367
	D	1.01789	1.01571	0.00218	8	0.273	CV
	E	1.02611	1.02305	0.00306	8	0.383	
CONC:	A	1.02791	1.02531	0.00260	8	0.325	AVG DRY
17%	B	1.04321	1.04005	0.00316	8	0.395	WEIGHT (mg)
	C	0.95838	0.95489	0.00349	8	0.436	0.384
	D	0.97880	0.97564	0.00316	8	0.395	CV
	E	0.99255	0.98959	0.00296	8	0.370	
CONC:	A	0.98247	0.97961	0.00286	8	0.357	AVG DRY
23%	B	1.00429	1.00131	0.00298	8	0.372	WEIGHT (mg)
	C	1.03362	1.03057	0.00305	8	0.381	0.384
	D	1.00983	1.00690	0.00293	8	0.366	CV
	E	1.02794	1.02442	0.00352	8	0.440	8.54
CONC:	A	1.02005	1.01718	0.00287	8	0.359	AVG DRY
31%	B	1.00933	1.00664	0.00269	8	0.336	WEIGHT (mg)
	C	0.97819	0.97500	0.00319	8	0.399	0.372
	D	0.96338	0.95992	0.00346	8	0.433	CV
	E	0.96799	0.96534	0.00265	8	0.331	

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

Pimephales promelas

FATHEAD MINNOW

TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/s: K1604005				TEST DATES (BEGIN / END): 4-6-16 / 4-13-16		
CLIENT: Sheridan				WEIGHING DATE / TIME: 4-15-16, 1345		
ANALYSTS: Jb, CT				DRYING TEMP (DEGREES C): 60°C		
SAMPLE ID: Outfall				DRYING TIME (HOURS): 24hrs.		
	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	AS1	.97314	0.97079		8	AVG DRY WEIGHT (mg)
	BS2	.96747	0.96435		8	
	CS3	.99662	0.99282		8	
	DS4	.98073	0.97742		8	CV
	ES5	.95924	0.95585		8	
10/	AS6	.95966	0.95673		8	AVG DRY WEIGHT (mg)
	BS7	1.03177	1.02876		8	
	CS8	1.03971	1.03648		8	
	DS9	1.00913	1.00638		8	CV
	ES10	1.00854	1.00515		8	
13/	AS11	1.099995	0.99721		8	AVG DRY WEIGHT (mg)
	BS12	1.00730	1.00382		8	
	CS13	1.01016	1.00694		8	
	DS14	1.01789	1.01571		8	CV
	ES15	1.02611	1.02305		8	
17/	AS16	1.02791	1.02531		8	AVG DRY WEIGHT (mg)
	BS17	1.04321	1.04005		8	
	CS18	.95838	0.95489		8	
	DS19	.97880	0.97564		8	CV
	ES20	.99255	0.98959		8	
23/	AS21	.98247	0.97961		8	AVG DRY WEIGHT (mg)
	BS22	1.00429	1.00131		8	
	CS23	1.03362	1.03057		8	
	DS24	1.00983	1.00690		8	CV
	ES25	1.02794	1.02442		8	
31/	AS26	1.02005	1.01718		8	AVG DRY WEIGHT (mg)
	BS27	1.00948	1.00664		8	
	CS28	.97819	0.97500		8	
	DS29	.96333	0.95992		8	CV
	ES30	.96799	0.96534		8	

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16
File: c:\toxstat\SHERIFH. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.204

W = 0.791

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 # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16
File: c:\toxstat\SHERIFH. Transform: ARC SINE(SQUARE ROOT(Y))

Hartley's test for homogeneity of variance

Bartlett's test for homogeneity of variance

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

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

TITLE: AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16
FILE: c:\toxstat\SHERIFH.
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	1.0000	1.3931
1	CONTROL	2	1.0000	1.3931
1	CONTROL	3	1.0000	1.3931
1	CONTROL	4	1.0000	1.3931
1	CONTROL	5	1.0000	1.3931
2	10 % EFFLUENT	1	1.0000	1.3931
2	10 % EFFLUENT	2	1.0000	1.3931
2	10 % EFFLUENT	3	0.8750	1.2094
2	10 % EFFLUENT	4	0.8750	1.2094
2	10 % EFFLUENT	5	1.0000	1.3931

