Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
April, 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 K1104002

Tuesday, April 26, 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 April 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:	4-13-11, 0845	4-14-11, 0845
Sample #2:	4-14-11, 0910	4-15-11, 0910
Sample #3:	4-18-11, 0815	4-119-11, 0815

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:	4-14-11, 1351	4
Sample #2:	4-15-11, 1345	4
Sample #3:	4-19-11, 1325	4

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	17.0	X	
At least 60% of surviving females should have produced 3 broods	70%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	28.7%	X	

TEST ACCEPTANCE CRITERIA for *Pimephales promelas*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	95%	X	
The percent coefficient of variation between replicates must be 40% or less for survival	7.21%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.314	X	
The percent coefficient of variation between replicates must be 40% or less for growth	9.32%	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 3/31/11-4/7/11		*Pimephales promelas* 3/31/11-4/7/11	
NOEC Survival:	250 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	500 ppm KCl	LOEC Survival:	1000 ppm KCl
NOEC Reproduction:	250 ppm KCl	NOEC Growth:	500 ppm KCl
LOEC Reproduction:	500 ppm KCl	LOEC Growth:	1000 ppm KCl

Quality Assurance charts are provided in Appendix F.

Summary of Results
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)	25.1	%CV survival (critical dilution)	7.21 %
%CV Reproduction (critical dilution)	26.9%	Mean dry weight (critical dilution) in milligrams	0.437
		%CV growth (critical dilution)	22.7%
PMSD Reproduction	29.2	PMSD Growth	29.6

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

Chris Turney

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:	4-13-11, 0845	4-14-11, 0845
Sample #2:	4-14-11, 0910	4-15-11, 0910
Sample #3:	4-18-11, 0815	4-119-11, 0815

Test initiated (date, time): 4-14-11, 1630 Test terminated (date, time): 4-21-11, 1455

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	87.5	87.5	100		100	100	95	7.21
32%	100	100	100	100	100		100	100	100	
42%	87.5	100	100	75	100		100	100	92.5	
56%	100	100	100	100	100		100	100	100	
75%	100	100	100	100	100		100	100	100	
100%	87.5	100	100	87.5	100		100	97.5	95	7.21

SUMMARY

Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.275	0.340	0.309	0.299	0.345		0.314	9.32
32%	0.301	0.441	0.324	0.347	0.524		0.387	
42%	0.336	0.456	0.416	0.363	0.353		0.385	
56%	0.382	0.424	0.385	0.480	0.543		0.443	
75%	0.382	0.493	0.418	0.447	0.386		0.425	
100%	0.340	0.578	0.343	0.463	0.464		0.438	22.7

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)= _____**22.7**_____%

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:	4-13-11, 0845	4-14-11, 0845
Sample #2:	4-14-11, 0910	4-15-11, 0910
Sample #3:	4-18-11, 0815	4-119-11, 0815

Test initiated (date, time): 4-14-11, 1600 Test terminated (date, time): 4-21-11, 1420

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	23	21	21	33	26	31
B	17	20	20	x12	23	25
C	22	18	17	16	18	33
D	20	20	17	18	13	20
E	12	17	16	22	21	35
F	10	13	17	18	16	15
G	12	22	18	22	18	18
H	14	18	12	22	20	20
I	23	27	16	16	21	28
J	17	22	22	25	18	26
Mean	17.0	19.8	17.6	20.4	19.4	25.1
Mean/surviving female	17.0	19.8	17.6	21.3	19.4	25.1
CV%*	28.7					26.9

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	100	100	100
Test termination	100	100	100	90	100	100

1. Fisher's Exact Test:
   Is the mean survival at test termination significantly different (p=0.05) than the control survival for:

   a) LOW FLOW OR CRITICAL DILUTION, (100%): YES_____ NO___**X**___

2. Dunnett's Procedure or Steel's Many One Rank Test:
   Is the mean number of young produced per female significantly different (p=0.05) than the controls number of young per female for:

   a) LOW FLOW OR CRITICAL DILUTION, (100%): YES_____ NO___**X**____

3. If NO was answered to 1.a) enter [0] otherwise enter [1] (parameter TLP3B):_____**0**_____

4. If NO was answered to 2.a) enter [0] otherwise enter [1] (parameter TGP3B):_____**0**_____

5. Enter percentage corresponding to each parameter below:

   a) NOEC survival (parameter TOP3B)= _____**100**____ % effluent

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

   c) Coefficient of variation (parameter TQP3B)= _____**28.7**_____%

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 R

CLIENT INFORMATION		Project Description	Turnaround Time	Preservation Cod
EEMA O & M Services Group	EEMA O & M Services Group	Magcobar Mine Site	24 Hour	1. Cool, 4 Degrees Centigrade / 4. Th
Magcobar Mine Site	P.O. Box 732	Biomonitoring Sample	48 Hour	2. Sulfuric Acid (H_2SO_4), pH < 2 / 5. Hy
P.O. Box 699	Kulpsville, PA 19443	Reporting Information	72 Hour	3. Nitric Acid (HNO_3), pH < 2 / 6. Sod
Malvern, AR 72104		Telephone: 501-467-8355	Routine (5 Day)	TEST PARAMETERS
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
FD-1 Comp.	4/14/2011 KP 4/28/11	8:45 AM		X	4	W	Facility Discharge	X

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / S
Bill McAlister	4-14-11 1351		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: 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 R

CLIENT INFORMATION		Project Description	Turnaround Time	Preservation Cod
EEMA O & M Services Group	EEMA O & M Services Group	Magcobar Mine Site	24 Hour	1. Cool, 4 Degrees Centigrade
Magcobar Mine Site	P.O. Box 732	Biomonitoring Sample	48 Hour	2. Sulfuric Acid (H_2SO_4), pH < 2
P.O. Box 699	Kulpsville, PA 19443	Reporting Information	72 Hour	3. Nitric Acid (HNO_3), pH < 2
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	Sampler(s) Printed
Bill McAlister	Bill McAlister

