

Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
April 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**
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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 April 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:	4-21-04, 1030	4-22-04, 1030
Sample #2:	4-22-04, 0930	4-23-04, 0930
Sample #3:	4-26-04, 1000	4-27-04, 1000

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:	4-22-04, 1325	4
Sample #2:	4-23-04, 1120	4
Sample #3:	4-27-04, 1527	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	90%	X	
Average of 15 or more young per surviving female	18.7	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	33.2%	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	0.394	X	
The percent coefficient of variation between replicates must be 40% or less for growth	14.5%	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:	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

<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)	15.2	%CV survival (critical dilution)	9.32%
%CV Reproduction (critical dilution)	21.4%	Mean dry weight (critical dilution) in milligrams	0.398
		%CV growth (critical dilution)	16.1%

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:


Melissa Green


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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:	4-21-04, 1030	4-22-04, 1300
Sample #2:	4-22-04, 0930	4-23-04, 0930
Sample #3:	4-26-04, 1000	4-27-04, 1000

Test initiated (date, time): 4-23-04, 1500 Test terminated (date, time): 4-30-04, 1445

Dilution water used: Soft Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

Effluent Conc %	Percent Survival in Replicate Chambers						Mean Percent Survival			CV %
	A	B	C	D	E		24 hours	48 hours	7 days	
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	80		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%	0.484	0.338	0.410	0.357	0.382		0.394	14.5
32%	0.331	0.475	0.426	0.468	0.446		0.429	
42%	0.509	0.479	0.488	0.430	0.438		0.469	
56%	0.465	0.498	0.521	0.384	0.646		0.503	
75%	0.427	0.415	0.408	0.507	0.368		0.425	
100%	0.429	0.491	0.379	0.368	0.324		0.398	16.1

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:	4-21-04, 1030	4-22-04, 1030
Sample #2:	4-22-04, 0930	4-23-04, 0930
Sample #3:	4-26-04, 1000	4-27-04, 1000

Test initiated (date, time): 4-23-04, 1015 Test terminated (date, time): 4-29-04, 1100

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	14	27	27	23	X0	19
B	15	11	19	27	9	10
C	13	19	23	21	19	11
D	15	17	14	20	18	14
E	20	28	19	22	19	15
F	30	31	26	26	28	19
G	22	24	16	27	24	15
H	X5	0	19	10	16	18
I	13	24	24	21	29	13
J	26	18	16	17	26	18
Mean	17.3	19.9	20.3	21.4	18.8	15.2
Mean/surviving female	18.7	19.9	20.3	21.4	20.9	15.2
CV%*	33.2					21.4

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	90	100	100	100	90	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)= 33.2 %

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		K404365							Test Start (Date/Time)	4-23-4/1500
Client		Weston							Test End (Date/Time)	4-30-04/1445
		Day of Test								
		1	2	3	4	5	6	7	notes/remarks	
Control		4/23	4/24	4/25	4/26	4/27	4/28	4/29	SS 99	
D.O (mg/L)	INITIAL	7.3	7.5	7.5	6.9	7.2	7.1	7.6		
	FINAL	6.9	7.0	7.3	6.7	7.0	7.0	6.6		
pH(mg/L)	INITIAL	6.7	6.8	6.7	6.7	6.8	6.7	6.9		
	FINAL	6.9	6.9	7.0	6.9	6.8	6.9	6.8		
temp(C)	INITIAL	23.2	22.7	23.0	23.6	22.9	22.2	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
ALKALINITY(mg/L)		30								
HARDNESS(mg/L)		46								
CONDUCTIVITY(umhos/cm)		172								
CHLORINE(mg/L)		40.05								
CONC:		32%	32%	32%	32%	32%	32%	32%		
D.O (mg/L)	INITIAL	7.3	7.5	7.4	7.5	7.2	7.3	7.6		
	FINAL	7.0	7.1	7.3	6.9	7.0	7.0	6.7		
pH(mg/L)	INITIAL	6.7	6.9	6.7	6.7	6.8	6.8	6.9		
	FINAL	6.9	7.0	7.0	6.9	6.8	6.9	6.7		
temp(C)	INITIAL	23.2	22.9	23.0	23.1	22.9	22.2	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		42%	42%	42%	42%	42%	42%	42%		
D.O (mg/L)	INITIAL	7.3	7.5	7.4	7.4	7.3	7.3	7.7		
	FINAL	7.0	7.2	7.3	6.9	7.0	7.1	6.6		
pH(mg/L)	INITIAL	6.7	6.9	6.8	6.7	6.8	6.9	7.0		
	FINAL	6.9	7.0	7.0	6.9	6.9	6.9	6.9		
temp(C)	INITIAL	23.2	23.0	23.0	23.0	22.9	22.2	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		56%	56%	56%	56%	56%	56%	56%		
D.O (mg/L)	INITIAL	7.4	7.5	7.4	7.5	7.3	7.3	7.7		
	FINAL	7.1	7.2	7.3	7.0	7.1	7.1	6.8		
pH(mg/L)	INITIAL	6.8	6.8	6.8	6.7	6.8	6.9	7.1		
	FINAL	7.0	7.1	7.0	6.9	6.9	7.0	6.9		
temp(C)	INITIAL	23.2	23.0	23.1	23.0	22.9	22.2	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		75%	75%	75%	75%	75%	75%	75%		
D.O (mg/L)	INITIAL	7.4	7.6	7.3	7.4	7.3	7.3	7.8		
	FINAL	7.1	7.2	7.3	7.0	7.1	7.2	7.0		
pH(mg/L)	INITIAL	6.8	6.9	6.8	6.7	6.8	7.0	7.2		
	FINAL	7.0	7.1	7.0	6.9	6.9	7.0	7.0		
temp(C)	INITIAL	23.2	23.3	23.2	23.0	22.9	22.9	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		100%	100%	100%	100%	100%	100%	100%		
D.O (mg/L)	INITIAL	7.7	7.7	7.4	7.6	7.3	7.3	7.8		
	FINAL	7.2	7.3	7.3	7.0	7.1	7.2	6.7		
pH(mg/L)	INITIAL	6.8	6.9	6.8	6.7	6.8	7.0	7.2		
	FINAL	7.0	7.2	7.0	7.0	6.9	7.0	7.0		
temp(C)	INITIAL	23.2	23.7	23.2	23.0	22.9	22.7	22.1		
	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)		13			23		30			
HARDNESS(mg/L)		1430			1420		1300			
CONDUCTIVITY(umhos/cm)		2400			2350		2410			
CHLORINE(mg/L)		40.05			40.05		40.05			

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Ceriodaphnia dubia

Lab # / Sample ID		K404315		Test Start (Date/Time)		4-23-04/1015				
Client		LJ15100		Test End (Date/Time)		4-29-04/1100				
		Day of Test								
		1	2	3	4	5	6	7	8	notes/remarks
Control		4/23	4/24	4/25	4/26	4/27	4/28			SS 99
D.O (mg/L)	INITIAL	7.3	7.5	7.5	6.9	7.2	7.1			
	FINAL	7.0	6.9	7.3	7.6	6.8	7.0			
pH	INITIAL	6.7	6.8	6.7	6.7	6.8	6.7			
	FINAL	7.0	6.9	7.2	7.1	7.0	7.0			
temp(C)	INITIAL	23.2	22.7	23.0	23.6	22.9	22.2			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
ALKALINITY(mg/L)		30								
HARDNESS(mg/L)		40								
CONDUCTIVITY(umhos/cm)		172								
CHLORINE(mg/L)		0.05								
CONC:		32%	32%	32%	32%	32%	32%			
D.O (mg/L)	INITIAL	7.3	7.5	7.4	7.5	7.2	7.3			
	FINAL	6.9	6.9	7.4	7.6	7.1	7.0			
pH	INITIAL	6.7	6.9	6.7	6.7	6.8	6.8			
	FINAL	7.1	7.2	7.1	7.1	7.0	6.9			
temp(C)	INITIAL	23.2	22.9	23.0	23.1	22.9	22.2			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		42%	42%	42%	42%	42%	42%			
D.O (mg/L)	INITIAL	7.3	7.5	7.4	7.4	7.3	7.3			
	FINAL	6.9	7.0	7.4	7.6	7.3	7.0			
pH	INITIAL	6.7	6.9	6.8	6.7	6.8	6.9			
	FINAL	7.1	7.2	7.1	7.1	7.0	6.9			
temp(C)	INITIAL	23.2	23.0	23.0	23.0	22.9	22.2			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		56%	56%	56%	56%	56%	56%			
D.O (mg/L)	INITIAL	7.4	7.5	7.4	7.5	7.3	7.3			
	FINAL	6.8	7.1	7.4	7.6	7.4	7.0			
pH	INITIAL	6.8	6.8	6.8	6.7	6.8	6.9			
	FINAL	7.2	7.1	7.1	7.1	7.1	7.0			
temp(C)	INITIAL	23.2	23.0	23.1	23.0	22.9	22.2			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		75%	75%	75%	75%	75%	75%			
D.O (mg/L)	INITIAL	7.4	7.6	7.3	7.4	7.3	7.3			
	FINAL	6.9	7.1	7.5	7.6	7.3	7.0			
pH	INITIAL	6.8	6.9	6.8	6.7	6.8	7.0			
	FINAL	7.2	7.2	7.1	7.2	7.1	7.0			
temp(C)	INITIAL	23.2	23.3	23.2	23.0	22.9	22.7			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		100%	100%	100%	100%	100%	100%			
D.O (mg/L)	INITIAL	7.4	7.7	7.4	7.6	7.3	7.3			
	FINAL	6.8	7.2	7.4	7.6	7.3	7.0			
pH	INITIAL	6.8	6.9	6.8	6.7	6.8	7.0			
	FINAL	7.2	7.1	7.1	7.2	7.2	7.1			
temp(C)	INITIAL	23.2	23.7	23.2	23.0	22.9	22.2			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		100%	A	A	B	B	C			
ALKALINITY(mg/L)		13			23		30			
HARDNESS(mg/L)		1430			1420		1360			
CONDUCTIVITY(umhos/cm)		2400			2350		2410			
CHLORINE(mg/L)		0.05			0.05		0.05			

APPENDIX C

Fathead Minnow Raw Data and Statistics

FATHEAD MINNOW, *Pimephales promelas*, Larval Survival and Growth test, Method 1000.0*

SURVIVAL DATA FOR LARVAE

Lab #/s: <i>Weston</i> <i>K404365</i>	TEST START DATE <i>4-23-4</i> TIME <i>1500</i>
	TEST END DATE <i>4-30</i> TIME <i>1445</i>
AGE AND SOURCE OF MINNOWS <i>24 hrs; Aquatox</i>	

CONC:	REP #	DAY (NUMBER SURVIVING)								SURVIVAL		
		start	1	2	3	4	5	6	7	%	MEAN %	
<i>Control</i>	A	10	10	10	10	10	10	10	10	100	100	0.1
	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		
<i>32%</i>	A	10	10	10	10	10	10	10	10	100	100	
	B	↓	10	10	10	10	10	10	10	100		
	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		
<i>42%</i>	A	10	10	10	10	10	10	10	10	100	100	
	B	↓	10	10	10	10	10	10	10	100		
	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		
<i>56%</i>	A	10	10	10	10	10	10	10	10	100	100	
	B	↓	10	10	10	10	10	10	10	100		
	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		
<i>75%</i>	A	10	10	10	10	10	10	10	10	100	100	
	B	↓	10	10	10	10	10	10	10	100		
	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		
<i>100%</i>	A	10	10	10	10	10	10	10	10	100	96	9.32%
	B	↓	10	10	10	10	10	10	10	100		
	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	8	80		
ANALYST:		AD	mq	mq	AD	AD	AD	AD	AD			
DATE:		4-23	4-24	4-25	4-26	4-27	4-28	4-29	4-30			
TIME:		1500	0920	1410	1400	1400	1345	1350	1445			

*EPA 600/4-89/001, March 1989.

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/S: <u>V404365</u>	TEST DATES (BEGIN/END): <u>4/23-30/04</u>
CLIENT: <u>Weston</u>	WEIGHING DATE/TIME: <u>5-5-04/1000</u>
ANALYST/S: <u>mg, AD</u>	DRYING TEMPERATURE (DEGREES C): <u>60°C</u>
SAMPLE ID:	DRYING TIME (HOURS): <u>24 hrs.</u>

	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	A1	0.97132	0.96648	0.00484	10	0.484	AVG DRY	
	B2	0.96735	0.96397	0.00338	10	0.338	WEIGHT (mg)	
	C3	0.96781	0.96371	0.00410	10	0.410		0.394
	D4	0.96748	0.96391	0.00357	10	0.357	CV	
	E5	0.97132	0.96750	0.00382	10	0.382		14.51
CONC: 32.1	A6	0.96990	0.96659	0.00331	10	0.331	AVG DRY	
	B7	0.95072	0.94597	0.00475	10	0.475	WEIGHT(MG)	
	C8	0.95075	0.94649	0.00426	10	0.426		0.429
	D9	0.96370	0.95902	0.00468	10	0.468	CV	
	E10	0.96505	0.96059	0.00446	10	0.446		
CONC: 42.1	A11	0.95663	0.95154	0.00509	10	0.509	AVG DRY	
	B12	0.96042	0.95563	0.00479	10	0.479	WEIGHT(MG)	
	C13	0.96417	0.95929	0.00488	10	0.488		0.469
	D14	0.96255	0.95825	0.00430	10	0.430	CV	
	E15	0.95340	0.94902	0.00438	10	0.438		
CONC: 56.1	A16	0.95591	0.95126	0.00465	10	0.465	AVG DRY	
	B17	0.95038	0.94540	0.00498	10	0.498	WEIGHT(MG)	
	C18	0.96117	0.95596	0.00521	10	0.521		0.503
	D19	0.95271	0.94887	0.00384	10	0.384	CV	
	E20	0.95076	0.94430	0.00646	10	0.646		
CONC: 75.1	A21	0.94791	0.94364	0.00427	10	0.427	AVG DRY	
	B22	0.96181	0.95756	0.00415	10	0.415	WEIGHT(MG)	
	C23	0.95763	0.95355	0.00408	10	0.408		0.425
	D24	0.94326	0.93819	0.00507	10	0.507	CV	
	E25	0.95191	0.94823	0.00368	10	0.368		
CONC: 100.1	A26	0.95365	0.94936	0.00429	10	0.429	AVG DRY	
	B27	0.95134	0.94643	0.00491	10	0.491	WEIGHT(MG)	
	C28	0.94822	0.94443	0.00379	10	0.379		0.398
	D29	0.96168	0.95800	0.00368	10	0.368	CV	
	E30	0.95486	0.95162	0.00324	10	0.324		116.17

CV = (STANDARD DEVIATION/MEAN)*100

AA# K404365 FATHEAD MINNOW SURVIVAL, 4-23-04
File: k404365s Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.074

W = 0.416

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# K404365 FATHEAD MINNOW SURVIVAL, 4-23-04 .
File: k404365s 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# K404365 FATHEAD MINNOW SURVIVAL, 4-23-04

FILE: k404365s

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	0.8000	1.1071

AA# K404365 FATHEAD MINNOW SURVIVAL, 4-23-04

File: k404365s

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	1.351	25.00	16.00	5.00	

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

AA # K404365, FATHEAD MINNOW GROWTH, 4-23-04 .
File: k404365g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.094

W = 0.982

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 # K404365, FATHEAD MINNOW GROWTH, 4-23-04
File: k404365g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 4.05

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.

TITLE: AA # K404365, FATHEAD MINNOW GROWTH, 4-23-04
FILE: k404365g
TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.4840	0.4840
1	CONTROL	2	0.3380	0.3380
1	CONTROL	3	0.4100	0.4100
1	CONTROL	4	0.3570	0.3570
1	CONTROL	5	0.3820	0.3820
2	32 % EFFLUENT	1	0.3310	0.3310
2	32 % EFFLUENT	2	0.4750	0.4750
2	32 % EFFLUENT	3	0.4260	0.4260
2	32 % EFFLUENT	4	0.4680	0.4680
2	32 % EFFLUENT	5	0.4460	0.4460
3	42 % EFFLUENT	1	0.5090	0.5090
3	42 % EFFLUENT	2	0.4790	0.4790
3	42 % EFFLUENT	3	0.4880	0.4880
3	42 % EFFLUENT	4	0.4300	0.4300
3	42 % EFFLUENT	5	0.4380	0.4380
4	56 % EFFLUENT	1	0.4650	0.4650
4	56 % EFFLUENT	2	0.4980	0.4980
4	56 % EFFLUENT	3	0.5210	0.5210
4	56 % EFFLUENT	4	0.3840	0.3840
4	56 % EFFLUENT	5	0.6460	0.6460
5	75 % EFFLUENT	1	0.4270	0.4270
5	75 % EFFLUENT	2	0.4150	0.4150
5	75 % EFFLUENT	3	0.4080	0.4080
5	75 % EFFLUENT	4	0.5070	0.5070
5	75 % EFFLUENT	5	0.3680	0.3680
6	100 % EFFLUENT	1	0.4290	0.4290
6	100 % EFFLUENT	2	0.4910	0.4910
6	100 % EFFLUENT	3	0.3790	0.3790
6	100 % EFFLUENT	4	0.3680	0.3680
6	100 % EFFLUENT	5	0.3240	0.3240

AA # K404365, FATHEAD MINNOW GROWTH, 4-23-04
File: k404365g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.044	0.009	2.263
Within (Error)	24	0.094	0.004	
Total	29	0.139		

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

AA # K404365, FATHEAD MINNOW GROWTH, 4-23-04
 File: k404365g 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	0.394	0.394		
2	32 % EFFLUENT	0.429	0.429	-0.883	
3	42 % EFFLUENT	0.469	0.469	-1.883	
4	56 % EFFLUENT	0.503	0.503	-2.741	
5	75 % EFFLUENT	0.425	0.425	-0.777	
6	100 % EFFLUENT	0.398	0.398	-0.101	

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

AA # K404365, FATHEAD MINNOW GROWTH, 4-23-04
 File: k404365g 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	0.094	23.7	-0.035
3	42 % EFFLUENT	5	0.094	23.7	-0.075
4	56 % EFFLUENT	5	0.094	23.7	-0.109
5	75 % EFFLUENT	5	0.094	23.7	-0.031
6	100 % EFFLUENT	5	0.094	23.7	-0.004

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia

SURVIVAL AND REPRODUCTION TEST

Discharger: Wester

Analyst: AD, MG

Location: K404865

Test Start-Date/Time: 4-23-84/1015

Date Sample Collected:

Test Stop-Date/Time: 4-29-84/1100

Conc 1	Replicate																	Total	No. of Young Adults	No. of Young Adult	Analyst						
	Day	A	B	C	D	E	F	G	H	I	J	Day	A	B	C	D	E					F	G	H	I	J	
%	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	MG	
	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	MG	
	3	0	0	0	0	5	0	0	0	0	0	3	0	0	0	4	0	0	0	0	0	0	4	10	0.4	AD	
	4	7	3	3	7	12	0	0	0	0	0	4	7	4	0	5	3	7	5	2	4	0	43	10	4.3	AD	
	5	0	8	4	9	7	0	9	1	7	11	5	10	9	10	9	1	13	1	8	10	8	80	10	8.0	AD	
	6	7	4	0	3	0	13	7	X	4	0	9	6	0	14	5	0	10	14	9	7	9	7	87	10	8.7	AD
	7											7															
	8											8															
	Total	14	15	13	15	20	30	22	X5	13	26	Total	23	27	21	20	22	26	27	10	21	17	214				

Conc 2	Replicate																	Total	No. of Young Adults	No. of Young Adult	Analyst						
Day	A	B	C	D	E	F	G	H	I	J	Day	A	B	C	D	E	F					G	H	I	J		
%	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	10	0	MG	
	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	10	0	MG	
	3	0	0	0	0	5	0	0	0	0	0	3	X	0	0	0	0	7	0	0	0	0	7	9	0.7	AD	
	4	8	3	4	0	0	13	7	0	5	5	4	-	0	0	4	1	10	4	0	0	7	38	9	4.2	AD	
	5	11	5	11	2	19	0	9	0	11	8	5	-	5	8	9	10	0	10	8	13	11	74	9	8.2	AD	
	6	8	3	4	9	3	13	8	0	8	5	6	-	4	5	8	11	10	8	10	8	8	69	9	7.7	AD	
	7											7															
	8											8															
	Total	27	11	19	17	28	31	24	0	24	18	Total	X	9	19	18	19	28	24	14	29	26	188				

Conc 3	Replicate																	Total	No. of Young Adults	No. of Young Adult	Analyst						
Day	A	B	C	D	E	F	G	H	I	J	Day	A	B	C	D	E	F					G	H	I	J		
%	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	10	0	MG	
	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	10	0	MG	
	3	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	10	0	10	0	0	0	20	10	2.0	AD	
	4	0	4	4	5	0	10	0	7	5	1	4	0	3	4	3	5	8	1	0	2	4	30	10	3.0	AD	
	5	11	10	12	9	7	0	0	12	9	9	5	0	3	0	11	8	1	10	4	11	9	40	10	4.0	AD	
	6	10	5	7	0	12	13	10	0	10	0	6	4	4	7	0	2	0	4	4	0	5	30	10	3.0	AD	
	7											7															
	8											8															
	Total	27	19	23	14	19	26	16	19	24	16	Total	19	10	11	14	15	19	15	18	13	16	152				X=15.2 CV=21.4

X=DEAD; Y=MALE

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
32% effluent	0	10	10
TOTAL	1	19	20

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

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
42% effluent	0	10	10
TOTAL	1	19	20

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

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF		
	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
56% effluent	0	10	10

TOTAL 1 19 20

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

FISHER'S EXACT TEST

NUMBER OF

IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	9	1	10
75% effluent	9	1	10
TOTAL	18	2	20

CRITICAL FISHER'S VALUE (10,10,9) (p=0.05) IS 4. b VALUE IS 9.

Since b is greater than 4 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

NUMBER OF

IDENTIFICATION	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
100% effluent	0	10	10
TOTAL	1	19	20

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

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
	CONTROL	10	1	

1	32% effluent	10	0
2	42% effluent	10	0
3	56% effluent	10	0
4	75% effluent	10	1
5	100% effluent	10	0

AA# K404365, CERIODAPHNIA REPRODUCTION, 4-23-04
File: C:\TOXSTAT\WESTON\K404365C. 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# K404365, CERIODAPHNIA REPRODUCTION, 4-23-04 .
File: C:\TOXSTAT\WESTON\K404365C. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 13.14

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# K404365, CERIODAPHNIA REPRODUCTION, 4-23-04
 FILE: C:\TOXSTAT\WESTON\K404365C.
 TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	14.0000	14.0000
1	CONTROL	2	15.0000	15.0000
1	CONTROL	3	13.0000	13.0000
1	CONTROL	4	15.0000	15.0000
1	CONTROL	5	20.0000	20.0000
1	CONTROL	6	30.0000	30.0000
1	CONTROL	7	22.0000	22.0000
1	CONTROL	8	5.0000	5.0000
1	CONTROL	9	13.0000	13.0000
1	CONTROL	10	26.0000	26.0000
2	32 % EFFLUENT	1	27.0000	27.0000
2	32 % EFFLUENT	2	11.0000	11.0000
2	32 % EFFLUENT	3	19.0000	19.0000
2	32 % EFFLUENT	4	17.0000	17.0000
2	32 % EFFLUENT	5	28.0000	28.0000
2	32 % EFFLUENT	6	31.0000	31.0000
2	32 % EFFLUENT	7	24.0000	24.0000
2	32 % EFFLUENT	8	0.0000	0.0000
2	32 % EFFLUENT	9	24.0000	24.0000
2	32 % EFFLUENT	10	18.0000	18.0000
3	42 % EFFLUENT	1	27.0000	27.0000
3	42 % EFFLUENT	2	19.0000	19.0000
3	42 % EFFLUENT	3	23.0000	23.0000
3	42 % EFFLUENT	4	14.0000	14.0000
3	42 % EFFLUENT	5	19.0000	19.0000
3	42 % EFFLUENT	6	26.0000	26.0000
3	42 % EFFLUENT	7	16.0000	16.0000
3	42 % EFFLUENT	8	19.0000	19.0000
3	42 % EFFLUENT	9	24.0000	24.0000
3	42 % EFFLUENT	10	16.0000	16.0000
4	56 % EFFLUENT	1	23.0000	23.0000
4	56 % EFFLUENT	2	27.0000	27.0000
4	56 % EFFLUENT	3	21.0000	21.0000
4	56 % EFFLUENT	4	20.0000	20.0000
4	56 % EFFLUENT	5	22.0000	22.0000
4	56 % EFFLUENT	6	26.0000	26.0000
4	56 % EFFLUENT	7	27.0000	27.0000
4	56 % EFFLUENT	8	10.0000	10.0000
4	56 % EFFLUENT	9	21.0000	21.0000
4	56 % EFFLUENT	10	17.0000	17.0000
5	75 % EFFLUENT	1	0.0000	0.0000
5	75 % EFFLUENT	2	9.0000	9.0000
5	75 % EFFLUENT	3	19.0000	19.0000
5	75 % EFFLUENT	4	18.0000	18.0000
5	75 % EFFLUENT	5	19.0000	19.0000
5	75 % EFFLUENT	6	28.0000	28.0000
5	75 % EFFLUENT	7	24.0000	24.0000
5	75 % EFFLUENT	8	16.0000	16.0000
5	75 % EFFLUENT	9	29.0000	29.0000

5	75	%	EFFLUENT	10	26.0000	26.0000
6	100	%	EFFLUENT	1	19.0000	19.0000
6	100	%	EFFLUENT	2	10.0000	10.0000
6	100	%	EFFLUENT	3	11.0000	11.0000
6	100	%	EFFLUENT	4	14.0000	14.0000
6	100	%	EFFLUENT	5	15.0000	15.0000
6	100	%	EFFLUENT	6	19.0000	19.0000
6	100	%	EFFLUENT	7	15.0000	15.0000
6	100	%	EFFLUENT	8	18.0000	18.0000
6	100	%	EFFLUENT	9	13.0000	13.0000
6	100	%	EFFLUENT	10	18.0000	18.0000

STEEL'S MANY-ONE RANK TEST

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	17.300				
2	32 % EFFLUENT	19.900	118.00	75.00	10.00	
3	42 % EFFLUENT	20.300	122.00	75.00	10.00	
4	56 % EFFLUENT	21.400	124.50	75.00	10.00	
5	75 % EFFLUENT	18.800	114.50	75.00	10.00	
6	100 % EFFLUENT	15.200	96.50	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 4-23-2004 Ark. Aquatox

SPECIES P. promelas

QUANTITY SHIPPED 600+

AGE/LIFE STAGE 24 HRS

BROODSTOCK SOURCE Andersons Farms, Ar

CULTURE WATER GROUNDWATER

ALKALINITY (Mg/l as CaCO₃) ~180

HARDNESS (Mg/l as CaCO₃)/Salinity (ppt) ~160

FEEDING Y/A

COMMENTS ORDERED BY Amy

PACKAGED BY _____

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



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

ORGANISM HISTORY

DATE: 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 ₃):	<u>112 mg/l</u>	<u>90-124 mg/l</u>
TOTAL ALKALINITY (as CaCO ₃):	<u>85 mg/l</u>	<u>50-85 mg/l</u>
pH:	<u>8.09</u>	<u>7.68-8.14</u>

Comments:

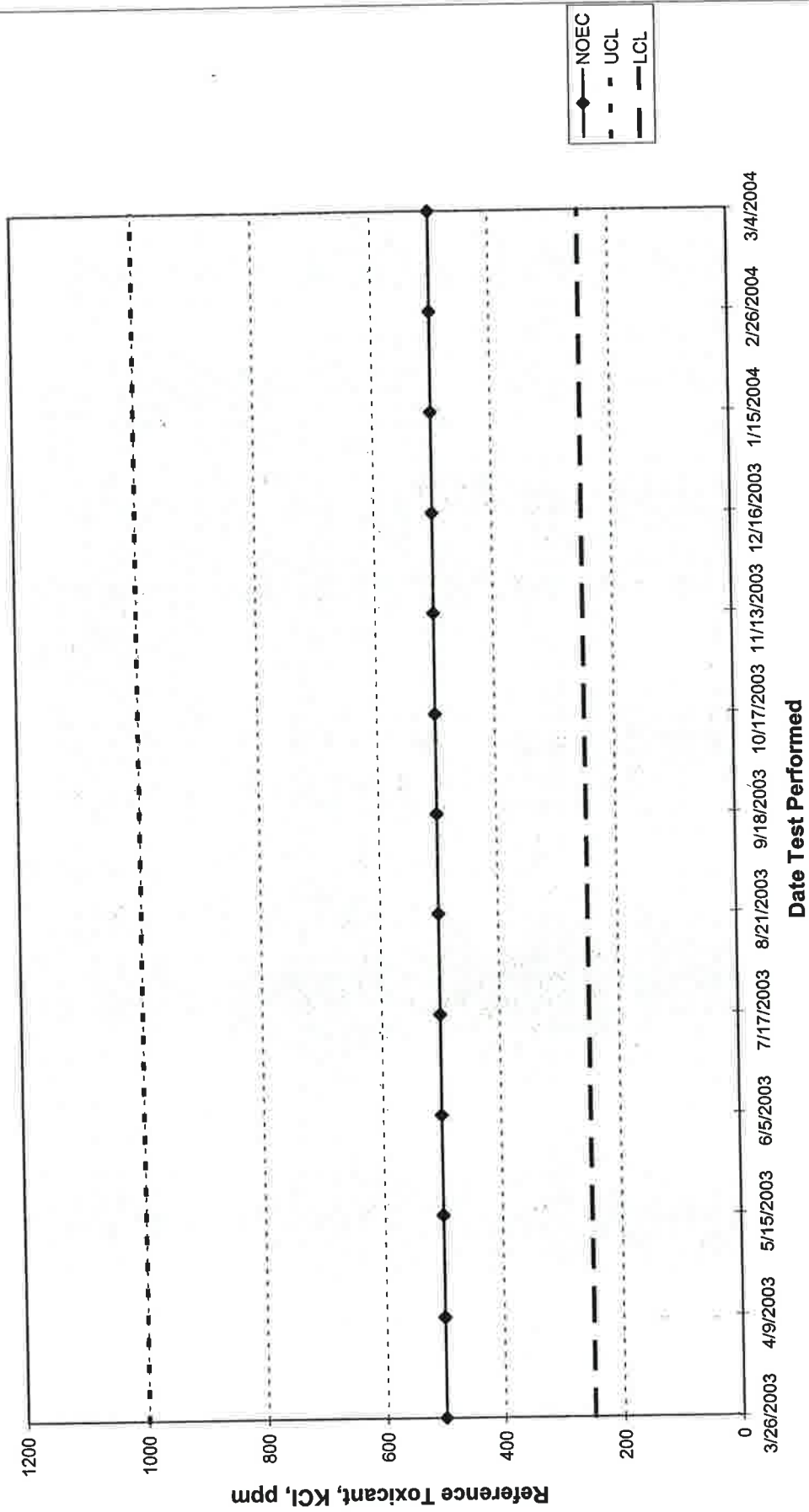


Facility Supervisor

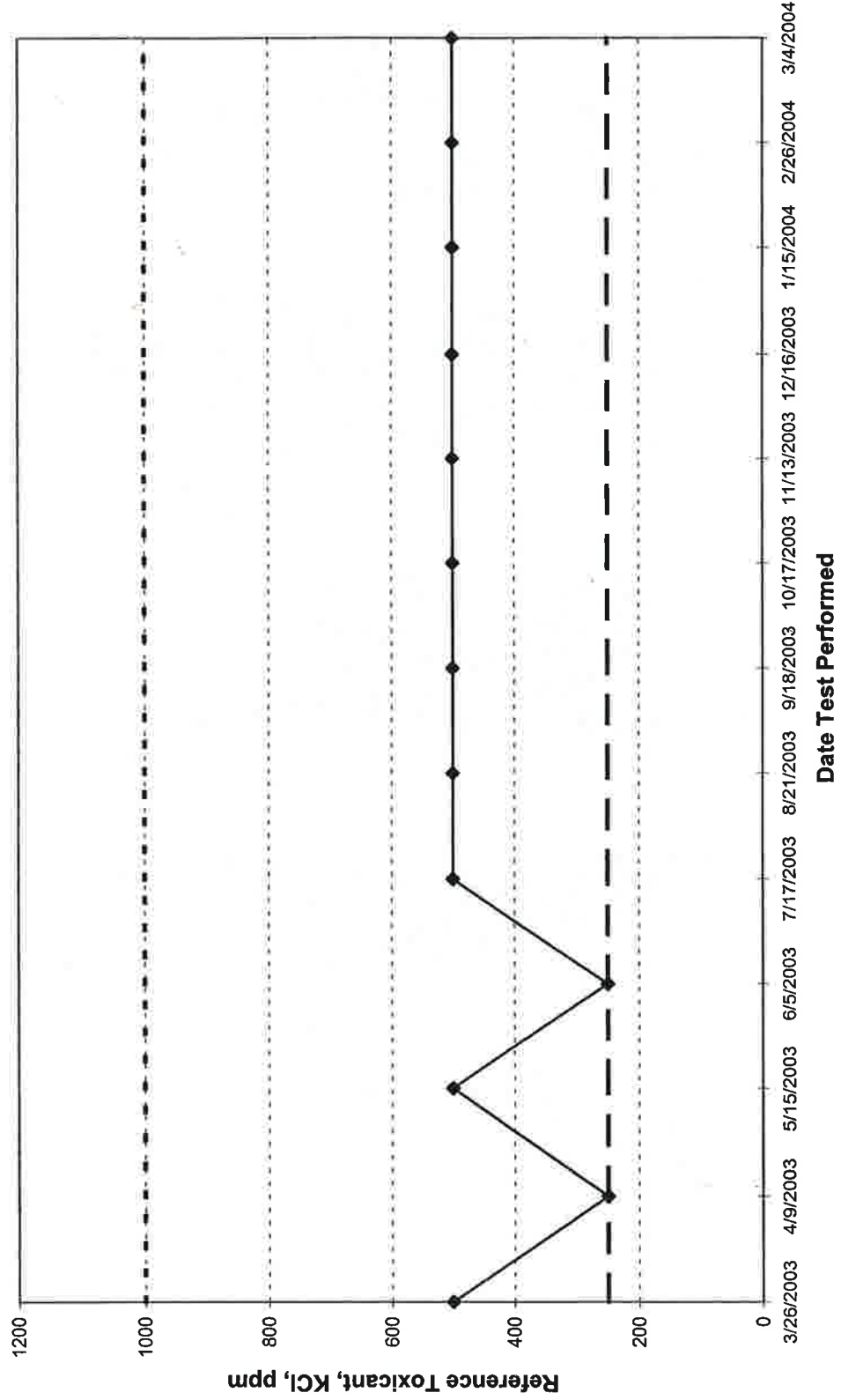
APPENDIX F

Quality Assurance Charts

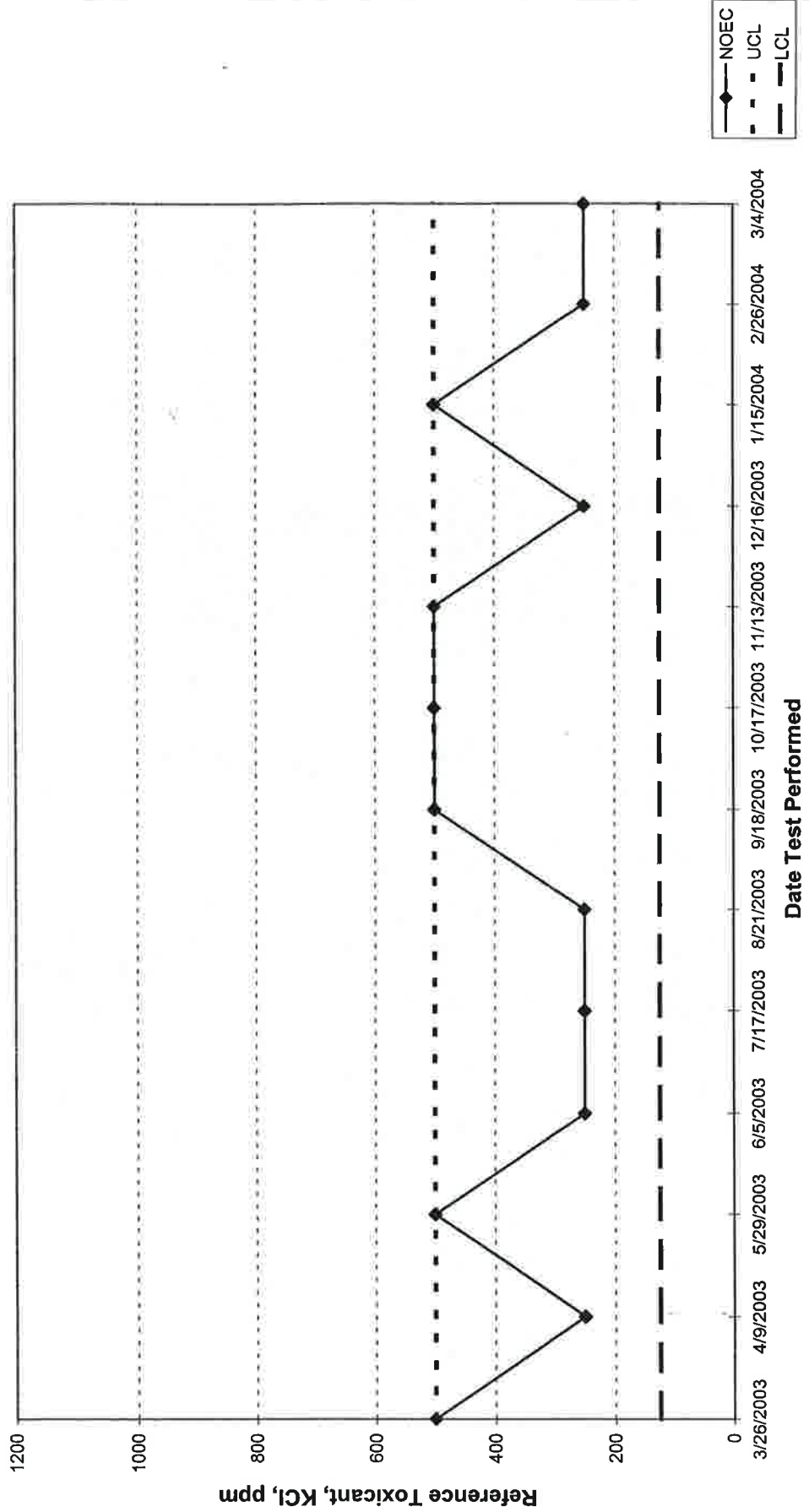
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL
QUALITY ASSURANCE



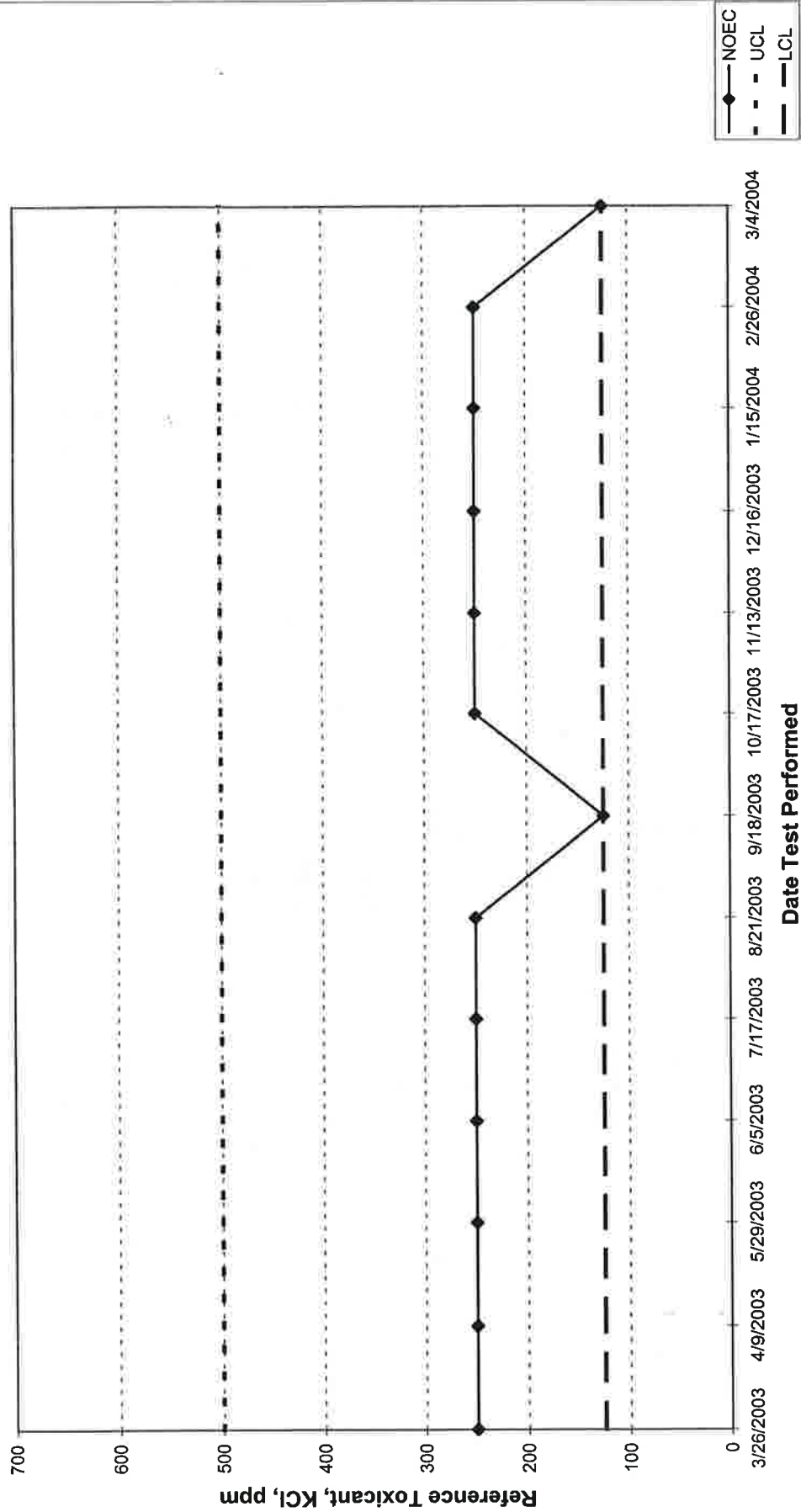
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH
QUALITY ASSURANCE



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 Sembruski
 Quality Assurance Officer

October 24, 2003
 Date