



# Arkansas Analytical, Inc.

## Toxicity Test Results

**MAGCOBAR MINE SITE**  
**NPDES PERMIT NUMBER: AR0049794**  
**January 2004**

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

*Ceriodaphnia dubia*, Survival and Reproduction Test  
Test 1002.0

Prepared for: **Mr. Alan B. Brown**  
**Weston Solutions**  
**Magcobar Mine Site**  
**2000 Darby Lane**  
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Tuesday, February 17, 2004



## **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 Quachita River in Segment 2F of the Ouachita River Basin.

The permit requires chronic biomonitoring testing once per month for both *Ceriodaphnia dubia* and *Pimephales promelas*. The test results in this report represent the testing for January of 2004.

## **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:	1-26-04, 1400	1-27-04, 1400
Sample #2:	1-27-04, 1100	1-28-04, 1100
Sample #3:	1-28-04, 1130	1-29-04, 1130

The sample was a composite 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	Storage Temperature (°C)
Sample #1:	1-27-04, 1545	4
Sample #2:	1-28-04, 1525	4
Sample #3:	1-29-04, 1500	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. There were no deviations from the reference method. The test chambers were 500 ml plastic cups, and each chamber contained ten organisms in a test solution volume of 250 mls. The test temperature was 25 degrees Centigrade. Raw data and statistics are provided in Appendix C.

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia*, Survival and Reproduction Test, was 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	23.6	X	
At least 60% of surviving females should have produced 3 broods	90%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	19.9%	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%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.277	X	
The percent coefficient of variation between replicates must be 40% or less for growth	12.6%	X	

### Reference Toxicant

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

#### REFERENCE TOXICANT

<i>Ceriodaphnia dubia</i>		<i>Pimephales promelas</i>	
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

<i>Ceriodaphnia dubia</i>		<i>Pimephales promelas</i>	
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)	23.6	%CV survival (critical dilution)	9.32%
%CV Reproduction (critical dilution)	19.9%	Mean dry weight (critical dilution) in milligrams	0.557
		%CV growth (critical dilution)	11.9%

### 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, 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.

Biomonitoring Analysts:

  
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**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:	1-26-04, 1400	1-27-04, 1400
Sample #2:	1-27-04, 1100	1-28-04, 1100
Sample #3:	1-28-04, 1130	1-29-04, 1130

Test initiated (date, time): 1-29-04, 1500      Test terminated (date, time): 2-5-04, 1615

Dilution water used:      Soft Synthetic

**DATA TABLE FOR FATHEAD MINNOW SURVIVAL**

Effluent Conc %	Percent Survival in Replicate Chambers					Mean Percent Survival			
	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	90	100	100	100	98	
42%	100	100	100	90	100	100	100	98	
56%	100	100	100	100	100	100	100	100	
75%	100	100	100	100	100	100	100	100	
100%	100	80	100	100	100	100	100	96	9.32

**DATA TABLE FOR GROWTH OF FATHEAD MINNOWS**

Effluent Conc %	Average Dry Weight in milligrams in replicate chambers					Mean Dry Weight	CV%
	A	B	C	D	E		
0%	0.277	0.274	0.279	0.229	0.328	0.277	12.6
32%	0.349	0.334	0.322	0.314	0.599	0.384	
42%	0.449	0.345	0.397	0.356	0.405	0.390	
56%	0.413	0.486	0.473	0.478	0.617	0.493	
75%	0.403	0.422	0.553	0.574	0.506	0.492	
100%	0.499	0.489	0.603	0.643	0.550	0.557	11.9

Coefficient of Variation = standard deviation / mean \* 100

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING  
FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL  
*Pimephales promelas*

1. Dunnett's procedure or Steel's Many-One Rank Test as appropriate:  
Is the mean survival at 7 days significantly different ( $p=0.05$ ) than the control survival for:
  - a) LOW FLOW OR CRITICAL DILUTION, (100%)    YES \_\_\_\_\_    NO   X
  
2. Dunnett's Procedure  
Is the mean dry weight (growth) at 7 days significantly different ( $p=0.05$ ) than the control's dry weight (growth) for:
  - a) LOW FLOW OR CRITICAL DILUTION, (100%)    YES \_\_\_\_\_    NO   X
  
3. If NO was answered to 1.a) enter [0] otherwise enter [1] (parameter TLP6C):   0
  
4. If NO was answered to 2.a) enter [0] otherwise enter [1] (parameter TGP6C):   0
  
5. Enter percentage corresponding to each parameter below:
  - a) NOEC survival (parameter TOP6C)=   100   % effluent
  - b) NOEC growth (parameter TPP6C)=   100   % effluent
  - c) Coefficient of variation (parameter TQP6C)=   9.32   %



**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:	1-26-04, 1400	1-27-04, 1400
Sample #2:	1-27-04, 1100	1-28-04, 1100
Sample #3:	1-28-04, 1130	1-29-04, 1130

Test initiated (date, time): 1-29-04, 1030      Test terminated (date, time): 2-4-04, 0845

Dilution water used:    Soft Synthetic

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

Replicate	0%	32%	42%	52%	75%	100%
A	27	27	26	21	11	23
B	24	26	29	29	25	27
C	26	24	20	34	21	19
D	20	28	25	26	31	24
E	25	28	30	29	29	22
F	24	14	29	26	24	20
G	30	25	25	27	30	25
H	13	27	19	29	31	29
I	26	27	32	30	18	30
J	21	29	30	26	27	26
Mean	23.6	25.5	26.5	27.7	24.7	24.5
Mean/surviving female	23.6	25.5	26.5	27.7	24.7	24.5
CV%*	19.9					14.8

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	100	100	100

1. Fisher's Exact Test:

Is the mean survival at test termination significantly different ( $p=0.05$ ) than the control survival for:

a) LOW FLOW OR CRITICAL DILUTION, (100%):      YES \_\_\_\_\_      NO   X  

2. Dunnett's Procedure or Steel's Many One Rank Test:

Is the mean number of young produced per female significantly different ( $p=0.05$ ) than the controls number of young per female for:

a) LOW FLOW OR CRITICAL DILUTION, (100%):      YES \_\_\_\_\_      NO   X  

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

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

5. Enter percentage corresponding to each parameter below:

a) NOEC survival (parameter TOP3B)=   100   % effluent

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

c) Coefficient of variation (parameter TQP3B)=   19.9   %



APPENDIX A

Chain of Custody Forms









## APPENDIX B

### Effluent and Dilution Water Data



CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Fathead Minnow

Lab # / Sample ID		k401494							Test Start (Date/Time)	1-29-04/1500
Client		Weston							Test End (Date/Time)	25-04/1615
		Day of Test								
		1	2	3	4	5	6	7	notes/remarks	
<b>Control</b>		1/29	1/30	1/31	2/1	2/2	2/3	2/4	SS#90 1/29	
D.O (mg/L)	INITIAL	7.5	8.0	7.7	7.4	7.8	8.0	8.1	SS#91 1/31	
	FINAL	6.9	8.1	8.0	7.3	7.7	7.9	7.4	SS#92 2/4	
pH(mg/L)	INITIAL	7.5	7.8	7.7	7.0	7.8	7.7	7.7		
	FINAL	6.2	7.7	7.6	7.7	7.5	7.4	7.0		
temp(C)	INITIAL	21.3	20.6	21.4	22.9	22.3	21.9	21.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
ALKALINITY(mg/L)		29	→	33			→	25		
HARDNESS(mg/L)		44	→	35			→	46		
CONDUCTIVITY(umhos/cm)		162	→	149			→	160		
CHLORINE(mg/L)		40.05	→	40.05			→	40.05		
<b>CONC:</b>		32%	32%	32%	32%	32%	32%	32%		
D.O (mg/L)	INITIAL	7.5	8.0	8.2	7.8	8.1	8.3	8.1		
	FINAL	6.9	8.0	8.0	7.4	7.6	6.4	7.3		
pH(mg/L)	INITIAL	7.4	7.1	7.4	7.3	7.5	7.3	7.4		
	FINAL	6.9	7.4	7.4	7.5	7.2	7.3	6.8		
temp(C)	INITIAL	21.2	20.5	21.5	23.2	22.4	21.9	21.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
<b>CONC:</b>		42%	42%	42%	42%	42%	42%	42%		
D.O (mg/L)	INITIAL	7.6	8.2	8.3	8.0	8.2	8.5	8.1		
	FINAL	6.7	7.9	7.7	7.0	7.6	6.8	7.4		
pH(mg/L)	INITIAL	7.4	7.2	7.5	7.3	7.5	7.3	7.4		
	FINAL	6.9	7.4	7.4	7.5	7.3	7.3	6.9		
temp(C)	INITIAL	21.2	20.6	21.7	23.4	22.6	22.0	21.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
<b>CONC:</b>		56%	56%	56%	56%	56%	56%	56%		
D.O (mg/L)	INITIAL	7.7	8.6	8.3	8.2	8.6	8.8	8.2		
	FINAL	7.1	7.6	7.3	7.1	7.5	7.2	7.4		
pH(mg/L)	INITIAL	7.4	7.2	7.4	7.3	7.5	7.3	7.3		
	FINAL	7.0	7.4	7.4	7.5	7.3	7.2	7.0		
temp(C)	INITIAL	21.2	20.9	21.7	23.9	22.7	22.3	21.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
<b>CONC:</b>		75%	75%	75%	75%	75%	75%	75%		
D.O (mg/L)	INITIAL	7.9	8.6	8.4	8.7	8.4	8.9	8.7		
	FINAL	7.1	7.6	7.3	7.0	7.5	7.5	7.4		
pH(mg/L)	INITIAL	7.4	7.2	7.4	7.2	7.5	7.2	7.4		
	FINAL	7.0	7.4	7.4	7.4	7.2	7.2	7.0		
temp(C)	INITIAL	21.3	21.0	21.8	24.7	22.7	22.6	22.0		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
<b>CONC:</b>		100%	100%	100%	100%	100%	100%	100%		
D.O (mg/L)	INITIAL	8.8	9.0	8.9	8.9	8.9	8.9	8.4		
	FINAL	7.2	7.6	7.4	7.1	7.3	7.0	7.3		
pH(mg/L)	INITIAL	7.4	7.2	7.3	7.2	7.4	7.2	7.4		
	FINAL	7.1	7.3	7.3	7.4	7.2	7.2	7.0		
temp(C)	INITIAL	21.2	21.0	23.6	24.8	23.0	23.0	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
<b>CONC:</b>		100%	B	A	A	C	C	b	A	
ALKALINITY(mg/L)		18	16	→	16	→	18	16		
HARDNESS(mg/L)		1320	1310	→	1420	→	1320	1310		
CONDUCTIVITY(umhos/cm)		2390	2390	→	2390	→	2390	2390		
CHLORINE(mg/L)		40.05	40.05	→	40.05	→	40.05	40.05		



CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Ceriodaphnia dubia

Lab # / Sample ID		K401494						Test Start (Date/Time)		1-29-04/1030	
Client		WESTON						Test End (Date/Time)		2-4-04/0845	
		Day of Test									
		1	2	3	4	5	6	7	8	notes/remarks	
<b>Control</b>		1/29	1/30	1/31	2/1	2/2	2/3			SS # 90 1/29	
D.O (mg/L)	INITIAL	7.5	8.0	7.7	7.4	7.8	8.0			SS # 91 1/31	
	FINAL	7.1	8.4	8.1	7.9	7.6	7.7				
pH	INITIAL	7.5	6.8	7.7	7.0	7.8	7.7				
	FINAL	7.0	7.0	7.8	7.1	7.7	8.0				
temp(C)	INITIAL	21.3	20.6	21.4	22.9	22.3	21.9				
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0				
ALKALINITY(mg/L)		29		33							
HARDNESS(mg/L)		44		35							
CONDUCTIVITY(umhos/cm)		162		149							
CHLORINE(mg/L)		<0.05		<0.05							
<b>CONC:</b>		32%	32%	32%	32%	32%	32%				
D.O (mg/L)	INITIAL	7.5	8.0	8.2	7.8	8.1	8.3				
	FINAL	7.2	8.4	7.9	7.7	7.7	7.6				
pH	INITIAL	7.4	7.1	7.4	7.3	7.5	7.3				
	FINAL	7.1	7.5	7.5	7.3	7.5	7.9				
temp(C)	INITIAL	21.2	20.5	21.5	23.2	22.4	21.9				
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0				
<b>CONC:</b>		42%	42%	42%	42%	42%	42%				
D.O (mg/L)	INITIAL	7.6	8.2	8.3	8.0	8.2	8.5				
	FINAL	7.2	8.3	7.7	7.6	7.5	7.6				
pH	INITIAL	7.4	7.2	7.5	7.3	7.5	7.3				
	FINAL	7.2	7.6	7.5	7.3	7.5	7.9				
temp(C)	INITIAL	21.2	20.6	21.7	23.4	22.6	22.0				
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0				
<b>CONC:</b>		56%	56%	56%	56%	56%	56%				
D.O (mg/L)	INITIAL	7.7	8.6	8.3	8.2	8.6	8.8				
	FINAL	7.2	8.1	7.8	7.6	7.5	7.6				
pH	INITIAL	7.4	7.2	7.4	7.3	7.5	7.3				
	FINAL	7.2	7.6	7.6	7.3	7.5	7.9				
temp(C)	INITIAL	21.2	20.9	21.7	23.9	22.7	22.3				
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0				
<b>CONC:</b>		75%	75%	75%	75%	75%	75%				
D.O (mg/L)	INITIAL	7.9	8.6	8.4	8.7	8.4	8.9				
	FINAL	7.3	8.3	7.8	7.7	7.4	7.6				
pH	INITIAL	7.4	7.2	7.4	7.2	7.5	7.2				
	FINAL	7.2	7.6	7.6	7.3	7.5	7.9				
temp(C)	INITIAL	21.3	21.0	21.8	24.7	22.7	22.6				
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0				
<b>CONC:</b>		100%	100%	100%	100%	100%	100%				
D.O (mg/L)	INITIAL	8.8	9.0	8.9	8.9	8.9	8.9				
	FINAL	7.2	8.2	8.0	7.7	7.4	7.6				
pH	INITIAL	7.4	7.2	7.3	7.2	7.4	7.2				
	FINAL	7.2	7.6	7.5	7.4	7.5	7.8				
temp(C)	INITIAL	21.2	21.0	23.6	24.8	23.0	23.0				
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0				
<b>CONC:</b>	100%	B	A	A	C	C	B				
ALKALINITY( mg/L)		18	16		16		18				
HARDNESS(mg/L)		1320	1310		1420		1320				
CONDUCTIVITY(umhos/cm)		2390	2390		2390		2390				
CHLORINE(mg/L)		<0.05	<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 KM01494 TEST START DATE 1-29 TIME 1500  
 CLIENT WESTON TEST END DATE 2-5 TIME 1615  
 AGE AND SOURCE OF MINNOWS 24hrs; Aquatex

		DAY (NUMBER SURVIVING)									SURVIVAL	
CONC:	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
control	A	10	10	10	10	10	10	10	10	100	100	0%
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
32%	A	10	10	10	10	10	10	10	10	100	98	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	9	9	9	9	9	90		
	E	10	10	10	10	10	10	10	10	100		
42%	A	10	10	10	10	10	10	10	10	100	98	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	9	9	9	9	9	90		
	E	10	10	10	10	10	10	10	10	100		
56%	A	10	10	10	10	10	10	10	10	100	100	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
75%	A	10	10	10	10	10	10	10	10	100	100	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
100%	A	10	10	10	10	10	10	10	10	100	96	9.32%
	B	10	10	10	9	9	9	8	80			
	C	10	10	10	10	10	10	10	100			
	D	10	10	10	10	10	10	10	100			
	E	10	10	10	10	10	10	10	100			
ANALYST:		MG	TC	TC	TC	TC	TC	TC	TC			
DATE:		1-29	1-30	1-31	2-1	2-2	2-3	2-4	2-5			
TIME:		1500	1445	0855	1455	1345	1610	1500	1615			

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



WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/S: K401494	TEST DATES (BEGIN/END): 1-29-04/2-5-04
CLIENT: Weston	WEIGHING DATE/TIME:
ANALYST/S: MG, TC	DRYING TEMPERATURE (DEGREES C): 60°C
SAMPLE ID:	DRYING TIME (HOURS): 24 hrs.

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVA (mg)		REMARKS
CONTROL	A31	0.96643	0.96366	0.00277	10	0.277	AVG DRY	
	B32	0.96864	0.96590	0.00274	10	0.274	WEIGHT (mg)	
	C33	0.96544	0.96245	0.00299	10	0.299		0.277
	D34	0.96417	0.96188	0.00229	10	0.229	CV	
	E35	0.96429	0.96101	0.00328	10	0.328		12.6%
CONC:	A36	0.96123	0.95774	0.00349	10	0.349	AVG DRY	
	B37	0.96511	0.96177	0.00334	10	0.334	WEIGHT(MG)	
	C38	0.96828	0.96506	0.00322	10	0.322		0.384
	D39	0.96795	0.96481	0.00314	10	0.314	CV	
	E40	0.96324	0.95725	0.00599	10	0.599		
CONC:	A41	0.96052	0.95603	0.00449	10	0.449	AVG DRY	
	B42	0.96199	0.95854	0.00345	10	0.345	WEIGHT(MG)	
	C43	0.96200	0.95803	0.00397	10	0.397		0.390
	D44	0.96214	0.95858	0.00356	10	0.356	CV	
	E45	0.96232	0.95827	0.00405	10	0.405		
CONC:	A46	0.97205	0.96792	0.00413	10	0.413	AVG DRY	
	B47	0.97482	0.96996	0.00486	10	0.486	WEIGHT(MG)	
	C48	0.97491	0.97018	0.00473	10	0.473		0.493
	D49	0.97297	0.96819	0.00478	10	0.478	CV	
	E50	0.97642	0.97025	0.00617	10	0.617		
CONC:	A51	0.97282	0.96879	0.00403	10	0.403	AVG DRY	
	B52	0.97257	0.96835	0.00422	10	0.422	WEIGHT(MG)	
	C53	0.97193	0.96640	0.00553	10	0.553		0.492
	D54	0.96786	0.96212	0.00574	10	0.574	CV	
	E55	0.97504	0.96998	0.00506	10	0.506		
CONC:	A56	0.97460	0.96961	0.00499	10	0.499	AVG DRY	
	B57	0.97609	0.97120	0.00489	10	0.489	WEIGHT(MG)	
	C58	0.97613	0.97010	0.00603	10	0.603		0.557
	D59	0.97190	0.96547	0.00643	10	0.643	CV	
	E60	0.97075	0.96525	0.00550	10	0.550		11.9%

CV = (STANDARD DEVIATION/MEAN)\*100

AA# K401494 FATHEAD MINNOW SURVIVAL, 1-29-04  
File: k401494s Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

---

D = 0.117

W = 0.656

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# K401494 FATHEAD MINNOW SURVIVAL, 1-29-04  
File: k401494s 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# K401494 FATHEAD MINNOW SURVIVAL, 1-29-04  
FILE: k401494s  
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	0.9000	1.2490
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	0.9000	1.2490
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	0.8000	1.1071
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# K401494 FATHEAD MINNOW SURVIVAL, 1-29-04  
 File: k401494s 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	1.379	25.00	16.00	5.00	
3	42 % EFFLUENT	1.379	25.00	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	1.351	25.00	16.00	5.00	

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

AA # K401494, FATHEAD MINNOW GROWTH, 1-29-04  
File: k401494g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

---

D = 0.134

W = 0.909

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 # K401494, FATHEAD MINNOW GROWTH, 1-29-04  
File: k401494g Transform: NO TRANSFORMATION

---

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 6.94

---

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 # K401494, FATHEAD MINNOW GROWTH, 1-29-04  
FILE: k401494g  
TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

---

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.2770	0.2770
1	CONTROL	2	0.2740	0.2740
1	CONTROL	3	0.2790	0.2790
1	CONTROL	4	0.2290	0.2290
1	CONTROL	5	0.3280	0.3280
2	32 % EFFLUENT	1	0.3490	0.3490
2	32 % EFFLUENT	2	0.3340	0.3340
2	32 % EFFLUENT	3	0.3220	0.3220
2	32 % EFFLUENT	4	0.3140	0.3140
2	32 % EFFLUENT	5	0.5990	0.5990
3	42 % EFFLUENT	1	0.4490	0.4490
3	42 % EFFLUENT	2	0.3450	0.3450
3	42 % EFFLUENT	3	0.3970	0.3970
3	42 % EFFLUENT	4	0.3560	0.3560
3	42 % EFFLUENT	5	0.4050	0.4050
4	56 % EFFLUENT	1	0.4130	0.4130
4	56 % EFFLUENT	2	0.4860	0.4860
4	56 % EFFLUENT	3	0.4730	0.4730
4	56 % EFFLUENT	4	0.4780	0.4780
4	56 % EFFLUENT	5	0.6170	0.6170
5	75 % EFFLUENT	1	0.4030	0.4030
5	75 % EFFLUENT	2	0.4220	0.4220
5	75 % EFFLUENT	3	0.5530	0.5530
5	75 % EFFLUENT	4	0.5740	0.5740
5	75 % EFFLUENT	5	0.5060	0.5060
6	100 % EFFLUENT	1	0.4990	0.4990
6	100 % EFFLUENT	2	0.4890	0.4890
6	100 % EFFLUENT	3	0.6030	0.6030
6	100 % EFFLUENT	4	0.6430	0.6430
6	100 % EFFLUENT	5	0.5500	0.5500

---

AA # K401494, FATHEAD MINNOW GROWTH, 1-29-04  
File: k401494g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.254	0.051	9.111
Within (Error)	24	0.134	0.006	
Total	29	0.388		

Critical F value = 2.62 (0.05,5,24)  
Since  $F > \text{Critical F}$  REJECT  $H_0$ : All equal

AA # K401494, FATHEAD MINNOW GROWTH, 1-29-04  
 File: k401494g Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	0.277	0.277		
2	32 % EFFLUENT	0.384	0.384	-2.247	
3	42 % EFFLUENT	0.390	0.390	-2.391	
4	56 % EFFLUENT	0.493	0.493	-4.571	
5	75 % EFFLUENT	0.492	0.492	-4.532	
6	100 % EFFLUENT	0.557	0.557	-5.912	

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

AA # K401494, FATHEAD MINNOW GROWTH, 1-29-04  
 File: k401494g Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	5			
2	32 % EFFLUENT	5	0.112	40.2	-0.106
3	42 % EFFLUENT	5	0.112	40.2	-0.113
4	56 % EFFLUENT	5	0.112	40.2	-0.216
5	75 % EFFLUENT	5	0.112	40.2	-0.214
6	100 % EFFLUENT	5	0.112	40.2	-0.279



APPENDIX D

*Ceriodaphnia dubia* Raw Data and Statistics

*Ceriodaphnia dubia*

SURVIVAL AND REPRODUCTION TEST

Discharger: WRSTDA Analyst: AF, TC, MG  
 Location: K401494 Test Start-Date/Time: 1-29-04/1030  
 Date Sample Collected: 2-4-04/0845

Conc 1	Replicate													No. of Young Adults	No. of Young/Adult	Analyst
	A	B	C	D	E	F	G	H	I	J						
Day 1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
Day 2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
Day 3	5	4	4	3	3	4	0	3	0	0	0	0	0	30	10	TC
Day 4	10	8	7	5	0	1	3	5	1	5	5	10	5	55	10	MG
Day 5	12	12	15	11	12	8	11	8	9	8	10	10	9	100	10	TC
Day 6	0	0	0	0	10	12	2	0	13	8	10	10	10	45	10	TC
Day 7																
Day 8																
Total	27	24	26	20	25	24	20	13	26	21	23	26	21	226	226	90/30 brood
%	Control															

Conc 2	Replicate													No. of Young Adults	No. of Young/Adult	Analyst
	A	B	C	D	E	F	G	H	I	J						
Day 1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
Day 2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
Day 3	4	6	0	6	5	4	3	5	6	5	4	5	5	44	10	TC
Day 4	11	0	6	0	0	0	10	10	0	1	38	10	3.8	102	10	MG
Day 5	12	13	11	9	11	11	10	12	10	8	10	10	10	71	10	TC
Day 6	0	7	7	13	12	4	2	0	11	15	7	10	7.1			
Day 7																
Day 8																
Total	27	26	24	28	28	14	25	27	27	29	25	25	25			
%	32%															

Conc 3	Replicate													No. of Young Adults	No. of Young/Adult	Analyst
	A	B	C	D	E	F	G	H	I	J						
Day 1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
Day 2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
Day 3	5	3	3	5	0	4	0	4	0	0	3	10	3.1	31	10	TC
Day 4	8	0	7	9	0	4	7	6	7	8	5	10	5.0	88	10	MG
Day 5	2	9	10	11	11	13	2	8	11	11	8	10	8.8	87	10	TC
Day 6	11	15	0	0	14	12	1	14	11	14	11	10	9.0	90	10	TC
Day 7																
Day 8																
Total	26	29	20	25	30	29	25	19	32	30	26	24	24.5	245	245	14/8
%	100%															

X=DEAD; Y=MALE

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
32% effluent	10	0	10
TOTAL	20	0	20

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

FISHER'S EXACT TEST

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

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

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
56% effluent	10	0	10

-----  
TOTAL 20 0 20  
=====

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

FISHER'S EXACT TEST

=====

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

=====

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

FISHER'S EXACT TEST

=====

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

-----



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



AA# K401494, CERIODAPHNIA REPRODUCTION, 1-29-04  
File: k401494c 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# K401494, CERIODAPHNIA REPRODUCTION, 1-29-04  
File: k401494c Transform: NO TRANSFORMATION

---

Bartlett's test for homogeneity of variance  
Calculated B1 statistic = 4.85

---

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# K401494, CERIODAPHNIA REPRODUCTION, 1-29-04  
 FILE: k401494c  
 TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	27.0000	27.0000
1	CONTROL	2	24.0000	24.0000
1	CONTROL	3	26.0000	26.0000
1	CONTROL	4	20.0000	20.0000
1	CONTROL	5	25.0000	25.0000
1	CONTROL	6	24.0000	24.0000
1	CONTROL	7	30.0000	30.0000
1	CONTROL	8	13.0000	13.0000
1	CONTROL	9	26.0000	26.0000
1	CONTROL	10	21.0000	21.0000
2	32 % EFFLUENT	1	27.0000	27.0000
2	32 % EFFLUENT	2	26.0000	26.0000
2	32 % EFFLUENT	3	24.0000	24.0000
2	32 % EFFLUENT	4	28.0000	28.0000
2	32 % EFFLUENT	5	28.0000	28.0000
2	32 % EFFLUENT	6	14.0000	14.0000
2	32 % EFFLUENT	7	25.0000	25.0000
2	32 % EFFLUENT	8	27.0000	27.0000
2	32 % EFFLUENT	9	27.0000	27.0000
2	32 % EFFLUENT	10	29.0000	29.0000
3	42 % EFFLUENT	1	26.0000	26.0000
3	42 % EFFLUENT	2	29.0000	29.0000
3	42 % EFFLUENT	3	20.0000	20.0000
3	42 % EFFLUENT	4	25.0000	25.0000
3	42 % EFFLUENT	5	30.0000	30.0000
3	42 % EFFLUENT	6	29.0000	29.0000
3	42 % EFFLUENT	7	25.0000	25.0000
3	42 % EFFLUENT	8	19.0000	19.0000
3	42 % EFFLUENT	9	32.0000	32.0000
3	42 % EFFLUENT	10	30.0000	30.0000
4	56 % EFFLUENT	1	21.0000	21.0000
4	56 % EFFLUENT	2	29.0000	29.0000
4	56 % EFFLUENT	3	34.0000	34.0000
4	56 % EFFLUENT	4	26.0000	26.0000
4	56 % EFFLUENT	5	29.0000	29.0000
4	56 % EFFLUENT	6	26.0000	26.0000
4	56 % EFFLUENT	7	27.0000	27.0000
4	56 % EFFLUENT	8	29.0000	29.0000
4	56 % EFFLUENT	9	30.0000	30.0000
4	56 % EFFLUENT	10	26.0000	26.0000
5	75 % EFFLUENT	1	11.0000	11.0000
5	75 % EFFLUENT	2	25.0000	25.0000
5	75 % EFFLUENT	3	21.0000	21.0000
5	75 % EFFLUENT	4	31.0000	31.0000
5	75 % EFFLUENT	5	29.0000	29.0000
5	75 % EFFLUENT	6	24.0000	24.0000
5	75 % EFFLUENT	7	30.0000	30.0000
5	75 % EFFLUENT	8	31.0000	31.0000
5	75 % EFFLUENT	9	18.0000	18.0000
5	75 % EFFLUENT	10	27.0000	27.0000

6	100	%	EFFLUENT	1	23.0000	23.0000
6	100	%	EFFLUENT	2	27.0000	27.0000
6	100	%	EFFLUENT	3	19.0000	19.0000
6	100	%	EFFLUENT	4	24.0000	24.0000
6	100	%	EFFLUENT	5	22.0000	22.0000
6	100	%	EFFLUENT	6	20.0000	20.0000
6	100	%	EFFLUENT	7	25.0000	25.0000
6	100	%	EFFLUENT	8	29.0000	29.0000
6	100	%	EFFLUENT	9	30.0000	30.0000
6	100	%	EFFLUENT	10	26.0000	26.0000

---

AA# K401494, CERIODAPHNIA REPRODUCTION, 1-29-04  
 File: k401494c Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	23.600				
2	32 % EFFLUENT	25.500	125.00	75.00	10.00	
3	42 % EFFLUENT	26.500	122.50	75.00	10.00	
4	56 % EFFLUENT	27.700	133.50	75.00	10.00	
5	75 % EFFLUENT	24.700	115.00	75.00	10.00	
6	100 % EFFLUENT	24.500	107.00	75.00	10.00	

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

## APPENDIX E

### Organism History

# AQUATOX, INC.

100 Springwood Drive #15  
Hot Springs, Arkansas 71913  
(501) 767-9120

## TEST ORGANISM HISTORY

DATE SHIPPED 1-29-04 Arkansas Analytical

SPECIES Pimephales promelas

QUANTITY SHIPPED 6000+

AGE/LIFE STAGE 24 hrs 1/30 15 DOUGT

BROODSTOCK SOURCE Anderson Farms, AR

CULTURE WATER groundwater

ALKALINITY (Mg/l as CaCO<sub>3</sub>) = 180

HARDNESS (Mg/l as CaCO<sub>3</sub>)/Salinity (ppt) = 160

FEEDING Artemia

COMMENTS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

PACKAGED BY WH

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: 1/17/01

SPECIES: Ceriodaphnia dubia

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, Selenastrum

### Water Chemistry Record:

	Mean	Range
TEMPERATURE:	<u>24 °C</u>	<u>21-24°C</u>
SALINITY/CONDUCTIVITY:	<u>--</u>	<u>--</u>
TOTAL HARDNESS (as CaCO <sub>3</sub> ):	<u>112 mg/l</u>	<u>90-124 mg/l</u>
TOTAL ALKALINITY (as CaCO <sub>3</sub> ):	<u>85 mg/l</u>	<u>50-85 mg/l</u>
pH:	<u>8.09</u>	<u>7.68-8.14</u>

### Comments:

  
\_\_\_\_\_  
*Facility Supervisor*

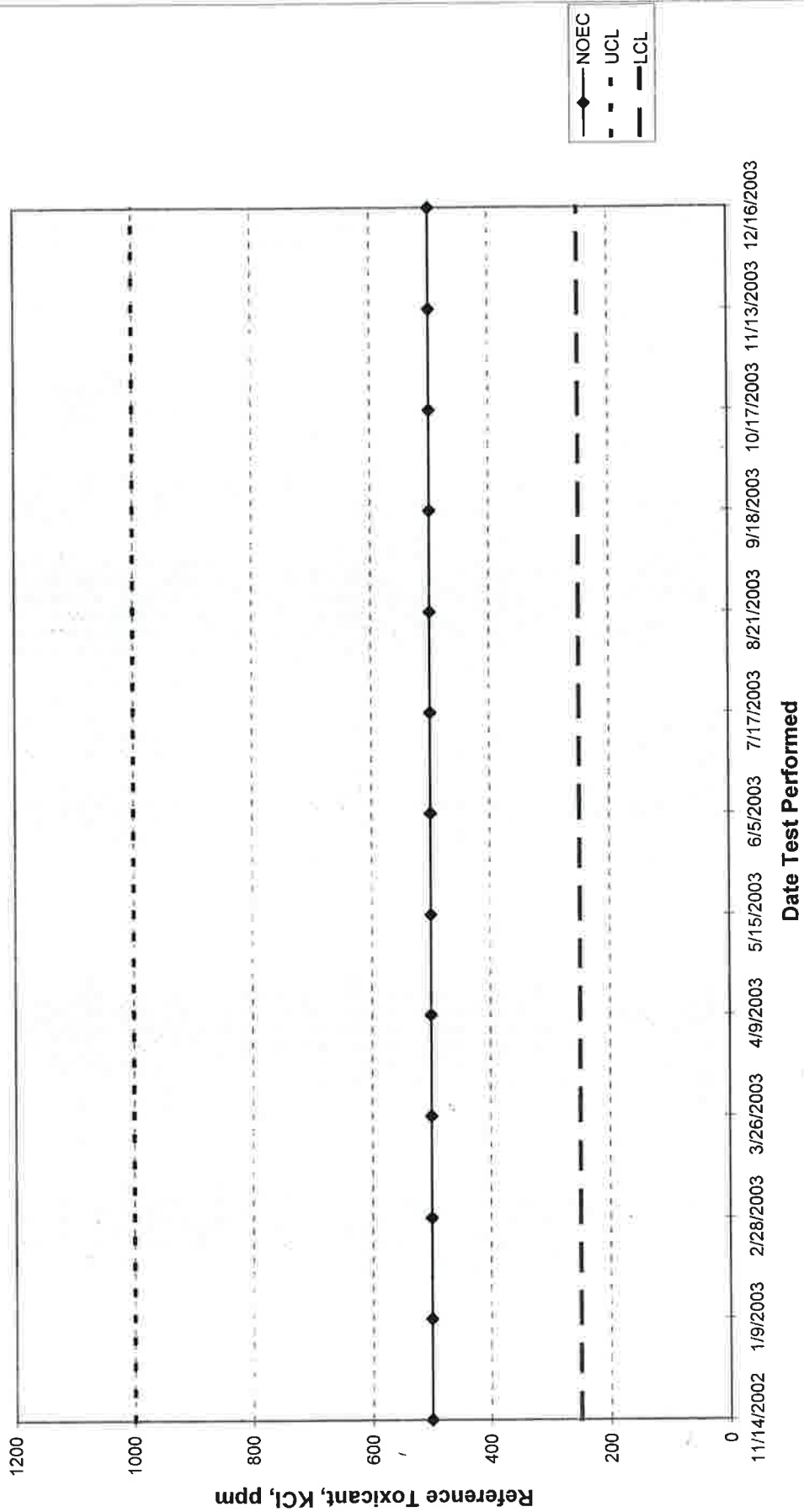


## APPENDIX F

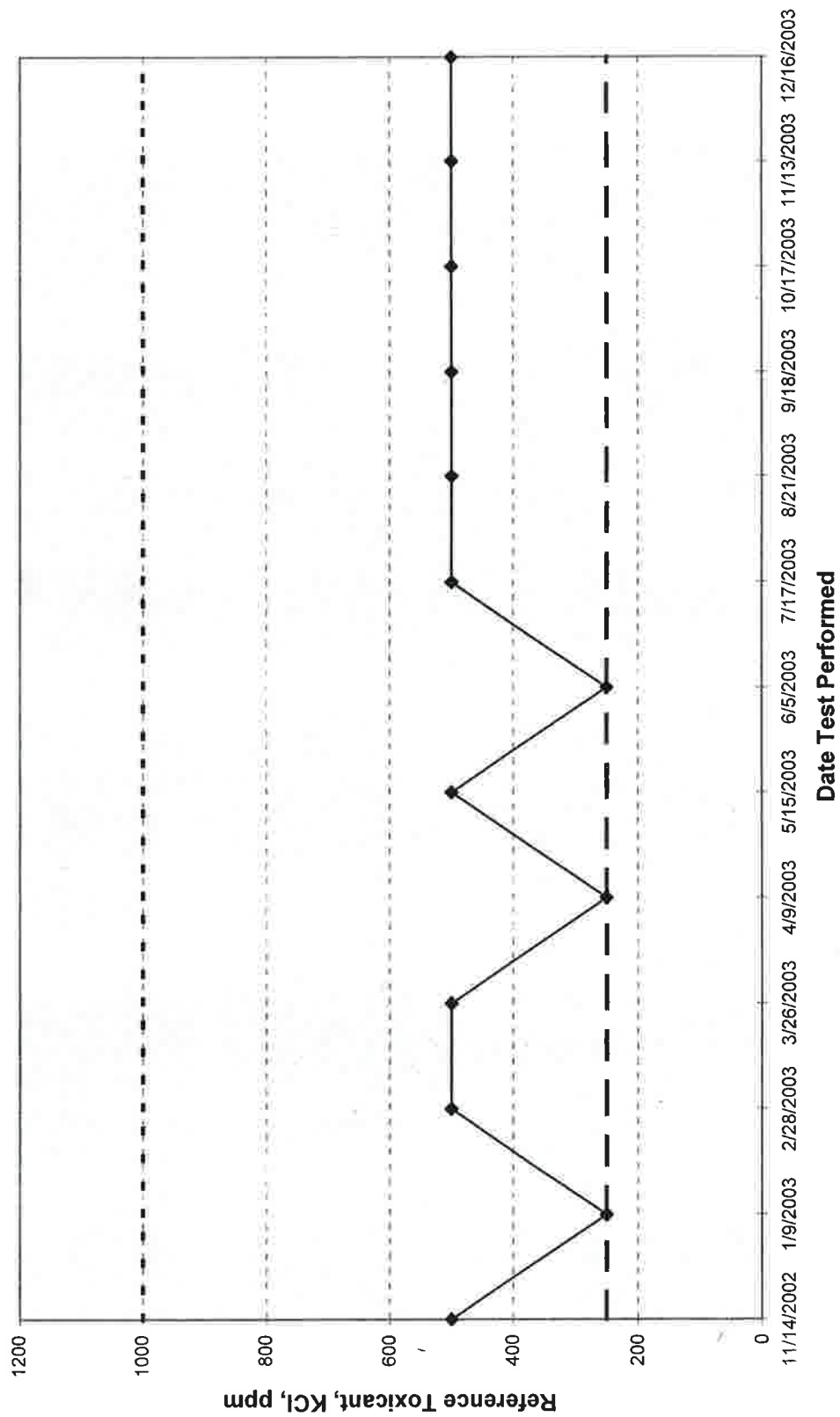
### Quality Assurance Charts



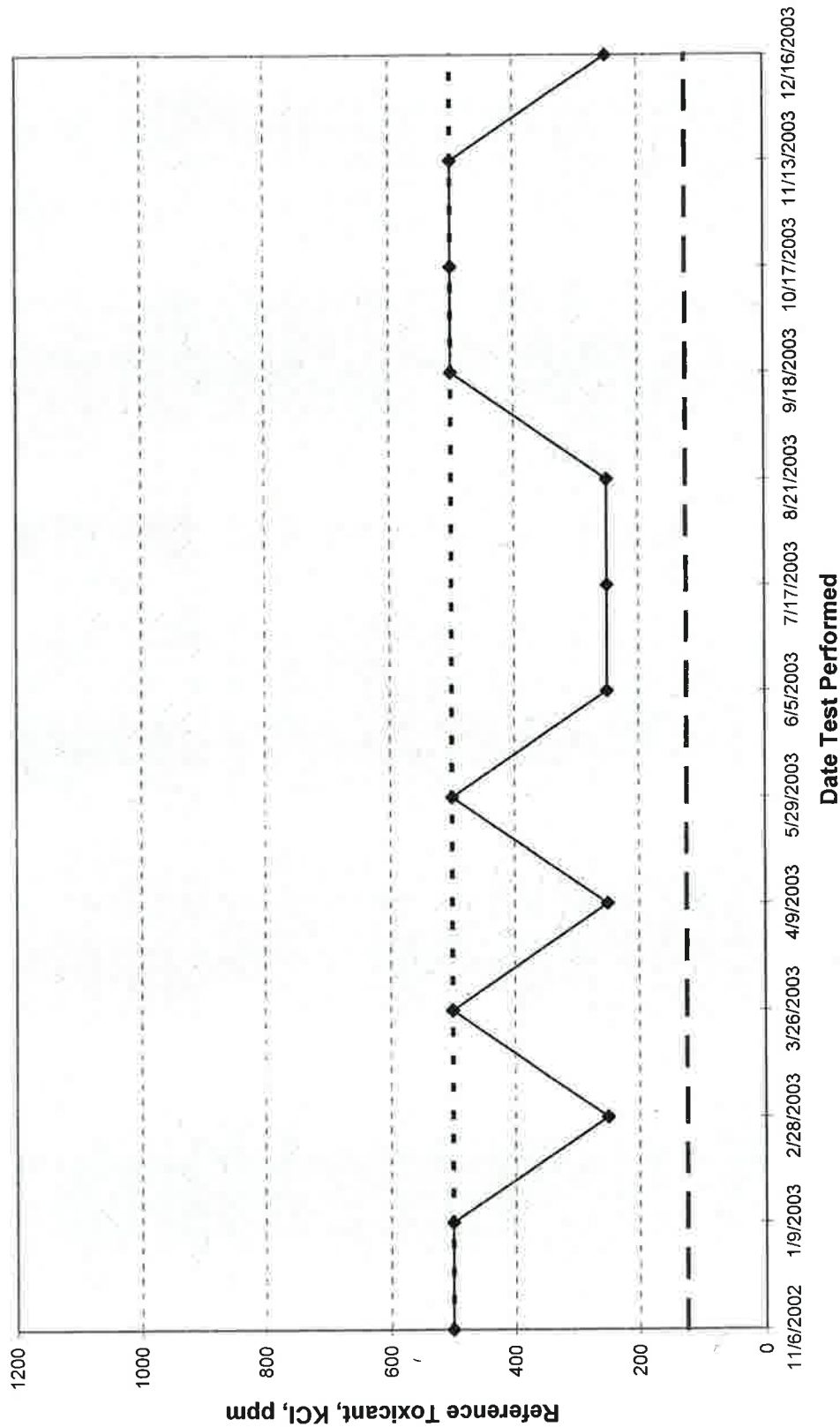
**ARKANSAS ANALYTICAL, INC.**  
**FATHEAD MINNOW SURVIVAL**  
**QUALITY ASSURANCE**



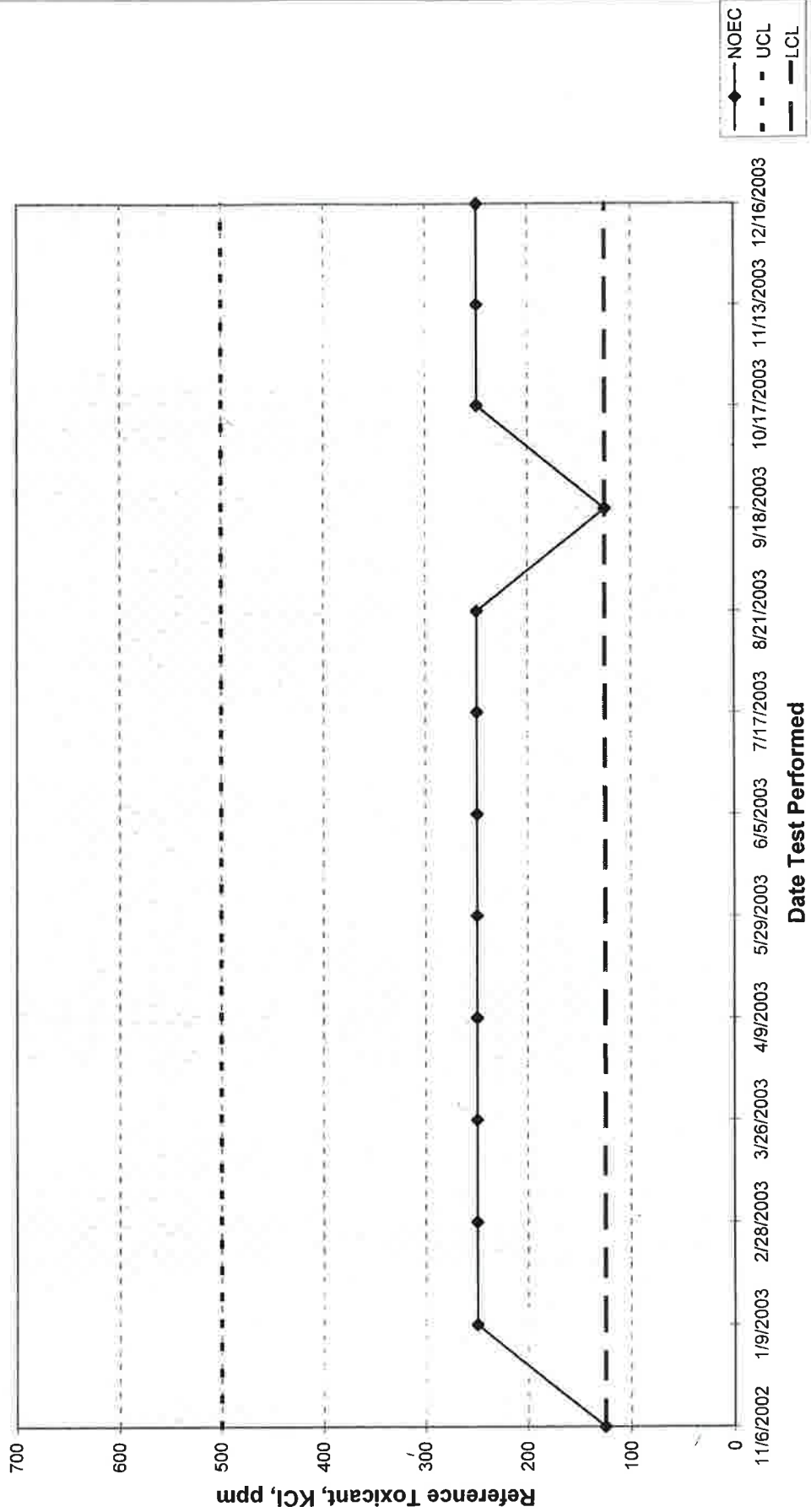
**ARKANSAS ANALYTICAL, INC.**  
**FATHEAD MINNOW GROWTH**  
**QUALITY ASSURANCE**



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



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





## APPENDIX G

### Lab Certification



State of Arkansas

Department of Environmental Quality  
Laboratory Certification Program



Be it known that **Arkansas Analytical, Inc**  
**Little Rock, Arkansas**  
has earned certification by this Department for the period of  
**October 30, 2003 to October 30, 2004**

Laboratory ID # 60-1754

Certificate # 03-079-0

The following parameters are certified:

Alkalinity	Oil & Grease	Turbidity	Lead	Tin
Ammonia	Orthophosphate	Aluminum	Magnesium	Titanium
BOD	Perchlorate	Antimony	Manganese	Vanadium
Bromide	pH	Arsenic	Mercury	Zinc
CBOD	Phenol	Barium	Molybdenum	Herbicides
Chloride	Sulfate	Beryllium	Nickel	Pesticides & PCBs
Chlorine	Sulfide	Boron	Potassium	Semi-volatiles
COD	Surfactants	Cadmium	Selenium	TPHC
Conductivity	TDS	Calcium	Silver	Volatile Organics
Cyanide	TKN	Chromium	Sodium	Fecal Coliform
Fluoride	TOC	Cobalt	Strontium	Acute Toxicity
Hardness	Total Phosphorus	Copper	Thallium	Chronic Toxicity
Nitrate	Total Solids	Hex. Chromium		
Nitrite	TSS	Iron		

*John Semberki*  
Quality Assurance Officer

October 24, 2003  
Date