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Biomonitoring	TEST PARAMETERS
FD-2 Comp.	4/15/2011 (4/14/2011)	9:10 AM		X	3	W	Facility Discharge	X	

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / S
Bill McAlister	4-15-11 1345		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: 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 R

CLIENT INFORMATION		Project Description	Turnaround Time	Preservation Co
EEMA O & M Services Group	EEMA O & M Services Group	Magcobar Mine Site	24 Hour	1. Cool, 4 Degrees Centigrade
Magcobar Mine Site	P.O. Box 732	Biomonitoring Sample	48 Hour	2. Sulfuric Acid (H_2SO_4), pH < 2
P.O. Box 699	Kulpsville, PA 19443	Reporting Information	72 Hour	3. Nitric Acid (HNO_3), pH < 2
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	Sampler(s) Printed
Bill McAlister	Bill McAlister

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Biomonitoring	TEST PARAMETER
FD-2 Comp.	4/19/2010 4/28/11	8:15 AM		X	3	W	Facility Discharge	X	

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / S
Bill McAlister	4-19-11		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	
	4-19-11 1325	Amanda Forbush	5. RECEIVED ON ICE: ___ Yes ___ No	
			6. TEMPERATURE ON RECEIPT: 4°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		10400 2			Test Start (Date/Time)		4/14/11		
Client:	Weston				Test End (Date/Time)		4/21/11		
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
D.O. (mg/L)	INITIAL	6.3	6.5	8.2	8.2	8.0	8.6	8.6	
	FINAL	8.0	8.2	8.3	7.8	7.7	7.9	8.2	
pH (s.u.)	INITIAL	7.7	8.0	7.5	7.7	7.7	7.9	7.7	
	FINAL	7.6	8.4 7.5	7.6	8 7.7	7.8	7.7	7.7	
temp (C)	INITIAL	23.2	23.0	23.2	24.0	22.9	22.6	21.3	
	FINAL	25.0	25.0 25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY (mg/L)		36							
HARDNESS (mg/L)		46							
CONDUCTIVITY (umhos/cm)		175							
CHLORINE (mg/L)		<0.05							
CONC:									
D.O. (mg/L)	INITIAL	8.2	7.2	8.2	8.2	8.2	8.6	8.6	
	FINAL	7.8	8.1	8.1	7.5	7.6	7.8	8.6	
pH (s.u)	INITIAL	7.3	7.8	7.6	7.5	7.9	7.8	7.4	
	FINAL	7.5	8.3 7.6	7.5	7.3	7.4	7.4	7.4	
temp (C)	INITIAL	23.2	22.7	22.6	24.1	23.0	23.1	22.1	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.4	7.6	8.3	8.1	8.3	8.5	8.6	
	FINAL	7.8	8.0	7.9	7.5	7.6	7.8	8.0	
pH (mg/L)	INITIAL	7.2	7.8	7.6	7.6	7.4	7.8	7.2	
	FINAL	7.5	8.3 7.4	7.5	7.4	7.5	7.4	7.4	
temp (C)	INITIAL	23.3	22.5	22.7	24.4	23.0	23.4	22.4	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.8	8.1	8.3	8.2	8.5	8.7	8.6	
	FINAL	7.9	7.9	8.0	7.6	7.6	7.8	8.0	
pH (s.u.)	INITIAL	7.1	7.7	7.6	7.5	7.4	7.7	7.2	
	FINAL	7.5	8.3 7.5	7.6	7.4	7.5	7.4	7.3	
temp (C)	INITIAL	23.3	22.7	22.9	24.9	22.9	23.9	23.6	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.8	8.4	8.3	8.3	8.6	8.8	8.7	
	FINAL	7.9	7.8	8.0	7.5	7.7	7.8	8.0	
pH (s.u.)	INITIAL	7.1	7.6	7.5	7.5	7.4	7.6	7.2	
	FINAL	7.5	8.3 7.5	7.5	7.4	7.4	7.4	7.3	
temp (C)	INITIAL	23.5	22.2	23.2	25.7	23.4	24.1	24.7	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:									
D.O. (mg/L)	INITIAL	8.8	9.0	8.5	8.3	8.8	8.9	8.9	
	FINAL	7.9	7.8	8.0	7.5	7.6	7.7	8.0	
pH (s.u.)	INITIAL	7.1	7.6	7.5	7.4	7.4	7.5	7.4	
	FINAL	7.5	8.2 7.4	7.4	7.3	7.4	7.4	7.3	
temp (C)	INITIAL	23.7	22.6	23.3	27.0	23.8	24.6	25.4	
	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)		20	—	1	12	1	20	1	
HARDNESS (mg/L)		>600	—	1	>600	1	>600	1	
CONDUCTIVITY (umhos/cm)		2070	—	1	2110	1	2100	1	
CHLORINE (mg/L)		<0.05	—	1	<0.05	1	<0.05	1	

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Cerodaphnia Dubia

Lab # / Sample ID: K1104002 — Test Start (Date/Time): 4/14/11

Client: Weston — Test End (Date/Time): 4/21/11

		Day of Test 1	2	3	4	5	6	7	notes/remarks
Control	MHS551	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
D.O. (mg/L)	INITIAL	6.3	6.5	8.2	8.2	8.0	8.6	8.6	
	FINAL	8.2	8.4	8.3	8.2	8.1	7.8	7.6	
pH (s.u.)	INITIAL	7.7	8.0	7.5	7.7	7.2	7.9	7.7	
	FINAL	7.9	8.4	8.1	7.9	7.5	8.0	8.0	
temp (C)	INITIAL	23.2	23.0	23.2	24.0	22.9	22.6	21.3	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY (mg/L)		36							
HARDNESS (mg/L)		46							
CONDUCTIVITY (umhos/cm)		175							
CHLORINE (mg/L)		<0.05							
CONC: 32									
D.O. (mg/L)	INITIAL	8.2	7.2	8.2	8.2	8.2	8.6	8.6	
	FINAL	8.2	8.7	8.3	8.2	8.1	7.8	7.6	
pH (s.u)	INITIAL	7.3	7.8	7.6	7.5	7.4	7.8	7.4	
	FINAL	7.6	8.3	7.6	7.7	7.5	8.0	8.1	
temp (C)	INITIAL	23.2	22.7	22.6	24.1	23.0	23.1	22.1	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC: 42									
D.O. (mg/L)	INITIAL	8.4	7.6	8.3	8.1	8.3	8.5	8.6	
	FINAL	8.3	8.7	8.3	8.3	8.1	7.9	7.6	
pH (mg/L)	INITIAL	7.2	7.8	7.6	7.5	7.4	7.8	7.2	
	FINAL	7.6	8.3	7.6	7.7	7.7	7.9	8.2	
temp (C)	INITIAL	23.3	22.5	22.7	24.4	23.0	23.4	22.4	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC: 56									
D.O. (mg/L)	INITIAL	8.8	8.1	8.3	8.3	8.5	8.7	8.6	
	FINAL	8.3	8.8	8.4	8.3	8.1	8.1	7.5	
pH (s.u.)	INITIAL	7.1	7.7	7.6	7.5	7.4	7.7	7.2	
	FINAL	7.6	8.3	7.6	7.7	7.6	7.9	8.2	
temp (C)	INITIAL	23.3	22.7	22.9	24.9	22.9	23.9	23.6	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC: 75									
D.O. (mg/L)	INITIAL	8.8	8.4	8.3	8.3	8.6	8.8	8.7	
	FINAL	8.3	8.9	8.4	8.4	8.2	8.3	7.6	
pH (s.u.)	INITIAL	7.1	7.6	7.5	7.5	7.4	7.6	7.2	
	FINAL	7.6	8.3	7.6	7.7	7.5	7.8	8.2	
temp (C)	INITIAL	23.5	22.2	23.2	25.7	23.4	24.1	24.7	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC: 100									
D.O. (mg/L)	INITIAL	8.8	9.0	8.5	8.2	8.8	8.9	8.9	
	FINAL	8.3	8.5 9.0	8.4	8.5	8.3	8.3	7.6	
pH (s.u.)	INITIAL	7.1	7.6	7.5	7.4	7.4	7.5	7.1	
	FINAL	7.5	25.0 8.3	7.5	7.6	7.6	7.8	8.2	
temp (C)	INITIAL	23.7	22.6	23.3	27.0	23.8	24.6	25.4	
	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)		20	—	—	12	—	20	—	
HARDNESS (mg/L)		>600	—	—	>600	—	>600	—	
CONDUCTIVITY (umhos/cm)		2070	—	—	2110	—	2300	—	
CHLORINE (mg/L)		<0.05	—	—	<0.05	—	<0.05	—	

APPENDIX C

Fathead minnow raw data and statistics

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID 14104002 TEST START DATE 4/14/11 TIME 1630

CLIENT Weston Summary Page TEST END DATE 4/21/11 TIME 1455

AGE AND SOURCE OF MINNOWS

		D A Y (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	95	7.21
	B	8	8	8	8	8	8	8	8	100		
	C	8	8	8	8	7	7	7	7	87.5		
	D	8	8	8	8	8	8	7	7	87.5		
	E	8	8	8	8	8	8	8	8	100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 31	A	8	8	8	8	8	8	8	8	100	100	
	B	8	8	8	8	8	8	8	8	100		
	C	8	8	8	8	8	8	8	8	100		
	D	8	8	8	8	8	8	8	8	100		
	E	8	8	8	8	8	8	8	8	100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	8	8	8	8	8	8	8	7	87.5	92.5	
	B	8	8	8	8	8	8	8	8	100		
	C	8	8	8	8	8	8	8	8	100		
	D	8	8	8	8	8	8	7	6	75		
	E	8	8	8	8	8	8	8	8	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	8	8	8	8	8	8	8	8	100		
	C	8	8	8	8	8	8	8	8	100		
	D	8	8	8	8	8	8	8	8	100		
	E	8	8	8	8	8	8	8	8	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	8	8	8	8	8	8	8	8	100		
	C	8	8	8	8	8	8	8	8	100		
	D	8	8	8	8	8	8	8	8	100		
	E	8	8	8	8	8	8	8	8	100		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	8	8	8	7	7	7	7	7	87.5	95	7.21
	B	8	8	8	8	8	8	8	8	100		
	C	8	8	8	8	8	8	8	8	100		
	D	8	8	7	7	7	7	7	7	87.5		
	E	8	8	8	8	8	8	8	8	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 IC110400 2 TEST START DATE 4/14/11 TIME 1630

CLIENT Weston TEST END DATE 4/21/11 TIME 1455

AGE AND SOURCE OF MINNOWS A

D A Y (NUMBER SURVIVING)

	REP #	start	1	2	3	4	5	6	7	SURVIVAL %	MEAN %	CV
CONC: 0	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D	7	7	7	7	7	7	7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 3.2	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D	7	7	7	7	7	7	7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 1.2	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D	7	7	7	7	7	7	7	6			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 5.6	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D	7	7	7	7	7	7	7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 10	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D	7	7	7	7	7	7	7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 18	A	7	7	7	7	7	7	7	7			
	B				7	7	7	7	7			
	C				7	7	7	7	7			
	D	7	7	7	7	7	7	7	7			
	E											
ANALYST		KP	KP	KP	KP	KP	KP	KP	KP			
DATE:		4/14/11	4/15/11	4/16	4/17	4/18/11	4/19/11	4/20/11	4/21/11			
TIME:		1630	0935	1330	1445	1330	1610	1410	1455			

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID KI104002 TEST START DATE 4/14/11 TIME 1630

CLIENT Weston TEST END DATE TIME

AGE AND SOURCE OF MINNOWS B

D A Y (NUMBER SURVIVING) SURVIVAL

	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D								7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 3.2	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D								7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D								7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 56	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D								7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 75	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D								7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	7	7	7	7	7	7	7	7			
	B								7			
	C								7			
	D								7			
	E											
ANALYST		KP										
DATE:		4/14/11										
TIME:		1630										

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID 1C110402 TEST START DATE 4/14/11 TIME 1630

CLIENT Weston TEST END DATE TIME

AGE AND SOURCE OF MINNOWS C

D A Y (NUMBER SURVIVING) SURVIVAL

	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	7	2	2	2	2	2	2	2			
	B					1	1	1	1			
	C					2	2	2	2			
	D	1	1	1	1	2	2	2	2			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 32	A	2	2	2	2	2	2	2	2			
	B								2			
	C								2			
	D	1	1	1	1	1	1	1	2			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	2	2	2	2	2	2	2	2			
	B								2			
	C								2			
	D	1	1	1	1	1	1	1	2			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 56	A	2	2	2	2	2	2	2	2			
	B								2			
	C								2			
	D	1	1	1	1	1	1	1	2			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 75	A	2	2	2	2	2	2	2	2			
	B								2			
	C								2			
	D	1	1	1	1	1	1	1	2			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	2	2	2	2	2	2	2	2			
	B								2			
	C								2			
	D	1	1	1	1	1	1	1	2			
	E											
ANALYST		KP										
DATE:		4/14/11										
TIME:		1630										

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID: KC104002 TEST START DATE: 4/14/11 TIME: 1630

CLIENT: Weston TEST END DATE: TIME:

AGE AND SOURCE OF MINNOWS: D

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	7	7	7	7	7	7	7	7			
	B					7		7	7			
	C					7		7	7			
	D					7		7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 32	A	7	7	7	7	7	7	7	7			
	B					7			7			
	C					7			7			
	D					7			7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	7	7	7	7	7	7	7	7			
	B					7		7	7			
	C					7		7				
	D					7		7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 56	A	7	7	7	7	7	7	7	7			
	B					7			7			
	C					7			7			
	D					7			7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 75	A	7	7	7	7	7	7	7	7			
	B					7		7	7			
	C					7		7	7			
	D					7		7	7			
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	7	7	7	7	7	7	7	7			
	B			1	1	1	1	1	1			
	C			7	7	7	7	7	7			
	D			1	7	7	7	7	7			
	E											
ANALYST		KP										
DATE:		4/14/11										
TIME:		1630										

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB # / SAMPLE ID IC104002 TEST START DATE 4/14/11 TIME 1630

CLIENT Weston TEST END DATE TIME

AGE AND SOURCE OF MINNOWS E

DAY (NUMBER SURVIVING) SURVIVAL

	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 0	A	7	7	7	7	7	7	7	7			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 32	A	7	7	7	7	7	7	7	7			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 42	A	7	7	7	7	7	7	7	7			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 56	A	7	7	7	7	7	7	7	7			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 75	A	7	7	7	7	7	7	7	7			
	B											
	C											
	D											
	E											
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: 100	A	7	7	7	7	7	7	7	7			
	B											
	C											
	D											
	E											
ANALYST		KP										
DATE:		4/14/11										
TIME:		1630										

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:	K1104002				TEST DATES (BEGIN / END):	4/14-21/11		
CLIENT:	EEMA				WEIGHING DATE / TIME:	4/26/11, 0850		
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	1.01065	1.00845	0.00220	8	0.275	AVG DRY	
	B	1.01989	1.01717	0.00272	8	0.340	WEIGHT (mg)	
	C	1.03210	1.02963	0.00247	8	0.309		0.314
	D	1.00668	1.00429	0.00239	8	0.299	CV	
	E	1.02399	1.02123	0.00276	8	0.345		9.32
CONC:	A	1.02175	1.01934	0.00241	8	0.301	AVG DRY	
	B	1.01626	1.01273	0.00353	8	0.441	WEIGHT (mg)	
32%	C	0.98363	0.98104	0.00259	8	0.324		0.387
	D	1.00016	0.99738	0.00278	8	0.347	CV	
	E	1.01003	1.00584	0.00419	8	0.524		
CONC:	A	1.01259	1.00990	0.00269	8	0.336	AVG DRY	
	B	1.01920	1.01555	0.00365	8	0.456	WEIGHT (mg)	
42%	C	1.03177	1.02844	0.00333	8	0.416		0.385
	D	1.03858	1.03568	0.00290	8	0.363	CV	
	E	1.02136	1.01854	0.00282	8	0.353		
CONC:	A	1.00650	1.00344	0.00306	8	0.382	AVG DRY	
	B	1.00828	1.00489	0.00339	8	0.424	WEIGHT (mg)	
56%	C	1.01671	1.01363	0.00308	8	0.385		0.443
	D	1.05825	1.05441	0.00384	8	0.480	CV	
	E	1.02878	1.02444	0.00434	8	0.543		
CONC:	A	1.03639	1.03333	0.00306	8	0.382	AVG DRY	
	B	1.03999	1.03605	0.00394	8	0.493	WEIGHT (mg)	
75%	C	1.02635	1.02301	0.00334	8	0.418		0.425
	D	1.03555	1.03197	0.00358	8	0.447	CV	
	E	1.03716	1.03407	0.00309	8	0.386		
CONC:	A	1.00770	1.00498	0.00272	8	0.340	AVG DRY	
	B	1.02040	1.01578	0.00462	8	0.578	WEIGHT (mg)	
100%	C	1.04889	1.04615	0.00274	8	0.343		0.437
	D	1.02782	1.02412	0.00370	8	0.463	CV	
	E	1.05050	1.04679	0.00371	8	0.464		22.7

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

Pimephales promelas **FATHEAD MINNOW** TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s: K1104602
CLIENT: Weston
ANALYSTS: KP
SAMPLE ID:

TEST DATES (BEGIN / END): 4/14-21/11
WEIGHING DATE / TIME: 4/22/11, 0850
DRYING TEMP (DEGREES C): 60
DRYING TIME (HOURS): 24

	REP#	FINAL DRY WEIGHT TIN+LARVAE (g)	INTIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVAE (mg)	
CONTROL	A 1	1.01065	1.00845				AVG DRY WEIGHT (mg)
	B 2	1.01989	1.01717				
	C 3	1.03210	1.02963				
	D 4	1.00668	1.00429				CV
	E 5	1.02399	1.02123				
CONC: 32	A 6	1.02175	1.01934				AVG DRY WEIGHT (mg)
	B 7	1.01626	1.01273				
	C 8	0.98363	0.98104				
	D 9	1.00016	0.99738				CV
	E 10	1.01003	1.00584				
CONC: 42	A 11	1.01259	1.00990				AVG DRY WEIGHT (mg)
	B 12	1.01920	1.01555				
	C 13	1.03177	1.02844				
	D 14	1.03858	1.03568				CV
	E 15	1.02136	1.01854				
CONC: 56	A 16	1.00650	1.00344				AVG DRY WEIGHT (mg)
	B 17	1.00828	1.00489				
	C 18	1.01671	1.01363				
	D 19	1.05825	1.05441				CV
	E 20	1.02878	1.02444				
CONC: 75	A 21	1.03639	1.03333				AVG DRY WEIGHT (mg)
1.03999	B 22	~~1.04086~~	1.03605				
	C 23	1.02635	1.02301				
	D 24	1.03555	1.03197				CV
	E 25	1.03716	1.03407				
CONC: 100	A 26	1.00770	1.00498				AVG DRY WEIGHT (mg)
1.02040	B 27	~~1.02050~~	1.01578				
	C 28	1.04980	1.04615				
	D 29	1.02782	1.02412				CV
	E 30	1.05050	1.04679				

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

AA# K1104002, FATHEAD MINNOW SURVIVAL, CHRONIC, 4-14-1
File: Z:\TOXSTAT\MONTE\FHSURV. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.208

W = 0.854

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# K1104002, FATHEAD MINNOW SURVIVAL, CHRONIC, 4-14-1
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.

AA# K1104002, FATHEAD MINNOW SURVIVAL, CHRONIC, 4-14-1
File: Z:\TOXSTAT\MONTE\FHSURV. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.178

W = 0.853

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# K1104002, FATHEAD MINNOW SURVIVAL, CHRONIC, 4-14-1
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# K1104002, FATHEAD MINNOW SURVIVAL, CHRONIC, 4-14-1
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	1.3931
1	CONTROL	2	1.0000	1.3931
1	CONTROL	3	0.8750	1.2094
1	CONTROL	4	0.8750	1.2094
1	CONTROL	5	1.0000	1.3931
2	32 % EFFLUENT	1	1.0000	1.3931
2	32 % EFFLUENT	2	1.0000	1.3931
2	32 % EFFLUENT	3	1.0000	1.3931
2	32 % EFFLUENT	4	1.0000	1.3931
2	32 % EFFLUENT	5	1.0000	1.3931
3	42 % EFFLUENT	1	0.8750	1.2094
3	42 % EFFLUENT	2	1.0000	1.3931
3	42 % EFFLUENT	3	1.0000	1.3931
3	42 % EFFLUENT	4	0.7500	1.0472
3	42 % EFFLUENT	5	1.0000	1.3931
4	56 % EFFLUENT	1	1.0000	1.3931
4	56 % EFFLUENT	2	1.0000	1.3931
4	56 % EFFLUENT	3	1.0000	1.3931
4	56 % EFFLUENT	4	1.0000	1.3931
4	56 % EFFLUENT	5	1.0000	1.3931
5	75 % EFFLUENT	1	1.0000	1.3931
5	75 % EFFLUENT	2	1.0000	1.3931
5	75 % EFFLUENT	3	1.0000	1.3931
5	75 % EFFLUENT	4	1.0000	1.3931
5	75 % EFFLUENT	5	1.0000	1.3931
6	100 % EFFLUENT	1	0.8750	1.2094
6	100 % EFFLUENT	2	1.0000	1.3931
6	100 % EFFLUENT	3	1.0000	1.3931
6	100 % EFFLUENT	4	0.8750	1.2094
6	100 % EFFLUENT	5	1.0000	1.3931

AA# K1104002, FATHEAD MINNOW SURVIVAL, CHRONIC, 4-14-1
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	1.320				
2	32 % EFFLUENT	1.393	32.50	16.00	5.00	
3	42 % EFFLUENT	1.287	26.50	16.00	5.00	
4	56 % EFFLUENT	1.393	32.50	16.00	5.00	
5	75 % EFFLUENT	1.393	32.50	16.00	5.00	
6	100 % EFFLUENT	1.320	27.50	16.00	5.00	

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

AA# K1104002, FATHEAD MINNOW GROWTH CHRONIC, 4-14-11
File: Z:\TOXSTAT\MONTE\FHGR. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.119

W = 0.953

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# K1104002, FATHEAD MINNOW GROWTH CHRONIC, 4-14-11
File: Z:\TOXSTAT\MONTE\FHGR. Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 6.56

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# K1104002, FATHEAD MINNOW GROWTH CHRONIC, 4-14-11
FILE: Z:\TOXSTAT\MONTE\FHGR.
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.2750	0.5520
1	CONTROL	2	0.3400	0.6225
1	CONTROL	3	0.3090	0.5894
1	CONTROL	4	0.2990	0.5785
1	CONTROL	5	0.3450	0.6278
2	32 % EFFLUENT	1	0.3010	0.5807
2	32 % EFFLUENT	2	0.4410	0.7263
2	32 % EFFLUENT	3	0.3240	0.6055
2	32 % EFFLUENT	4	0.3470	0.6299
2	32 % EFFLUENT	5	0.5240	0.8094
3	42 % EFFLUENT	1	0.3360	0.6183
3	42 % EFFLUENT	2	0.4560	0.7413
3	42 % EFFLUENT	3	0.4160	0.7010
3	42 % EFFLUENT	4	0.3630	0.6466
3	42 % EFFLUENT	5	0.3530	0.6362
4	56 % EFFLUENT	1	0.3820	0.6663

4	56 % EFFLUENT	2	0.4240	0.7091
4	56 % EFFLUENT	3	0.3850	0.6694
4	56 % EFFLUENT	4	0.4800	0.7654
4	56 % EFFLUENT	5	0.5430	0.8285
5	75 % EFFLUETN	1	0.3820	0.6663
5	75 % EFFLUETN	2	0.4930	0.7784
5	75 % EFFLUETN	3	0.4180	0.7030
5	75 % EFFLUETN	4	0.4470	0.7323
5	75 % EFFLUETN	5	0.3860	0.6704
6	100 % EFFLUENT	1	0.3400	0.6225
6	100 % EFFLUENT	2	0.5780	0.8637
6	100 % EFFLUENT	3	0.3430	0.6257
6	100 % EFFLUENT	4	0.4630	0.7484
6	100 % EFFLUENT	5	0.4640	0.7494

AA# K1104002, FATHEAD MINNOW GROWTH CHRONIC, 4-14-11
File: Z:\TOXSTAT\MONTE\FHGR. Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.063	0.013	2.520
Within (Error)	24	0.119	0.005	
Total	29	0.182		

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

AA# K1104002, FATHEAD MINNOW GROWTH CHRONIC, 4-14-11
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	0.594	0.314		
2	32 % EFFLUENT	0.670	0.387	-1.712	
3	42 % EFFLUENT	0.669	0.385	-1.674	
4	56 % EFFLUENT	0.728	0.443	-2.998	
5	75 % EFFLUETN	0.710	0.425	-2.603	
6	100 % EFFLUENT	0.722	0.438	-2.869	

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

AA# K1104002, FATHEAD MINNOW GROWTH CHRONIC, 4-14-11
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	0.093	29.6	-0.074
3	42 % EFFLUENT	5	0.093	29.6	-0.071
4	56 % EFFLUENT	5	0.093	29.6	-0.129
5	75 % EFFLUETN	5	0.093	29.6	-0.112
6	100 % EFFLUENT	5	0.093	29.6	-0.124

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia — **SURVIVAL AND REPRODUCTION TEST**

Discharger: Weston
Location:
Date Sample Collected:
Lab Number/s: K1104002
Analyst: KP
Test Start - Date/ Time: 4/14/11 1600
Test Stop - Date/Time: 4/21/11 1420

Conc 1 — 0%

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
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	
3	1	0	1	0	0	1	0	0	2	0	5	10	0.5	KP
4	5	2	6	4	2	1	3	0	2	4	29	10	2.9	KP
5	1	1	3	1	02	0	0	1	1	3	18	10	1.8	KP
6	3	10	11	9	3	1	0	8	12	3	60	10	6.0	KP
7	8	4	1	6	5	7	9	5	6	7	58	10	5.8	KP
8														
Total	23	17	22	20	12	10	12	14	23	17	170		X̄= 17.0	

Conc 2 — 32%

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
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	3	1	0	1	0	0	2	1	0	8	10	0.8	
4	4	3	4	2	4	1	3	2	3	4	31	10	2.7	
5	7	0	1	1	0	1	6	0	5	6	27	10	2.7	
6	3	11	11	10	7	4	11	9	12	4	82	10	8.2	
7	7	2	3	5	4	7	2	5	6	8	54	10	5.4	
8														
Total	21	20	18	20	17	13	22	18	27	22	198			

Conc 3 — 42%

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
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	1	1	1	0	1	0	0	0	0	4	10	0.4	
4	5	3	6	3	4	3	1	2	6	4	37	10	3.7	
5	6	1	2	3	2	2	5	0	1	8	30	10	3.0	
6	8	8	5	9	7	6	4	9	7	4	67	10	6.7	
7	2	7	3	1	3	5	8	1	2	6	38	10	3.8	
8														
Total	21	29	17	17	16	17	18	12	16	22	176			

X= DEAD; Y= MALE 20 — 6

Conc 4 — 56%

Day	A	B	C	D	E	F	G	H
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	3	0	1	3
4	5	3	1	5	4	2	3	5
5	2	2	3	0	4	3	3	3
6	8	7	7	9	9	6	3	7
7	12	—	5	4	2	5	9	4
8								
Total	33	12	16	18	22	18	22	22

Conc 5 — 75%

Day	A	B	C	D	E	F	G	H
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	2	1	0	1	0	0	0
4	5	4	4	3	6	2	1	2
5	10	1	5	1	0	0	1	5
6	4	7	5	9	6	5	10	9
7	7	9	3	0	8	9	6	4
8								
Total	26	23	18	13	21	16	18	20

Conc 6 — 100%

Day	A	B	C	D	E	F	G	H
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	1	1	0	0	0	0	0
4	4	5	4	4	4	3	4	0
5	9	2	6	5	10	2	5	3
6	7	8	10	9	11	0	0	8
7	11	9	12	7	16	10	9	9
8								
Total	31	25	33	20	35	15	18	20

Revision 1
11/30/10

AA # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
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 # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 8.67

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	NUMBER OF 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	NUMBER OF 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	NUMBER OF 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

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
75%	10	0	10
TOTAL	20	0	20

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

FISHER'S EXACT TEST

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100%	10	0	10
TOTAL	20	0	20

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

SUMMARY OF FISHER'S EXACT TESTS

	NUMBER	NUMBER	SIG

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

TITLE: AA # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
FILE: Z:\TOXSTAT\MONTE\CD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	23.0000	23.0000
1	CONTROL	2	17.0000	17.0000
1	CONTROL	3	22.0000	22.0000
1	CONTROL	4	20.0000	20.0000
1	CONTROL	5	12.0000	12.0000
1	CONTROL	6	10.0000	10.0000
1	CONTROL	7	12.0000	12.0000
1	CONTROL	8	14.0000	14.0000
1	CONTROL	9	23.0000	23.0000
1	CONTROL	10	17.0000	17.0000
2	32 % EFFLUENT	1	21.0000	21.0000
2	32 % EFFLUENT	2	20.0000	20.0000
2	32 % EFFLUENT	3	18.0000	18.0000
2	32 % EFFLUENT	4	20.0000	20.0000
2	32 % EFFLUENT	5	17.0000	17.0000
2	32 % EFFLUENT	6	13.0000	13.0000
2	32 % EFFLUENT	7	22.0000	22.0000
2	32 % EFFLUENT	8	18.0000	18.0000
2	32 % EFFLUENT	9	27.0000	27.0000
2	32 % EFFLUENT	10	22.0000	22.0000
3	42 % EFFLUENT	1	21.0000	21.0000
3	42 % EFFLUENT	2	20.0000	20.0000
3	42 % EFFLUENT	3	17.0000	17.0000
3	42 % EFFLUENT	4	17.0000	17.0000
3	42 % EFFLUENT	5	16.0000	16.0000
3	42 % EFFLUENT	6	17.0000	17.0000
3	42 % EFFLUENT	7	18.0000	18.0000
3	42 % EFFLUENT	8	12.0000	12.0000
3	42 % EFFLUENT	9	16.0000	16.0000
3	42 % EFFLUENT	10	22.0000	22.0000
4	56 % EFFLUENT	1	33.0000	33.0000
4	56 % EFFLUENT	2	12.0000	12.0000
4	56 % EFFLUENT	3	16.0000	16.0000
4	56 % EFFLUENT	4	18.0000	18.0000
4	56 % EFFLUENT	5	22.0000	22.0000
4	56 % EFFLUENT	6	18.0000	18.0000
4	56 % EFFLUENT	7	22.0000	22.0000
4	56 % EFFLUENT	8	22.0000	22.0000

4	56 % EFFLUENT	9	16.0000	16.0000
4	56 % EFFLUENT	10	25.0000	25.0000
5	75 % EFFLUENT	1	26.0000	26.0000
5	75 % EFFLUENT	2	23.0000	23.0000
5	75 % EFFLUENT	3	18.0000	18.0000
5	75 % EFFLUENT	4	13.0000	13.0000
5	75 % EFFLUENT	5	21.0000	21.0000
5	75 % EFFLUENT	6	16.0000	16.0000
5	75 % EFFLUENT	7	18.0000	18.0000
5	75 % EFFLUENT	8	20.0000	20.0000
5	75 % EFFLUENT	9	21.0000	21.0000
5	75 % EFFLUENT	10	18.0000	18.0000
6	100 % EFFLUENT	1	31.0000	31.0000
6	100 % EFFLUENT	2	25.0000	25.0000
6	100 % EFFLUENT	3	33.0000	33.0000
6	100 % EFFLUENT	4	20.0000	20.0000
6	100 % EFFLUENT	5	35.0000	35.0000
6	100 % EFFLUENT	6	15.0000	15.0000
6	100 % EFFLUENT	7	18.0000	18.0000
6	100 % EFFLUENT	8	20.0000	20.0000
6	100 % EFFLUENT	9	28.0000	28.0000
6	100 % EFFLUENT	10	26.0000	26.0000

AA # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	412.483	82.497	3.565
Within (Error)	54	1249.700	23.143	
Total	59	1662.183		

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

AA # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
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	17.000	17.000		
2	32 % EFFLUENT	19.800	19.800	-1.301	
3	42 % EFFLUENT	17.600	17.600	-0.279	
4	56 % EFFLUENT	20.400	20.400	-1.580	
5	75 % EFFLUENT	19.400	19.400	-1.116	
6	100 % EFFLUENT	25.100	25.100	-3.765	

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

AA # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
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	4.970	29.2	-2.800
3	42 % EFFLUENT	10	4.970	29.2	-0.600
4	56 % EFFLUENT	10	4.970	29.2	-3.400
5	75 % EFFLUENT	10	4.970	29.2	-2.400
6	100 % EFFLUENT	10	4.970	29.2	-8.100

AA # K1104002 C. DUBIA CHRONIC, REPRODUCION, 4-14-11
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	17.000				
2	32 % EFFLUENT	19.800	120.00	75.00	10.00	
3	42 % EFFLUENT	17.600	107.00	75.00	10.00	
4	56 % EFFLUENT	20.400	119.50	75.00	10.00	
5	75 % EFFLUENT	19.400	119.50	75.00	10.00	
6	100 % EFFLUENT	25.100	138.00	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 4-14-11 **CLIENT** Arkansas Analytical

Purchase Order #: _____

SPECIES:	(Pimephales promelas)	Mysidopsis bahia	Cyprinodon variegates
Quantity Shipped:	400+		
Age:	Mixed 4/13 1500CST		
Brood Stock Source:	Anderson Hays, Ar		
Culture Water:	(Groundwater)	Artificial Salts	Artificial Salts
Hardness (Mg/l CaCO3)	160	**Salinity (ppt)**	
Dissolved Oxygen (Mg/1):	8.1		
Feeding:	Artemia		

Comments: _____

_____

_____

Shipped Via: (Federal Express) UPS Overnight

Packaged By: CAL

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.

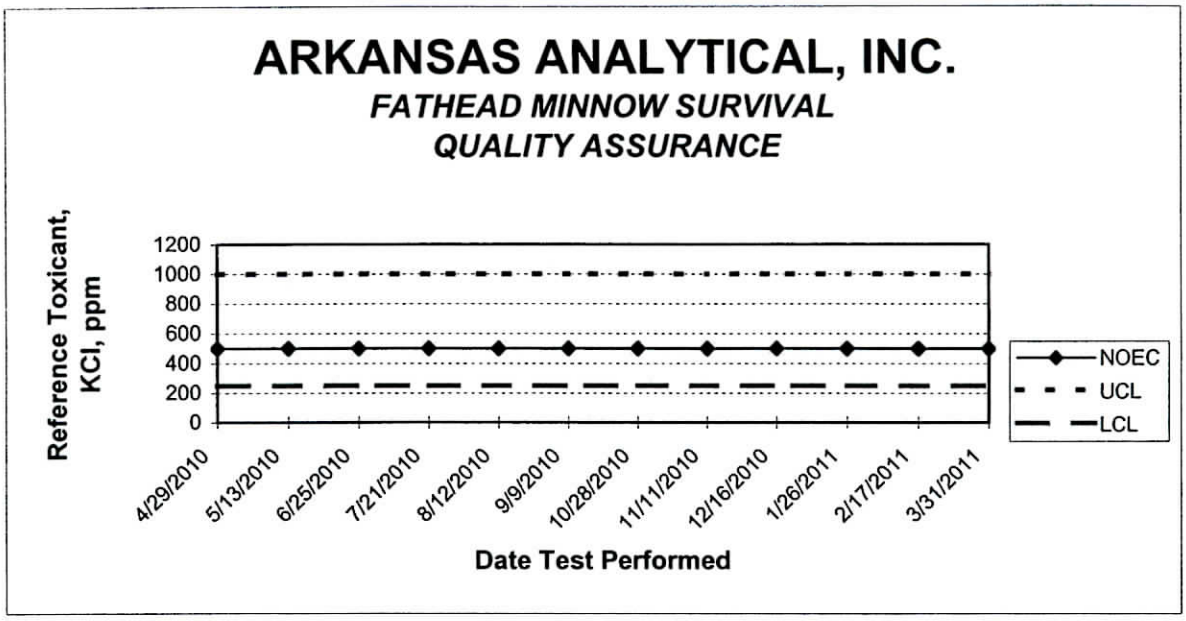
Water Chemistry Record:	**Current**	**Range**
TEMPERATURE:	25°C	20-25°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	142 mg/l	86-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	100 mg/l	65-130 mg/l
pH:	7.92	7.56-8.35

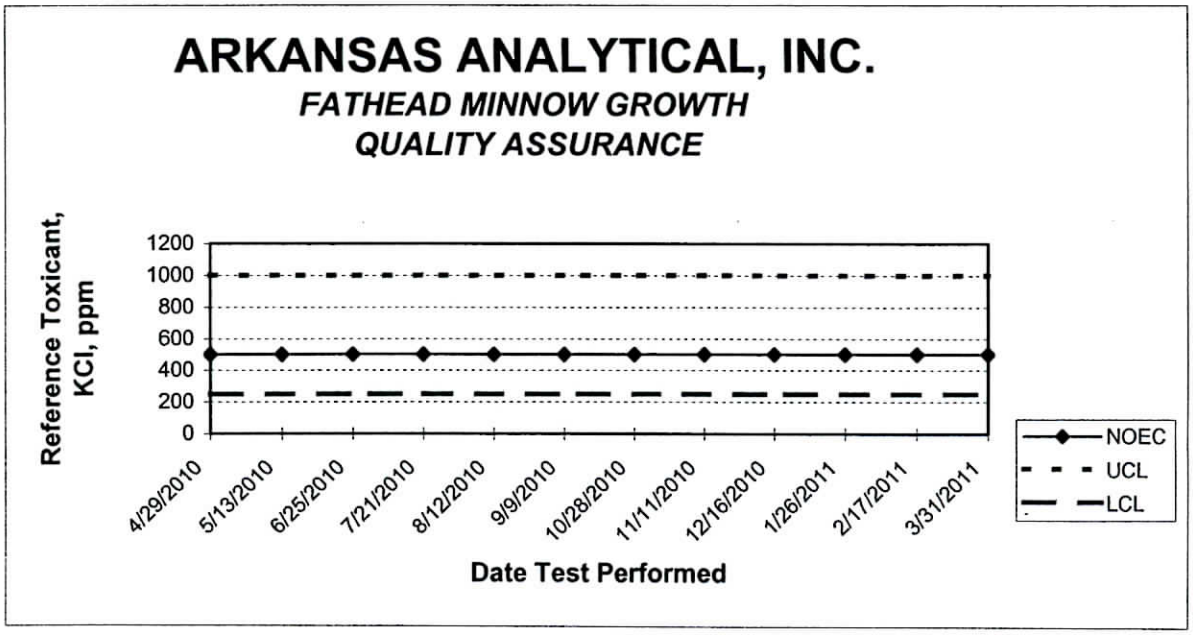
Comments:

Facility Supervisor

APPENDIX F

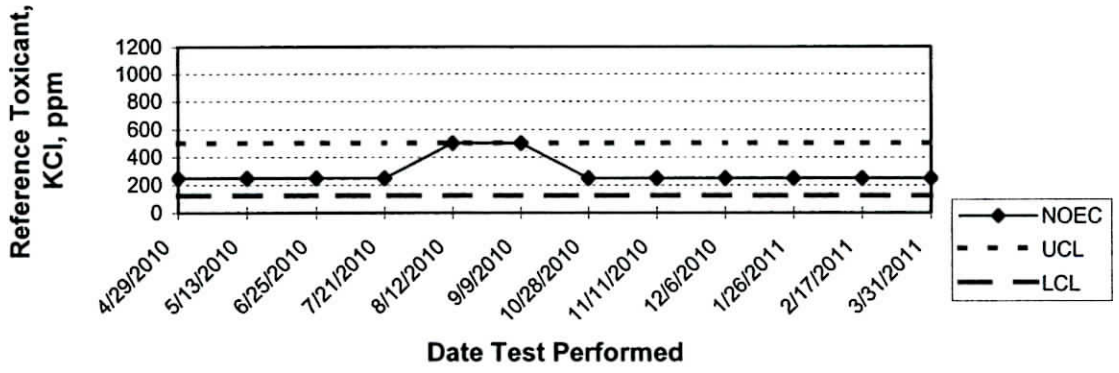
Quality Assurance Charts


ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL
QUALITY ASSURANCE
Reference Toxicant, KCl, ppm
1200
1000
800
600
400
200
0
4/29/2010
5/13/2010
6/25/2010
7/21/2010
8/12/2010
9/9/2010
10/28/2010
11/11/2010
12/16/2010
1/26/2011
2/17/2011
3/31/2011
Date Test Performed
NOEC
UCL
LCL


ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH
QUALITY ASSURANCE
Reference Toxicant, KCl, ppm
1200
1000
800
600
400
200
0
4/29/2010
5/13/2010
6/25/2010
7/21/2010
8/12/2010
9/9/2010
10/28/2010
11/11/2010
12/16/2010
1/26/2011
2/17/2011
3/31/2011
Date Test Performed
NOEC
UCL
LCL

ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE