Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
December, 2011
AFIN# 00-00348

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 Friedman**
EEMA O&M Services Group
P.O. Box 232
Kulpsville, PA 19443

Prepared by: Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, Arkansas 72209
Lab Number K1112004

Friday, December 16, 2011

Introduction

This report contains test results for toxicity testing for the Magcobar Mine Site. The NPDES permit number is AR0049794. The facility is located one mile northeast of Magnet Cove in Sections 10, 11, 14, & 15, Township 3 South, Range 17 West in Hot Springs County, Arkansas. The facility discharges into Chamberlain Creek, thence to Cove Creek, thence to Ouachita River in Segment 2F of the Ouachita River Basin.

The permit requires chronic biomonitoring testing bi-monthly for both *Ceriodaphnia dubia* and *Pimephales promelas.* The test results in this report represent the testing for December of 2011.

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:	12-7-11, 0745	12-8-11, 0745
Sample #2:	12-8-11, 0820	12-9-11, 0820
Sample #3:	12-12-11, 0715	12-13-11, 0715

The samples were composites collected at the final discharge from the Magcobar mine site.

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:	12-8-11, 1200	3
*Sample #2:	12-9-11, 1322	4
Sample #3:	12-13-11, 1350	3

* Storage temperature exceeded specifications on 12/9/11

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 either because zero flow conditions existed or due to an earlier characterization of the receiving water as being toxic.

Each sample 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 32%, 42%, 56%, 75%, and 100%. The low-flow effluent concentration (**critical dilution**) was defined as **100% 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 E.

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

Quality Assurance

Test Acceptability

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	16.4	X	
At least 60% of surviving females should have produced 3 broods	100%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	17.8%	X	

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	0.00%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.319	X	
The percent coefficient of variation between replicates must be 40% or less for growth	12.9%	X	

Reference Toxicant

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

REFERENCE TOXICANT

Ceriodaphnia dubia 11/30/11-12/7/11		*Pimephales promelas* 11/30/11-12/7/11	
NOEC Survival:	250 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	500 ppm KCl	LOEC Survival:	1000 ppm KCl
NOEC Reproduction:	125 ppm KCl	NOEC Growth:	500 ppm KCl
LOEC Reproduction:	250 ppm KCl	LOEC Growth:	1000 ppm KCl

Quality Assurance charts are provided in Appendix F.

Summary of Results
Magcobar Mine Site

Ceriodaphnia dubia		*Pimephales promelas*	
NOEC / LOEC Survival	100% / NA	NOEC / LOEC survival	100% / NA
NOEC / LOEC Reproduction	100% / NA	NOEC / LOEC growth	100% / NA
Mean number of neonates (critical dilution)	18.9	%CV survival (critical dilution)	0.00%
%CV Reproduction (critical dilution)	32.1%	Mean dry weight (critical dilution) in milligrams	0.456
		%CV growth (critical dilution)	9.07%
PMSD Reproduction	38.9	PMSD Growth	21.5

Conclusion

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

The permit issued to the Magcobar Mine Site, AR0049794, specifies that the **critical dilution is 100% effluent**. The effluent samples did not exhibit lethal effects 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 Magcobar Mine Site, AR0049794, specifies that the **critical dilution is 100% effluent**. The effluent samples did not exhibit lethal or sublethal effects at the critical dilution, and, as such, **passed** both the portions of the test.

Biomonitoring Analysts:

Ken Pigue

Teresa Coins KP

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

PERMITTEE: Magcobar Mine Site **NPDES #: AR0049794**

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	12-7-11, 0745	12-8-11, 0745
Sample #2:	12-8-11, 0820	12-9-11, 0820
Sample #3:	12-12-11, 0715	12-13-11, 0715

Test initiated (date, time): 12-8-11, 1515 Test terminated (date, time): 12-15-11, 0940

Dilution water used: Soft Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

Percent Survival in Replicate Chambers **Mean Percent Survival**

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Effluent Conc %	A	B	C	D	E		24 hours	48 hours	7 days	CV %
0%	100	100	100	100	100		100	100	100	0.00
32%	100	100	100	100	100		100	100	100	
42%	100	100	100	100	100		100	100	100	
56%	100	100	100	100	100		100	100	100	
75%	100	100	100	100	100		100	100	100	
100%	100	100	100	100	100		100	100	100	0.00

SUMMARY

Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.372	0.318	0.271	0.287	0.344		0.318	12.9
32%	0.447	0.449	0.323	0.351	0.363		0.387	
42%	0.526	0.431	0.382	0.394	0.430		0.433	
56%	0.496	0.407	0.410	0.477	0.444		0.447	
75%	0.456	0.480	0.350	0.362	0.445		0.419	
100%	0.504	0.437	0.420	0.421	0.497		0.456	9.07

Coefficient of Variation = standard deviation / mean * 100

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)= _____**100**____% effluent

   b) NOEC growth (parameter TPP6C)= _____**100**_____% effluent

   c) Coefficient of variation (parameter TQP6C)= _____**12.9**_____%

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
Ceriodaphnia dubia SURVIVAL AND REPRODUCTION

Permittee: Magcobar Mine Site **NPDES #: AR0049794**

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	12-7-11, 0745	12-8-11, 0745
Sample #2:	12-8-11, 0820	12-9-11, 0820
Sample #3:	12-12-11, 0715	12-13-11, 0715

Test initiated (date, time): 12-8-11, 1400 Test terminated (date, time): 12-15-11, 0900

Dilution water used: Soft Synthetic

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

Replicate	0%	32%	42%	56%	75%	100%
A	17	20	15	24	14	21
B	19	22	22	11	x0	15
C	16	16	19	23	15	26
D	14	20	13	17	x0	30
E	19	11	15	13	14	15
F	18	26	22	13	31	x7
G	17	19	7	20	x14	17
H	11	15	13	x0	18	10
I	20	10	16	17	18	19
J	13	20	15	16	18	17
Mean	16.4	17.9	15.7	15.4	14.2	17.7
Mean/surviving female	16.4	17.9	15.7	17.1	18.3	18.9
CV%*	17.8					32.1

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: Magcobar Mine Site **NPDES #: AR0049794**

PERCENT SURVIVAL

PERCENT EFFLUENT	0%	32%	42%	56%	75%	100%
Time of Reading: 24 HOURS	100	100	100	100	100	100
48 HOURS	100	100	100	90	80	100
Test termination	100	100	100	90	70	90

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)= _____**100**____ % effluent

   b) NOEC reproduction (parameter TPP3B)= _____**100**_____% effluent

   c) Coefficient of variation (parameter TQP3B)= _____**32.1**_____%

APPENDIX A

Chain of Custody Forms

Arkansas Analytical Inc.

11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION		Project Description	Turnaround Time
EEMA O & M Services Group	EEMA O & M Services Group	Magcobar Mine Site	24 Hour
Magcobar Mine Site	P.O. Box 732	Biomonitoring Sample	48 Hour
P.O. Box 699	Kulpsville, PA 19443	**Reporting Information**	72 Hour
Malvern, AR 72104		Telephone: 501-467-8355	Routine (5 Day)
Attn: Bill McAlister	Attn: Amber Rich	Fax: 501-467-8687	Preservative Code: 1
		Email: dave.friedman@eema-inc.com; bmcalister@eema-inc.com; bhorton@eema-inc.com	Bottle Type: P

Preservation Codes:

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

Bottle Type Code: G = Glass; P = Plastic; V = Septum; A = Amber

Sampler(s) Signature: Bill McAlister

Sampler(s) Printed: Bill McAlister

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Biomonitoring	TEST PARAMETERS	Arkansas Analytical Work Order Number:
FD-2 Comp.	12/13/2011	7:15 AM		X	3	W	Facility Discharge	X		K1112004 C

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)
Bill McAlister	12-13-11 1350	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)
		Amanda Forbush

SAMPLE CONDITION UPON RECEIPT IN LAB

1. CUSTODY SEALS:	✓ Yes	___ No
2. CONTAINERS CORRECT:	___ Yes	___ No
3. COC/LABELS AGREE:	___ Yes	___ No
4. PRESERVATION CONFIRMED:	___ Yes	___ No
5. RECEIVED ON ICE:	___ Yes	___ No
6. TEMPERATURE ON RECEIPT:	3°C	

FOR COMPLETION BY LAB ONLY

REMARKS / SAMPLE COMMENTS

Arkansas Analytical Inc.
11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION		Project Description	Turnaround Time	Preservation Codes:	
EEMA O & M Services Group	EEMA O & M Services Group	Magcobar Mine Site	24 Hour	1. Cool, 4 Degrees Centigrade	4. Thiosulfate for Dechlorination
Magcobar Mine Site	P.O. Box 732	Biomonitoring Sample	48 Hour	2. Sulfuric Acid (H_2SO_4), pH < 2	5. Hydrochloric Acid(HCl)
P.O. Box 699	Kulpsville, PA 19443	Reporting Information	72 Hour	3. Nitric Acid (HNO_3), pH < 2	6. Sodium Hydroxide (NaOH), pH > 12
Malvern, AR 72104		Telephone: 501-467-8355	Routine (5 Day)		
Attn: Bill McAlister	Attn: Amber Rich	Fax: 501-467-8687	Preservative Code:	1	
		Email: dave.friedman@eema-inc.com; bmcalister@eema-inc.com; bhorton@eema-inc.com	Bottle Type:	P	

Sampler(s) Signature: Bill McAlister

Sampler(s) Printed: Bill McAlister

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Biomonitoring	TEST PARAMETERS	Bottle Type Code (G = Glass; P = Plastic; V = Septum; A = Amber)	Arkansas Analytical Work Order Number: K1112004
FD-1 Comp.	12/9/2011	8:20 AM		X	3	W	Facility Discharge	X		B	

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / SAMPLE COMMENTS
Bill McAlister	12-9-11 1322		1. CUSTODY SEALS: Y Yes ___No	
			2. CONTAINERS CORRECT: ___Yes ___No	
			3. COC/LABELS AGREE: ___Yes ___No	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)	4. PRESERVATION CONFIRMED: ___Yes ___No	
		Sydney James	5. RECEIVED ON ICE: Yes ___No	
			6. TEMPERATURE ON RECEIPT: 4°C	
			FOR COMPLETION BY LAB ONLY	

Arkansas Analytical Inc.

11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION		Project Description	Turnaround Time
EEMA O & M Services Group	EEMA O & M Services Group	Magcobar Mine Site	24 Hour
Magcobar Mine Site	P.O. Box 732	Biomonitoring Sample	48 Hour
P.O. Box 699	Kulpsville, PA 19443	**Reporting Information**	72 Hour
Malvern, AR 72104		Telephone: 501-467-8355	Routine (5 Day)
Attn: Bill McAlister	Attn: Amber Rich	Fax: 501-467-8687	Preservative Code: 1
		Email: dave.friedman@eema-inc.com; bmcalister@eema-inc.com; bhorton@eema-inc.com	Bottle Type: P

Preservation Codes:

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

Sampler(s) Signature: Bill McAlister

Sampler(s) Printed: Bill McAlister

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Biomonitoring	TEST PARAMETERS	Bottle Type Code (G = Glass; P = Plastic; V = Septum; A = Amber)	Arkansas Analytical Work Order Number:
FD-2 Comp.	12/8/2011	7:45 AM		X	4	W	Facility Discharge	X			K1112-004A