3	13 % EFFLUENT	1	1.0000	1.3931
3	13 % EFFLUENT	2	1.0000	1.3931
3	13 % EFFLUENT	3	1.0000	1.3931
3	13 % EFFLUENT	4	0.7500	1.0472
3	13 % EFFLUENT	5	1.0000	1.3931
4	17 % EFFLUENT	1	0.8750	1.2094
4	17 % EFFLUENT	2	1.0000	1.3931
4	17 % EFFLUENT	3	1.0000	1.3931
4	17 % EFFLUENT	4	1.0000	1.3931
4	17 % EFFLUENT	5	0.8750	1.2094
5	23 % EFFLUENT	1	1.0000	1.3931
5	23 % EFFLUENT	2	1.0000	1.3931
5	23 % EFFLUENT	3	1.0000	1.3931
5	23 % EFFLUENT	4	1.0000	1.3931
5	23 % EFFLUENT	5	1.0000	1.3931
6	31 % EFFLUENT	1	1.0000	1.3931
6	31 % EFFLUENT	2	0.8750	1.2094
6	31 % EFFLUENT	3	1.0000	1.3931
6	31 % EFFLUENT	4	1.0000	1.3931
6	31 % EFFLUENT	5	1.0000	1.3931

AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16

File: c:\toxstat\SHERIFH.

Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST

- Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	1.393				
2	10 % EFFLUENT	1.320	22.50	16.00	5.00	
3	13 % EFFLUENT	1.324	25.00	16.00	5.00	
4	17 % EFFLUENT	1.320	22.50	16.00	5.00	
5	23 % EFFLUENT	1.393	27.50	16.00	5.00	
6	31 % EFFLUENT	1.356	25.00	16.00	5.00	

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

AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16
File: C:\TOXSTAT\SHERIFG. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.060

W = 0.966

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 # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16
File: C:\TOXSTAT\SHERIFG. Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 3.83

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 # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16
FILE: C:\TOXSTAT\SHERIFG.
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.2940	0.5731
1	CONTROL	2	0.3900	0.6745
1	CONTROL	3	0.4750	0.7604
1	CONTROL	4	0.4140	0.6990
1	CONTROL	5	0.4240	0.7091
2	10 % EFFLUENT	1	0.3660	0.6497
2	10 % EFFLUENT	2	0.3760	0.6601
2	10 % EFFLUENT	3	0.4040	0.6888
2	10 % EFFLUENT	4	0.3440	0.6267
2	10 % EFFLUENT	5	0.4240	0.7091
3	13 % EFFLUENT	1	0.3420	0.6246
3	13 % EFFLUENT	2	0.4350	0.7202
3	13 % EFFLUENT	3	0.4030	0.6878
3	13 % EFFLUENT	4	0.2730	0.5498
3	13 % EFFLUENT	5	0.3830	0.6673
4	17 % EFFLUENT	1	0.3250	0.6066

4	17 % EFFLUENT	2	0.3950	0.6796
4	17 % EFFLUENT	3	0.4360	0.7212
4	17 % EFFLUENT	4	0.3950	0.6796
4	17 % EFFLUENT	5	0.3700	0.6539
5	23 % EFFLUENT	1	0.3570	0.6404
5	23 % EFFLUENT	2	0.3720	0.6560
5	23 % EFFLUENT	3	0.3810	0.6652
5	23 % EFFLUENT	4	0.3660	0.6497
5	23 % EFFLUENT	5	0.4400	0.7253
6	31 % EFFLUENT	1	0.3590	0.6425
6	31 % EFFLUENT	2	0.3360	0.6183
6	31 % EFFLUENT	3	0.3990	0.6837
6	31 % EFFLUENT	4	0.4330	0.7182
6	31 % EFFLUENT	5	0.3310	0.6130

AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16

File: C:\TOXSTAT\SHERIFG.

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.003	0.001	0.268
Within (Error)	24	0.060	0.003	
Total	29	0.064		

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

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

AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16

File: C:\TOXSTAT\SHERIFG.

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	0.683	0.399		
2	10 % EFFLUENT	0.667	0.383	0.514	
3	13 % EFFLUENT	0.650	0.367	1.049	
4	17 % EFFLUENT	0.668	0.384	0.474	
5	23 % EFFLUENT	0.667	0.383	0.501	
6	31 % EFFLUENT	0.655	0.372	0.885	

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

AA # K1604005, P. PROMELAS 7 DAY CHRONIC, 4-6-16

File: C:\TOXSTAT\SHERIFG.

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	10 % EFFLUENT	5	0.072	18.0	0.017
3	13 % EFFLUENT	5	0.072	18.0	0.032
4	17 % EFFLUENT	5	0.072	18.0	0.015
5	23 % EFFLUENT	5	0.072	18.0	0.016
6	31 % EFFLUENT	5	0.072	18.0	0.028

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

SURVIVAL AND REPRODUCTION TEST

Ceriodaphnia dubia

Discharger: City of Sheridan													Lab Number/s				Analyst: tb																
Location:													K1604005				Test Start - Date/Time: 4-6-16/0935																
Date Sample Collected: See COC																	Test Stop - Date/Time: 4-12-16/1440																
Conc	1	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst	Conc	4	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst		
%	Day	A	B	C	D	E	F	G	H	I	J					A	B	C	D	E	F	G	H	I	J								
Control	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	17.0%	1	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	
	2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb		2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	
	3	6	0	6	6	0	6	6	0	0	0	0	30	10	3.0	tb		3	4	0	0	7	0	6	6	0	5	0	27	10	2.7	tb	
	4	0	0	1	0	6	9	0	4	5	5	30	9	3.3	tb	4		0	6	0	0	6	7	1	4	0	8	31	10	3.1	tb		
	5	11	0	11	10	9	0	11	9	8	11	80	9	8.9	tb	5		13	12	17	15	12	1	13	16	14	14	127	10	12.7	tb		
	6	14	0	15	13	0	13	19	10	13	0	97	9	10.8	tb	6		17	12	22	18	0	16	16	6	17	0	123	10	12.3	tb		
	7											0				7											0						
	8											0				8											0						
	Total	31	0	33	29	15	28	36	23	26	16	237		Avg. = 26.3 C.V. = 27.4		Total	34	29	39	40	18	30	34	26	36	22	308		Avg. = 30.8 C.V. = 23.4				
Conc	2	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst	Conc	5	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst		
%	Day	A	B	C	D	E	F	G	H	I	J					A	B	C	D	E	F	G	H	I	J								
10.0%	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	23.0%	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb		2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	
	3	6	0	6	5	0	7	6	0	5	0	35	10	3.5	tb	3		6	0	6	6	0	6	4	0	7	0	35	10	3.5	tb		
	4	0	3	0	1	7	11	1	4	0	4	31	10	3.1	tb	4		1	4	0	0	4	8	2	7	0	6	32	10	3.2	tb		
	5	9	10	14	12	12	0	13	14	11	14	109	10	10.9	tb	5		14	10	14	12	16	1	13	13	12	13	118	10	11.8	tb		
	6	17	0	20	18	0	18	20	0	16	0	109	10	10.9	tb	6		20	0	18	17	17	17	20	0	18	0	127	10	12.7	tb		
	7											0				7											0						
	8											0				8											0						
	Total	32	13	40	36	19	36	40	18	32	18	284		Avg. = 28.4 C.V. = 36.2		Total	41	14	38	35	37	32	39	20	37	19	312		Avg. = 31.2 C.V. = 31.3				
Conc	3	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst	Conc	6	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst		
%	Day	A	B	C	D	E	F	G	H	I	J					A	B	C	D	E	F	G	H	I	J								
13.0%	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	31.0%	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb		2	0	0	0	0	0	0	0	0	0	0	0	10	0.0	tb	
	3	5	0	7	7	0	6	6	0	6	0	37	10	3.7	tb	3		7	0	5	6	0	6	5	0	0	0	29	10	2.9	tb		
	4	1	6	0	0	6	10	0	0	0	0	6	29	10	2.9	tb		4	0	6	3	0	6	9	0	7	6	6	43	10	4.3	tb	
	5	13	14	14	12	12	0	13	15	13	11	117	10	11.7	tb	5		12	12	12	14	13	2	14	14	11	0	104	10	10.4	tb		
	6	20	0	21	19	1	11	20	10	17	2	121	10	12.1	tb	6		18	18	12	15	16	13	16	0	16	9	131	10	13.1	tb		
	7											0				7											0						
	8											0				8											0						
	Total	39	20	42	38	19	27	39	25	36	19	304		Avg. = 30.4 C.V. = 30.6		Total	35	36	32	35	35	30	35	21	33	15	307		Avg. = 30.7 C.V. = 23.0				

SURVIVAL AND REPRODUCTION TEST

Ceriodaphnia dubia

Discharger: Sheridan

Location: Outfall

Date Sample Collected: See LOC

Lab Number/s

R1604005

Analyst: tb

Test Start - Date/Time: 4-6-16 / 0935

Test Stop - Date/Time: 4-12-16 / 1440

Conc	1	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
100% CONTROL	1	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	3	6	0	6	6	0	6	6	0	0	0		10		tb
	4	0	X	0	1	0	6	9	0	4	5	5	9		tb
	5	11	-	11	10	9	0	11	9	8	11		9		tb
	6	14	-	15	13	0	13	19	10	13	0		9		tb
	7														
	8														
Total															

Conc	2	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
10%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	3	6	0	6	5	0	7	6	0	5	0		10		tb
	4	0	3	0	1	7	11	1	4	0	4		10		tb
	5	9	10	14	12	12	0	13	14	11	14		10		tb
	6	17	0	20	18	0	18	20	0	16	0				tb
	7														
	8														
Total															

Conc	3	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
3%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	3	5	0	7	7	0	6	6	0	6	10		10		tb
	4	1	6	0	0	6	10	0	0	0	6		10		tb
	5	13	14	14	12	12	0	13	15	13	11		10		tb
	6	20	0	21	19	1	11	20	10	17	2		10		tb
	7														
	8														
Total															

X = Dead

Conc	4	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
17%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	3	4	0	0	7	0	6	5	0	5	0		10		tb
	4	0	5	0	0	6	7	1	4	0	8		10		tb
	5	13	12	17	15	12	1	13	16	14	14		10		tb
	6	17	12	22	18	0	16	15	6	17	0		10		tb
	7														
	8														
Total															

Conc	5	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
23%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	3	6	0	6	6	0	6	4	0	7	0		10		tb
	4	1	4	0	0	4	8	2	7	0	6		10		tb
	5	14	10	14	12	16	1	13	13	12	13		10		tb
	6	20	0	18	17	17	17	20	0	18	0		10		tb
	7														
	8														
Total															

Conc	6	Replicate										No. of Young	No. of Adult	Young /Adult	Analyst
%	Day	A	B	C	D	E	F	G	H	I	J				
31%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	tb
	3	7	0	5	6	0	6	5	0	0	0		10		tb
	4	0	6	3	0	6	9	0	7	6	6		10		tb
	5	12	12	12	14	13	2	14	14	11	0		10		tb
	6	16	18	12	15	16	13	16	0	16	9		10		tb
	7														
	8														
Total															

FISHER'S EXACT TEST

=====			
NUMBER OF			

IDENTIFICATION	DEAD	ALIVE	TOTAL ANIMALS
-----	-----	-----	-----
CONTROL	1	9	10
10% effluent	0	10	10
-----	-----	-----	-----
TOTAL	1	19	20
=====			

CRITICAL FISHER'S VALUE (10,10,1) ($p=0.05$) IS LESS THAN 0. b VALUE IS 0.
NO SIGNIFICANT DIFFERENCE

FISHER'S EXACT TEST

=====			
NUMBER OF			

IDENTIFICATION	DEAD	ALIVE	TOTAL ANIMALS
-----	-----	-----	-----
CONTROL	1	9	10
13% effluent	0	10	10
-----	-----	-----	-----
TOTAL	1	19	20
=====			

CRITICAL FISHER'S VALUE (10,10,1) ($p=0.05$) IS LESS THAN 0. b VALUE IS 0.
NO SIGNIFICANT DIFFERENCE

FISHER'S EXACT TEST

=====			
NUMBER OF			

IDENTIFICATION	DEAD	ALIVE	TOTAL ANIMALS
-----	-----	-----	-----
CONTROL	1	9	10
17% effluent	0	10	10

TOTAL	1	19	20
-------	---	----	----

=====

CRITICAL FISHER'S VALUE (10,10,1) (p=0.05) IS LESS THAN 0. b VALUE IS 0.
NO SIGNIFICANT DIFFERENCE

FISHER'S EXACT TEST

=====

IDENTIFICATION	NUMBER OF		
	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
23% effluent	0	10	10
TOTAL	1	19	20

=====

CRITICAL FISHER'S VALUE (10,10,1) (p=0.05) IS LESS THAN 0. b VALUE IS 0.
NO SIGNIFICANT DIFFERENCE

FISHER'S EXACT TEST

=====

IDENTIFICATION	NUMBER OF		
	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
31% effluent	0	10	10
TOTAL	1	19	20

=====

CRITICAL FISHER'S VALUE (10,10,1) (p=0.05) IS LESS THAN 0. b VALUE IS 0.
NO SIGNIFICANT DIFFERENCE

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
-----	-----	-----	-----	-----

	CONTROL	10	1
1	10% effluent	10	0
2	13% effluent	10	0
3	17% effluent	10	0
4	23% effluent	10	0
5	31% effluent	10	0

AA # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
File: C:\TOXSTAT\SHERICD. 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 # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
File: C:\TOXSTAT\SHERICD. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 2.65

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 # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
FILE: C:\TOXSTAT\SHERICD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	31.0000	31.0000
1	CONTROL	2	0.0000	0.0000
1	CONTROL	3	33.0000	33.0000
1	CONTROL	4	29.0000	29.0000
1	CONTROL	5	15.0000	15.0000
1	CONTROL	6	28.0000	28.0000
1	CONTROL	7	36.0000	36.0000
1	CONTROL	8	23.0000	23.0000
1	CONTROL	9	26.0000	26.0000
1	CONTROL	10	16.0000	16.0000
2	10 % EFFLUENT	1	32.0000	32.0000
2	10 % EFFLUENT	2	13.0000	13.0000
2	10 % EFFLUENT	3	40.0000	40.0000
2	10 % EFFLUENT	4	36.0000	36.0000
2	10 % EFFLUENT	5	19.0000	19.0000
2	10 % EFFLUENT	6	36.0000	36.0000

2	10	% EFFLUENT	7	40.0000	40.0000
2	10	% EFFLUENT	8	18.0000	18.0000
2	10	% EFFLUENT	9	32.0000	32.0000
2	10	% EFFLUENT	10	18.0000	18.0000
3	13	% EFFLUENT	1	39.0000	39.0000
3	13	% EFFLUENT	2	20.0000	20.0000
3	13	% EFFLUENT	3	42.0000	42.0000
3	13	% EFFLUENT	4	38.0000	38.0000
3	13	% EFFLUENT	5	19.0000	19.0000
3	13	% EFFLUENT	6	27.0000	27.0000
3	13	% EFFLUENT	7	39.0000	39.0000
3	13	% EFFLUENT	8	25.0000	25.0000
3	13	% EFFLUENT	9	36.0000	36.0000
3	13	% EFFLUENT	10	19.0000	19.0000
4	17	% EFFLUENT	1	34.0000	34.0000
4	17	% EFFLUENT	2	29.0000	29.0000
4	17	% EFFLUENT	3	39.0000	39.0000
4	17	% EFFLUENT	4	40.0000	40.0000
4	17	% EFFLUENT	5	18.0000	18.0000
4	17	% EFFLUENT	6	30.0000	30.0000
4	17	% EFFLUENT	7	34.0000	34.0000
4	17	% EFFLUENT	8	26.0000	26.0000
4	17	% EFFLUENT	9	36.0000	36.0000
4	17	% EFFLUENT	10	22.0000	22.0000
5	23	% EFFLUENT	1	41.0000	41.0000
5	23	% EFFLUENT	2	14.0000	14.0000
5	23	% EFFLUENT	3	38.0000	38.0000
5	23	% EFFLUENT	4	35.0000	35.0000
5	23	% EFFLUENT	5	37.0000	37.0000
5	23	% EFFLUENT	6	32.0000	32.0000
5	23	% EFFLUENT	7	39.0000	39.0000
5	23	% EFFLUENT	8	20.0000	20.0000
5	23	% EFFLUENT	9	37.0000	37.0000
5	23	% EFFLUENT	10	19.0000	19.0000
6	31	% EFFLUENT	1	35.0000	35.0000
6	31	% EFFLUENT	2	36.0000	36.0000
6	31	% EFFLUENT	3	32.0000	32.0000
6	31	% EFFLUENT	4	35.0000	35.0000
6	31	% EFFLUENT	5	35.0000	35.0000
6	31	% EFFLUENT	6	30.0000	30.0000
6	31	% EFFLUENT	7	35.0000	35.0000
6	31	% EFFLUENT	8	21.0000	21.0000
6	31	% EFFLUENT	9	33.0000	33.0000
6	31	% EFFLUENT	10	15.0000	15.0000

AA # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
 File: C:\TOXSTAT\SHERICD. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	411.400	82.280	0.977
Within (Error)	54	4546.200	84.189	
Total	59	4957.600		

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

AA # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
 File: C:\TOXSTAT\SHERICD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 H_0 :Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	23.700	23.700		
2	10 % EFFLUENT	28.400	28.400	-1.145	
3	13 % EFFLUENT	30.400	30.400	-1.633	
4	17 % EFFLUENT	30.800	30.800	-1.730	
5	23 % EFFLUENT	31.200	31.200	-1.828	
6	31 % EFFLUENT	30.700	30.700	-1.706	

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

AA # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
 File: C:\TOXSTAT\SHERICD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 H_0 :Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	10 % EFFLUENT	10	9.479	40.0	-4.700
3	13 % EFFLUENT	10	9.479	40.0	-6.700
4	17 % EFFLUENT	10	9.479	40.0	-7.100
5	23 % EFFLUENT	10	9.479	40.0	-7.500
6	31 % EFFLUENT	10	9.479	40.0	-7.000

AA # K1604005, CERIODAPHNIA DUBIA REPRODUCTION, 4-6-16
 File: C:\TOXSTAT\SHERICD. Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST - H_0 :Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	23.700				
2	10 % EFFLUENT	28.400	120.00	75.00	10.00	
3	13 % EFFLUENT	30.400	122.50	75.00	10.00	
4	17 % EFFLUENT	30.800	126.50	75.00	10.00	
5	23 % EFFLUENT	31.200	129.00	75.00	10.00	
6	31 % EFFLUENT	30.700	128.50	75.00	10.00	

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

APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 7/6/16 CLIENT MARK ANALYTICAL

Purchase Order #: _____

SPECIES: Pimephales promelas

Quantity Shipped: 850+ 15-1600
CST

Age: HATCHED 4/5/16

Brood Stock Source: Anderson Farms, AR

Culture Water: Groundwater

Hardness (Mg/l CaCO₃): 2160

Dissolved Oxygen (Mg/l): 8.5

Temperature (°C): 25.1

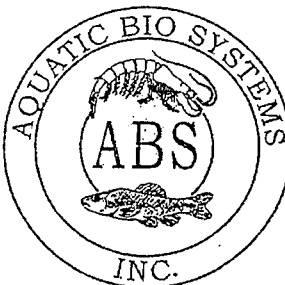
Feeding: ARTEMIA

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

Comments:



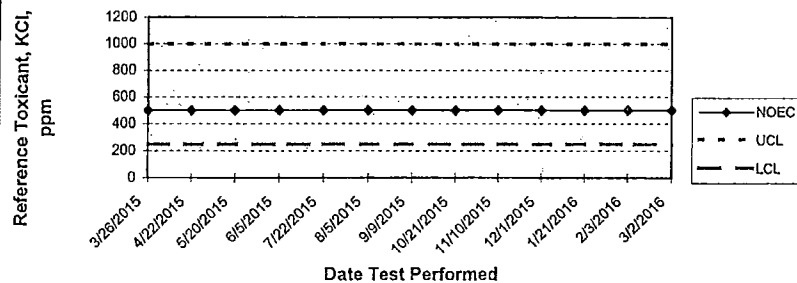
Facility Supervisor

APPENDIX F

Quality Assurance Charts

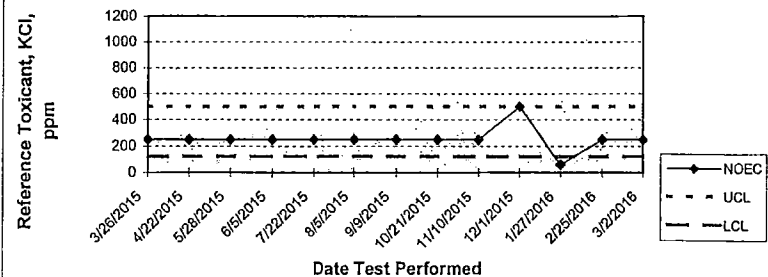
ARKANSAS ANALYTICAL, INC.

*FATHEAD MINNOW SURVIVAL 7 Day
QUALITY ASSURANCE*



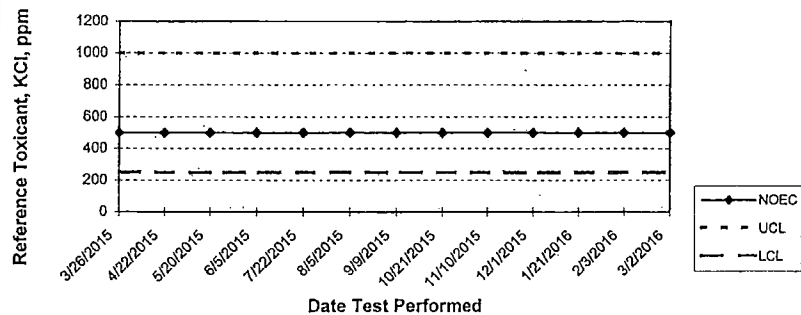
ARKANSAS ANALYTICAL, INC.

*CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE*



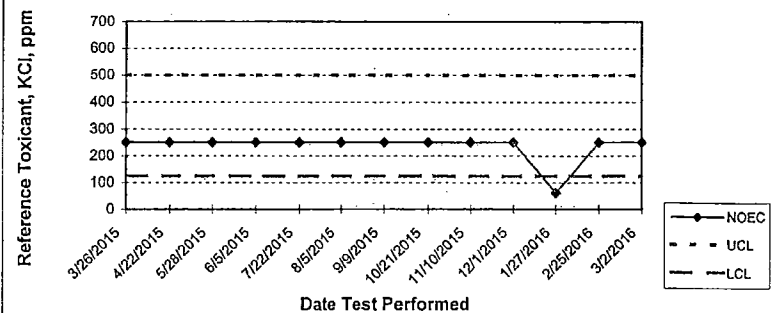
ARKANSAS ANALYTICAL, INC.

*FATHEAD MINNOW GROWTH 7 Day
QUALITY ASSURANCE*

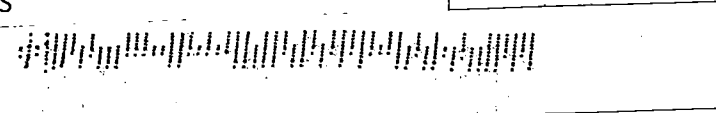


ARKANSAS ANALYTICAL, INC.

*CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE*



SHERIDAN WATER WORKS
PO BOX 486
SHERIDAN, AR



1000



72118

U.S. POSTAGE
PAID
SHERIDAN, AR
72150
JUL 27, 16
AMOUNT
\$2.62
R2305E123982-03

ADEQ
NPDES Enforcement Branch
5301 Northshore Drive
No Little Rock, AR 72118-5317