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / SAMPLE COMMENTS
Bill McAlister	12-8-11 1200		1. CUSTODY SEALS: ✓ Yes ___ No	
			2. CONTAINERS CORRECT: ___ Yes ___ No	
			3. COC/LABELS AGREE: ___ Yes ___ No	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)	4. PRESERVATION CONFIRMED: ___ Yes ___ No	
		Sydney James	5. RECEIVED ON ICE: ___ Yes ___ No	
			6. TEMPERATURE ON RECEIPT: 3°C	
			FOR COMPLETION BY LAB ONLY	

APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Fathead Minnow
Lab # / Sample ID: K1112004						Test Start (Date/Time): 12/8/11			
Client: Weston						Test End (Date/Time): 12/15/11			
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551	12/8/11	12/9	12/10	12/11	12/12	12/13	12/14	
D.O. (mg/L)	INITIAL	7.2	7.4	8.4	9.0	8.4	8.2	8.82	
	FINAL	8.2	8.6	8.6	8.3	8.2	8.1	8.6	
pH (s.u.)	INITIAL	7.5	7.7	8.0	7.8	7.7	7.8	7.9	
	FINAL	7.4	7.8	7.9	7.8	7.5	7.9	7.7	
temp (C)	INITIAL	22.8	22.6	21.2	20.1	21.2	22.9	22.5	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY (mg/L)		32							
HARDNESS (mg/L)		42							
CONDUCTIVITY (umhos/cm)		151							
CHLORINE (mg/L)		<0.05							
CONC:									
D.O. (mg/L)	INITIAL	7.3	7.8	8.5	8.9	8.4	8.3	8.6	
	FINAL	8.1	8.4	8.3	8.3	8.2	7.9	8.0	
pH (s.u)	INITIAL	7.3	7.3	7.5	7.6	7.3	7.3	7.5	
	FINAL	6.9	7.3	7.6	7.3	7.2	7.3	7.5	
temp (C)	INITIAL	22.1	22.8	22.1	20.9	21.9	23.2	22.7	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	7.8	8.0	8.8	9.0	8.4	8.4	8.6	
	FINAL	8.1	8.2	8.2	8.2	8.2	7.9	8.0	
pH (mg/L)	INITIAL	7.1	7.3	7.4	7.5	7.2	7.2	7.4	
	FINAL	6.9	7.4	7.5	7.3	7.0	7.3	7.4	
temp (C)	INITIAL	22.7	22.8	22.2	20.7	21.6	23.2	23.0	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.2	8.4	8.8	9.1	8.4	8.6	8.8	
	FINAL	8.1	8.3	8.4	8.2	8.1	7.9	7.9	
pH (s.u.)	INITIAL	7.1	7.2	7.4	7.5	7.3	7.2	7.4	
	FINAL	6.9	7.4	7.5	7.3	7.1	7.2	7.3	
temp (C)	INITIAL	22.8	23.1	22.2	21.1	22.1	23.4	23.2	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.4	8.6	9.3	9.1	8.7	8.7	8.9	
	FINAL	8.0	8.5	8.3	8.1	8.1	7.8	7.9	
pH (s.u.)	INITIAL	7.1	7.2	7.3	7.4	7.2	7.1	7.3	
	FINAL	6.90	7.4	7.5	7.2	7.0	7.2	7.3	
temp (C)	INITIAL	22.9	23.1	22.8	21.3	22.0	23.6	23.4	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.7	10.2	9.3	8.9	8.8	9.1	
	FINAL	8.0	8.4	8.3	8.1	8.0	7.8	7.9	
pH (s.u.)	INITIAL	7.0	7.1	7.1	7.3	7.2	7.1	7.3	
	FINAL	7.0	7.3	7.4	7.3	7.0	7.2	7.2	
temp (C)	INITIAL	23.1	23.2	22.2	21.3	22.2	24.3	23.7	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC: 100%		A	A	A	D	B	C	C	
ALKALINITY (mg/L)		4			6		6		
HARDNESS (mg/L)		>600			>600		>600		
CONDUCTIVITY (umhos/cm)		1928			1964		1968		
CHLORINE (mg/L)		<0.05			<0.05		<0.05		

Revision 1
11/30/10

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Cerodaphnia Dubia
Lab # / Sample ID		K11/2004				Test Start (Date/Time)		12/8/11	
Client:		Weston				Test End (Date/Time)		12/15/11	
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551	12/8/11	12/9	12/10	12/11	12/12	12/13	12/14	
D.O. (mg/L)	INITIAL	7.2	7.4	8.4	9.0	8.4	8.2	8.2	
	FINAL	8.2	8.4	8.4	8.3	8.4	8.4	8.1	
pH (s.u.)	INITIAL	7.5	7.7	8.0	7.8	7.7	7.8	7.9	
	FINAL	7.5	7.8	7.8	8.0	7.8	7.7	7.7	
temp (C)	INITIAL	22.8	22.6	21.2	20.1	21.2	22.9	22.5	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY (mg/L)		32							
HARDNESS (mg/L)		42							
CONDUCTIVITY (umhos/cm)		151							
CHLORINE (mg/L)		<0.05							
CONC:									
D.O. (mg/L)	INITIAL	7.3	7.8	8.5	8.9	8.7	8.3	8.6	
	FINAL	8.2	8.3	8.4	8.3	8.4	8.3	8.1	
pH (s.u)	INITIAL	7.3	7.3	7.5	7.6	7.3	7.3	7.5	
	FINAL	7.2	7.5	7.6	7.7	7.8	7.3	7.2	
temp (C)	INITIAL	22.1	22.8	22.1	20.9	21.9	23.2	22.7	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	7.8	8.6	8.8	9.0	8.4	8.4	8.6	
	FINAL	8.2	8.3	8.4	8.2	8.4	8.3	8.0	
pH (mg/L)	INITIAL	7.1	7.3	7.4	7.5	7.2	7.2	7.4	
	FINAL	7.1	7.5	7.6	7.6	7.7	7.3	7.3	
temp (C)	INITIAL	22.7	22.8	22.2	20.7	21.6	23.2	23.0	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.2	8.4	8.8	9.1	8.4	8.6	8.8	
	FINAL	8.3	8.3	8.4	8.2	8.3	8.3	7.9	
pH (s.u.)	INITIAL	7.8	7.2	7.4	7.5	7.3	7.2	7.4	
	FINAL	7.1	7.5	7.5	7.6	7.7	7.3	7.2	
temp (C)	INITIAL	22.8	23.1	22.2	21.1	22.1	23.4	23.2	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.4	8.6	9.3	9.1	8.7	8.7	8.9	
	FINAL	8.3	8.3	8.4	8.3	8.4	8.3	7.9	
pH (s.u.)	INITIAL	7.1	7.2	7.3	7.4	7.2	7.1	7.3	
	FINAL	7.1	7.4	7.5	7.5	7.7	7.3	7.3	
temp (C)	INITIAL	22.9	23.1	22.8	21.3	22.0	23.6	23.4	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.7	10.2	9.3	8.9	8.8	9.1	
	FINAL	8.3	8.3	8.5	8.4	8.4	8.2	7.9	
pH (s.u.)	INITIAL	7.0	7.1	7.1	7.3	7.2	7.1	7.3	
	FINAL	7.0	7.3	7.4	7.4	7.4	7.2	7.2	
temp (C)	INITIAL	23.1	23.2	22.2	21.3	22.2	24.3	23.7	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:	**100%**	A	A	A	B	B	C	C	
ALKALINITY (mg/L)		4			6		6		
HARDNESS (mg/L)		>600			>600		>600		
CONDUCTIVITY (umhos/cm)		1928			1964		1968		
CHLORINE (mg/L)		<0.05			<0.05		<0.05		

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APPENDIX C

Fathead minnow raw data and statistics

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID K11I2004 TEST START DATE 12/8/11 TIME 1515

CLIENT Weston TEST END DATE 12/15/11 TIME 0940

AGE AND SOURCE OF MINNOWS

Summary Page

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	8	8	8	8	8	8	8	8	100	100	0.00
	B									100		
	C									100		
	D									100		
	E									100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 32	A	8	8	8	8	8	8	8	8	100	100	
	B									100		
	C									100		
	D									100		
	E									100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	8	8	8	8	8	8	8	8	100	100	
	B									100		
	C									100		
	D									100		
	E									100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 56	A	8	8	8	8	8	8	8	8	100	100	
	B									100		
	C									100		
	D									100		
	E									100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 75	A	8	8	8	8	8	8	8	8	100	100	
	B									100		
	C									100		
	D									100		
	E									100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	8	8	8	8	8	8	8	8	100	100	0.00
	B									100		
	C									100		
	D									100		
	E									100		
ANALYST												
DATE:												
TIME:												

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID K1112004	TEST START	DATE 12/8/11	TIME 1515
CLIENT Weston	TEST END	DATE 12/15/11	TIME 0940
	AGE AND SOURCE OF MINNOWS		
A	D A Y (NUMBER SURVIVING)		SURVIVAL

CONC	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											

CONC	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 32	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											

CONC	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											

CONC	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 56	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											

CONC	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 75	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											

CONC	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
ANALYST		KP	~~TC~~ KP	TC	TC	KP	KP	KP	KP			
DATE:		12/8/11	12/9/11	12/10/11	12/11/11	12/12/11	12/13/11	12/14/11	12/15/11			
TIME:		1515	~~1230~~ 1300	~~1255~~ 1230	1245	1540	1500	1516	0940			

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

Revision 1
11/30/10

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID — TEST START DATE 12/8/11 TIME 1515

CLIENT Weston — TEST END DATE — TIME

B — AGE AND SOURCE OF MINNOWS

DAY (NUMBER SURVIVING) — SURVIVAL

	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 3.2	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 1.6	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0.8	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0.4	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0.2	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0.1	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
ANALYST		ICP	~~ICP~~	TC	TC							
DATE:		12/8/11	12/9/11	12/10/11	12/11/11							
TIME:		1515	1250 / 1200	1245 / 30	1245							

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID — TEST START DATE 12/8/11 TIME 1515

CLIENT Weston — TEST END DATE — TIME

AGE AND SOURCE OF MINNOWS

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 3.1	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 6.2	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 12.5	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 25	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 50	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D											
	E											
ANALYST		ICP	TCK	TC	TC							
DATE:		12/8/11	12/9/11	12/10/11	12/11/11							
TIME:		1515	~~1230~~ 1300	1245	1245							

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID — TEST START DATE 12/8/11 TIME 1515

CLIENT Weston — TEST END DATE — TIME

AGE AND SOURCE OF MINNOWS

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 3.2	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 1.6	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0.8	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0.4	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: [0]	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	—	1	1	1			
	E											
ANALYST		ICP	TC/KP	TC	TC							
DATE:		12/8/11	12/9/11	12/10/11	12/11/11							
TIME:		1515	1230 1300	1245 1250	1245							

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID — TEST START DATE 12/8/11 TIME 1515

CLIENT Weston — TEST END DATE — TIME

AGE AND SOURCE OF MINNOWS

D A Y (NUMBER SURVIVING)

	REP #	start	1	2	3	4	5	6	7	SURVIVAL %	MEAN %	CV
CONC: 0	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
CONC: 3.2	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
CONC: 1.6	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
CONC: 0.8	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
CONC: 0.4	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
CONC: 0.2	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
	A	2	2	2	2	2	2	2	2			
	B											
	C											
	D	1	1	1	1	1	1	1	1			
	E											
ANALYST		ICP	TC	TC	TC							
DATE:		12/8/11	12/9/11	12/10/11	12/11/11							
TIME:		1515	1230 1300	1245 1230	1245							

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

Pimephales promelas **FATHEAD MINNOW** **TEST 1000.0**

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K1112003				**TEST DATES (BEGIN / END):**		12/8-15/11	
CLIENT:	EEMA				**WEIGHING DATE / TIME:**		12/16/11, 1355	
ANALYSTS:	KP				**DRYING TEMP (DEGREES C):**		60	
SAMPLE ID:	SEE COC				**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**	0.96536	0.96238	0.00298	8	0.372	**AVG DRY**	
	B	0.96874	0.96620	0.00254	8	0.318	**WEIGHT (mg)**	
	C	0.98938	0.98721	0.00217	8	0.271		0.319
	D	0.99889	0.99659	0.00230	8	0.287	**CV**	
	E	1.01143	1.00868	0.00275	8	0.344		12.9
CONC:	**A**	0.98713	0.98355	0.00358	8	0.447	**AVG DRY**	
	B	1.00733	1.00374	0.00359	8	0.449	**WEIGHT (mg)**	
32%	**C**	0.99958	0.99700	0.00258	8	0.323		0.386
	D	1.00288	1.00007	0.00281	8	0.351	**CV**	
	E	0.99966	0.99676	0.00290	8	0.363		
CONC:	**A**	0.98741	0.98320	0.00421	8	0.526	**AVG DRY**	
	B	0.97306	0.96961	0.00345	8	0.431	**WEIGHT (mg)**	
42%	**C**	0.98663	0.98357	0.00306	8	0.382		0.433
	D	1.01364	1.01049	0.00315	8	0.394	**CV**	
	E	0.96513	0.96169	0.00344	8	0.430		
CONC:	**A**	0.95358	0.94961	0.00397	8	0.496	**AVG DRY**	
	B	1.00863	1.00537	0.00326	8	0.407	**WEIGHT (mg)**	
56%	**C**	0.96980	0.96652	0.00328	8	0.410		0.447
	D	0.96132	0.95750	0.00382	8	0.477	**CV**	
	E	0.96881	0.96526	0.00355	8	0.444		
CONC:	**A**	0.95652	0.95287	0.00365	8	0.456	**AVG DRY**	
	B	1.01035	1.00651	0.00384	8	0.480	**WEIGHT (mg)**	
75%	**C**	1.00364	1.00084	0.00280	8	0.350		0.419
	D	1.00090	0.99800	0.00290	8	0.362	**CV**	
	E	1.00509	1.00153	0.00356	8	0.445		
CONC:	**A**	0.99500	0.99097	0.00403	8	0.504	**AVG DRY**	
	B	0.96985	0.96635	0.00350	8	0.437	**WEIGHT (mg)**	
100%	**C**	0.98394	0.98058	0.00336	8	0.420		0.456
	D	1.01429	1.01092	0.00337	8	0.421	**CV**	
	E	1.00487	1.00089	0.00398	8	0.497		9.07

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

AA# K1112004, FATHEAD MINNOW, CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHSURV. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.000

W = 0.000

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# K1112004, FATHEAD MINNOW, CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHSURV. 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# K1112004, FATHEAD MINNOW, CHRONIC, 12-8-11
FILE: Z:\TOXSTAT\MONTE\FHSURV.
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	1.0000	1.4120
1	CONTROL	2	1.0000	1.4120
1	CONTROL	3	1.0000	1.4120
1	CONTROL	4	1.0000	1.4120
1	CONTROL	5	1.0000	1.4120
2	32 % EFFLUENT	1	1.0000	1.4120
2	32 % EFFLUENT	2	1.0000	1.4120
2	32 % EFFLUENT	3	1.0000	1.4120
2	32 % EFFLUENT	4	1.0000	1.4120
2	32 % EFFLUENT	5	1.0000	1.4120

3	42	% EFFLUENT	1	1.0000	1.4120
3	42	% EFFLUENT	2	1.0000	1.4120
3	42	% EFFLUENT	3	1.0000	1.4120
3	42	% EFFLUENT	4	1.0000	1.4120
3	42	% EFFLUENT	5	1.0000	1.4120
4	56	% EFFLUENT	1	1.0000	1.4120
4	56	% EFFLUENT	2	1.0000	1.4120
4	56	% EFFLUENT	3	1.0000	1.4120
4	56	% EFFLUENT	4	1.0000	1.4120
4	56	% EFFLUENT	5	1.0000	1.4120
5	75	% EFFLUENT	1	1.0000	1.4120
5	75	% EFFLUENT	2	1.0000	1.4120
5	75	% EFFLUENT	3	1.0000	1.4120
5	75	% EFFLUENT	4	1.0000	1.4120
5	75	% EFFLUENT	5	1.0000	1.4120
6	100	% EFFLUENT	1	1.0000	1.4120
6	100	% EFFLUENT	2	1.0000	1.4120
6	100	% EFFLUENT	3	1.0000	1.4120
6	100	% EFFLUENT	4	1.0000	1.4120
6	100	% EFFLUENT	5	1.0000	1.4120

AA# K1112004, FATHEAD MINNOW, CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHSURV. 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	1.412				
2	32 % EFFLUENT	1.412	27.50	16.00	5.00	
3	42 % EFFLUENT	1.412	27.50	16.00	5.00	
4	56 % EFFLUENT	1.412	27.50	16.00	5.00	
5	75 % EFFLUENT	1.412	27.50	16.00	5.00	
6	100 % EFFLUENT	1.412	27.50	16.00	5.00	

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

AA# K1112004, FATHEAD MINNOW GROWTH CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHGR. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.062

W = 0.932

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# K1112004, FATHEAD MINNOW GROWTH CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHGR. Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 1.27

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# K1112004, FATHEAD MINNOW GROWTH CHRONIC, 12-8-11
FILE: Z:\TOXSTAT\MONTE\FHGR.
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.3720	0.6560
1	CONTROL	2	0.3180	0.5991
1	CONTROL	3	0.2710	0.5475
1	CONTROL	4	0.2870	0.5654
1	CONTROL	5	0.3440	0.6267
2	32 % EFFLUENT	1	0.4470	0.7323
2	32 % EFFLUENT	2	0.4490	0.7343
2	32 % EFFLUENT	3	0.3230	0.6045
2	32 % EFFLUENT	4	0.3510	0.6341
2	32 % EFFLUENT	5	0.3630	0.6466
3	42 % EFFLUENT	1	0.5260	0.8114
3	42 % EFFLUENT	2	0.4310	0.7162
3	42 % EFFLUENT	3	0.3820	0.6663
3	42 % EFFLUENT	4	0.3940	0.6786
3	42 % EFFLUENT	5	0.4300	0.7152
4	56 % EFFLUENT	1	0.4960	0.7814

4	56 % EFFLUENT	2	0.4070	0.6919
4	56 % EFFLUENT	3	0.4100	0.6949
4	56 % EFFLUENT	4	0.4770	0.7624
4	56 % EFFLUENT	5	0.4440	0.7293
5	75 % EFFLUENT	1	0.4560	0.7413
5	75 % EFFLUENT	2	0.4800	0.7654
5	75 % EFFLUENT	3	0.3500	0.6331
5	75 % EFFLUENT	4	0.3620	0.6456
5	75 % EFFLUENT	5	0.4450	0.7303
6	100 % EFFLUENT	1	0.5040	0.7894
6	100 % EFFLUENT	2	0.4370	0.7222
6	100 % EFFLUENT	3	0.4200	0.7051
6	100 % EFFLUENT	4	0.4210	0.7061
6	100 % EFFLUENT	5	0.4970	0.7824

AA# K1112004, FATHEAD MINNOW GROWTH CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHGR. Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.069	0.014	5.333
Within (Error)	24	0.062	0.003	
Total	29	0.132		

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

AA# K1112004, FATHEAD MINNOW GROWTH CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHGR. 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	0.599	0.318		
2	32 % EFFLUENT	0.670	0.387	-2.213	
3	42 % EFFLUENT	0.718	0.433	-3.675	
4	56 % EFFLUENT	0.732	0.447	-4.122	
5	75 % EFFLUENT	0.703	0.419	-3.229	
6	100 % EFFLUENT	0.741	0.456	-4.403	

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

AA# K1112004, FATHEAD MINNOW GROWTH CHRONIC, 12-8-11
File: Z:\TOXSTAT\MONTE\FHGR. 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	32 % EFFLUENT	5	0.069	21.5	-0.068
3	42 % EFFLUENT	5	0.069	21.5	-0.114
4	56 % EFFLUENT	5	0.069	21.5	-0.128
5	75 % EFFLUENT	5	0.069	21.5	-0.100
6	100 % EFFLUENT	5	0.069	21.5	-0.137

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Cerodaphnia dubia

SURVIVAL AND REPRODUCTION TEST

Discharger: Weston
Location:
Date Sample Collected:

Lab Number/s: K1112004

Analyst: KP
Test Start - Date/ Time: 12/8/11 1400
Test Stop - Date/Time: 12/15/11 0900

Conc 1

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/Adult	Analyst
0	1	0	0	0	0	0	0	0	0	0	0	0	10	0	KP
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	Tc
	3	0	2	1	1	3	0	1	1	0	3	12	10	1.2	KP
	4	2	2	1	3	4	3	7	6	1	0	18	10	1.8	KP
	5	4	3	3	2	1	3	2	5	4	6	33	10	3.3	KP
	6	8	6	9	5	7	5	4	0	8	4	56	10	5.6	KP
	7	3	6	2	3	4	7	8	5	7	0	45	10	4.5	KP
	8														
	Total	17	19	16	14	19	18	17	11	20	13	164	x̄=16.4 CV=17.8		

Conc 2

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/Adult	Analyst
32	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	1	3	2	3	1	6	0	4	14	10	1.4	
	4	3	3	4	1	0	1	0	4	3	0	19	10	1.9	
	5	10	9	3	3	7	8	6	9	7	4	66	10	6.6	
	6	5	3	5	7	2	9	5	0	6	9	45	10	4.5	
	7	2	7	3	6	0	5	7	2	0	3	35	10	3.5	
	8														
	Total	20	24	16	20	11	26	19	15	10	20	179			

Conc 3

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/Adult	Analyst
42	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	1	1	3	3	4	4	1	0	2	3	22	10	2.2	
	4	6	3	1	1	0	2	0	2	0	0	9	10	0.9	
	5	4	8	5	2	4	7	6	6	8	10	60	10	6.0	
	6	3	6	8	7	4	7	8	5	3	0	47	10	4.7	
	7	3	9	2	0	3	2	0	0	3	2	19	10		
	8														
	Total	15	22	19	13	15	22	7	13	16	15	157			

X= DEAD; Y= MALE

Conc 4

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/Adult	Analyst
56	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	X0	0	0	0	9	0	
	3	2	0	1	0	1	1	4	~~0~~	2	2	13	9	1.4	
	4	7	1	5	2	1	0	1	—	2	3	17	9	1.9	
	5	8	1	4	7	2	5	4	—	9	6	46	9	5.1	
	6	7	6	6	4	7	0	6	—	0	3	39	9	4.3	
	7	5	3	7	4	2	7	5	—	4	2	39	9	4.3	
	8														
	Total	24	11	23	17	13	13	20	X0	17	16	154			

Conc 5

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/Adult	Analyst
75	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	X0	0	X0	0	0	0	0	0	0	0	8	0	
	3	1	—	6	—	2	5	2	3	1	3	17	8	2.1	
	4	2	—	1	—	0	4	2	1	3	1	14	8	1.8	
	5	4	—	3	—	4	7	10	9	0	7	44	8	5.5	
	6	6	—	4	—	5	9	0x	0	6	7	37	7	5.3	
	7	1	—	7	—	3	6	—	5	8	0	30	7	4.3	
	8														
	Total	14	X0	15	X0	14	31	X14	18	18	18	142			

Conc 6

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/Adult	Analyst
100	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	6	1	4	6	2	3	1	2	2	0	27	10	2.7	
	4	1	2	1	8	3	0	4	2	1	3	17	10	1.7	
	5	6	2	9	9	1	4x	9	3	7	6	56	9	6.2	
	6	3	8	4	9	2	—	0	3	5	8	42	9	4.7	
	7	3	2	8	6	7	—	3	0	4	0	35	9	3.9	
	8														
	Total	21	15	26	30	15	X7	17	10	19	17	177			

x̄=18.9
CV=32.1

Revision 1
11/30/10

AA # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
File: Z:/toxstat/monte\CD. 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 # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 12.05

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	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
32%	10	0	10
TOTAL	20	0	20

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

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
42%	10	0	10
TOTAL	20	0	20

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

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
56%	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	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
75%	7	3	10
TOTAL	17	3	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 7.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100%	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.

SUMMARY OF FISHER'S EXACT TESTS

	NUMBER	NUMBER	SIG

GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	32%	10	0	
2	42%	10	0	
3	56%	10	1	
4	75%	10	3	
5	100%	10	1	

TITLE: AA # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
FILE: Z:/toxstat/monte\CD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	17.0000	17.0000
1	CONTROL	2	19.0000	19.0000
1	CONTROL	3	16.0000	16.0000
1	CONTROL	4	14.0000	14.0000
1	CONTROL	5	19.0000	19.0000
1	CONTROL	6	18.0000	18.0000
1	CONTROL	7	17.0000	17.0000
1	CONTROL	8	11.0000	11.0000
1	CONTROL	9	20.0000	20.0000
1	CONTROL	10	13.0000	13.0000
2	32 % EFFLUENT	1	20.0000	20.0000
2	32 % EFFLUENT	2	22.0000	22.0000
2	32 % EFFLUENT	3	16.0000	16.0000
2	32 % EFFLUENT	4	20.0000	20.0000
2	32 % EFFLUENT	5	11.0000	11.0000
2	32 % EFFLUENT	6	26.0000	26.0000
2	32 % EFFLUENT	7	19.0000	19.0000
2	32 % EFFLUENT	8	15.0000	15.0000
2	32 % EFFLUENT	9	10.0000	10.0000
2	32 % EFFLUENT	10	20.0000	20.0000
3	42 % EFFLUENT	1	15.0000	15.0000
3	42 % EFFLUENT	2	22.0000	22.0000
3	42 % EFFLUENT	3	19.0000	19.0000
3	42 % EFFLUENT	4	13.0000	13.0000
3	42 % EFFLUENT	5	15.0000	15.0000
3	42 % EFFLUENT	6	22.0000	22.0000
3	42 % EFFLUENT	7	7.0000	7.0000
3	42 % EFFLUENT	8	13.0000	13.0000
3	42 % EFFLUENT	9	16.0000	16.0000
3	42 % EFFLUENT	10	15.0000	15.0000
4	56 % EFFLUENT	1	24.0000	24.0000
4	56 % EFFLUENT	2	11.0000	11.0000
4	56 % EFFLUENT	3	23.0000	23.0000
4	56 % EFFLUENT	4	17.0000	17.0000
4	56 % EFFLUENT	5	13.0000	13.0000
4	56 % EFFLUENT	6	13.0000	13.0000
4	56 % EFFLUENT	7	20.0000	20.0000
4	56 % EFFLUENT	8	0.0000	0.0000

4	56 % EFFLUENT	9	17.0000	17.0000
4	56 % EFFLUENT	10	16.0000	16.0000
5	75 % EFFLUENT	1	14.0000	14.0000
5	75 % EFFLUENT	2	0.0000	0.0000
5	75 % EFFLUENT	3	15.0000	15.0000
5	75 % EFFLUENT	4	0.0000	0.0000
5	75 % EFFLUENT	5	14.0000	14.0000
5	75 % EFFLUENT	6	31.0000	31.0000
5	75 % EFFLUENT	7	14.0000	14.0000
5	75 % EFFLUENT	8	18.0000	18.0000
5	75 % EFFLUENT	9	18.0000	18.0000
5	75 % EFFLUENT	10	18.0000	18.0000
6	100 % EFFLUENT	1	21.0000	21.0000
6	100 % EFFLUENT	2	15.0000	15.0000
6	100 % EFFLUENT	3	26.0000	26.0000
6	100 % EFFLUENT	4	30.0000	30.0000
6	100 % EFFLUENT	5	15.0000	15.0000
6	100 % EFFLUENT	6	7.0000	7.0000
6	100 % EFFLUENT	7	17.0000	17.0000
6	100 % EFFLUENT	8	10.0000	10.0000
6	100 % EFFLUENT	9	19.0000	19.0000
6	100 % EFFLUENT	10	17.0000	17.0000

AA # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	100.683	20.137	0.529
Within (Error)	54	2055.500	38.065	
Total	59	2156.183		

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

AA # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	16.400	16.400		
2	32 % EFFLUENT	17.900	17.900	-0.544	
3	42 % EFFLUENT	15.700	15.700	0.254	
4	56 % EFFLUENT	15.400	15.400	0.362	
5	75 % EFFLUENT	14.200	14.200	0.797	
6	100 % EFFLUENT	17.700	17.700	-0.471	

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

AA # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	32 % EFFLUENT	10	6.374	38.9	-1.500
3	42 % EFFLUENT	10	6.374	38.9	0.700
4	56 % EFFLUENT	10	6.374	38.9	1.000
5	75 % EFFLUENT	10	6.374	38.9	2.200
6	100 % EFFLUENT	10	6.374	38.9	-1.300

AA # K1112004, C. DUBIA CHRONIC, REPRODUCION, 12-8-11
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	16.400				
2	32 % EFFLUENT	17.900	118.50	75.00	10.00	
3	42 % EFFLUENT	15.700	98.50	75.00	10.00	
4	56 % EFFLUENT	15.400	101.50	75.00	10.00	
5	75 % EFFLUENT	14.200	95.00	75.00	10.00	
6	100 % EFFLUENT	17.700	109.00	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 12-7-11 **CLIENT** Arkansas Analytical

Purchase Order #: _____

SPECIES:	(Pimephales promelas)	Mysidopsis bahia	Cyprinodon variegates
Quantity Shipped:	300+ & 100+		
Age:	Hatched 12/7 AM = 7 Days old 12/7		
Brood Stock Source:	Anderson Labs, Inc		
Culture Water:	(Groundwater)	Artificial Salts	Artificial Salts
Hardness (Mg/l CaCO3)	160	**Salinity (ppt)**	
Dissolved Oxygen (Mg/1):	8.2		

Feeding: Artemia

Comments: 25.3°C

Shipped Via: Federal Express UPS Overnight Shuttle

Packaged By: [signature]

Bill Hall Printers 3171

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

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

ORGANISM HISTORY

DATE: 6/22/09

SPECIES: *Ceriodaphnia dubia*

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, *Selenastrum* sp.

Water Chemistry Record:	Current	Range
TEMPERATURE:	25°C	20-25°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	142 mg/l	86-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	100 mg/l	65-130 mg/l
pH:	7.92	7.56-8.35

Comments:

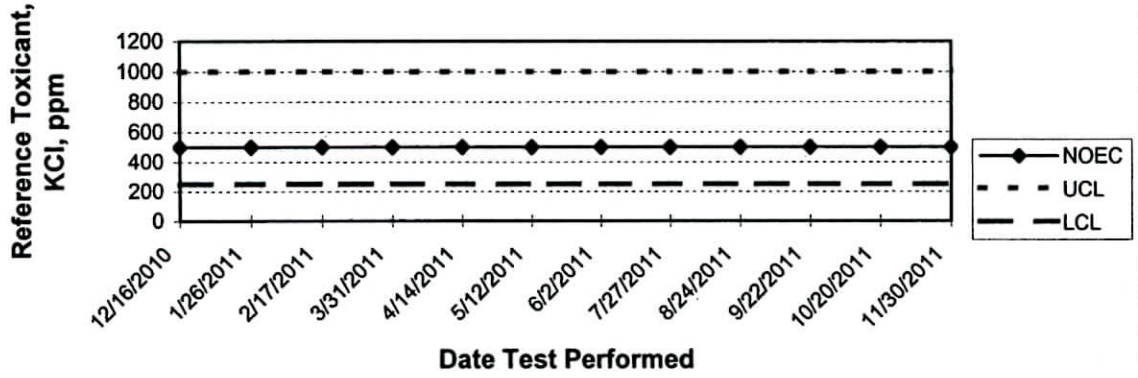
Facility Supervisor

APPENDIX F

Quality Assurance Charts

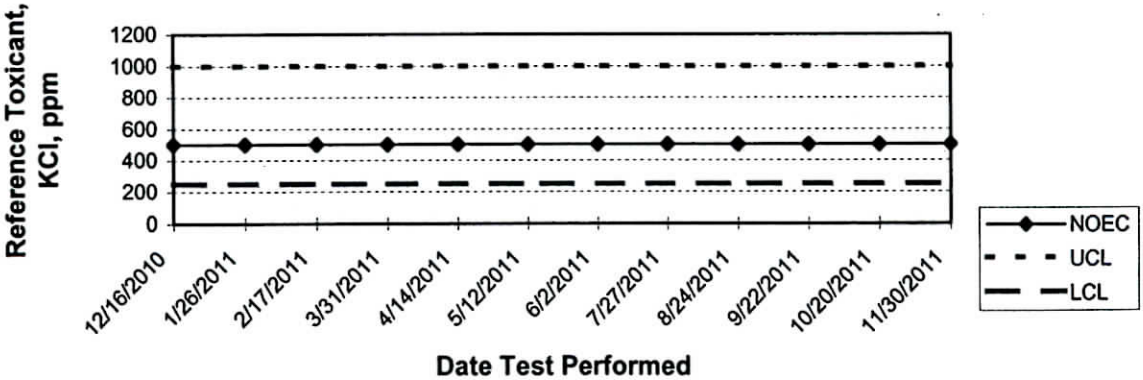
ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW SURVIVAL
QUALITY ASSURANCE



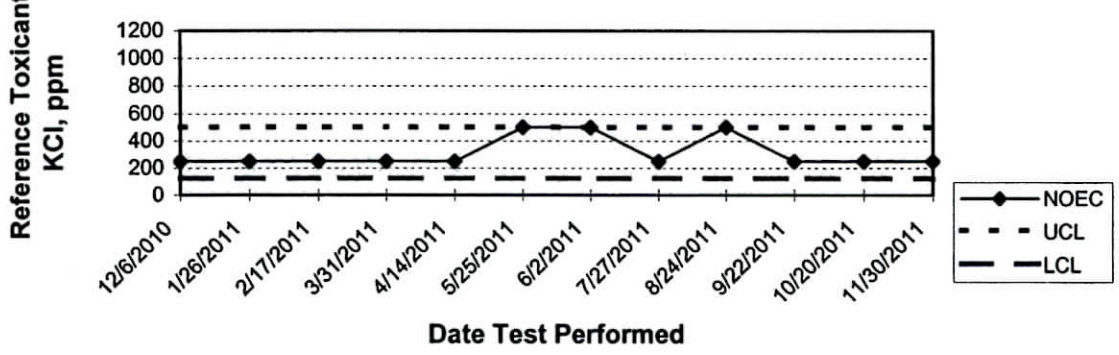
ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW GROWTH
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE